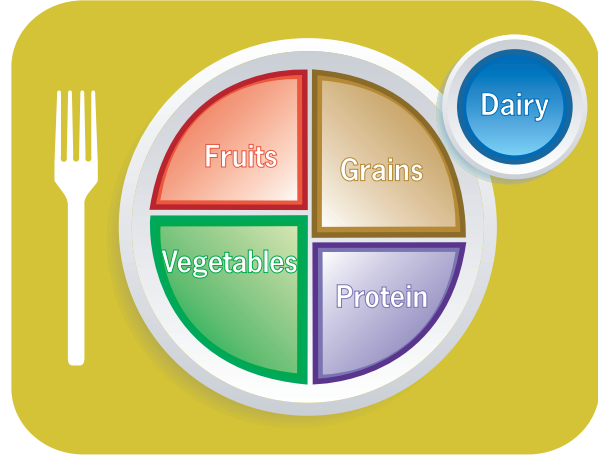


Major Food Nutrients

YOUR BODY needs six major nutrients for good nutrition. The U.S. Department of Agriculture's MyPlate program provides a recommended daily allowance (RDA) of nutrients for every age group. Remember that water is a nutrient: drinking water between meals is important to good nutrition. To "feed your body right," you need to maintain a balance (homeostasis) of your nutritional intake. Remember, you are what you eat!



Objective:



Analyze how the six major nutrients impact good nutrition.

Key Terms:



amino acids

calorie

carbohydrates

cholesterol

complex carbohydrates

fat-soluble vitamins

fats

homeostasis

metabolism

minerals

nutrition

polymer

proteins

saturated fats

simple carbohydrates

unsaturated fats

vitamins

water-soluble vitamins

The Importance of Good Nutrition

Nutrition is the process by which organisms consume nutrients to complete bodily functions. Proper nutrition should be the main goal of eating and meal planning. Good nutrition gives the body the energy it needs to survive. **Metabolism** is the chemical processes that occur in the body to break down food and release energy. The energy contained in food is measured with the unit called the calorie. A **calorie** is the amount of energy released when nutrients are burned—the amount of energy necessary to raise the temperature of 1 gram of water 1 degree Celsius. The more calories a food contains, the more energy the food contains. However, the makeup of those calories determines the food's usefulness to your body.

THE SIX MAJOR NUTRIENTS

The six major nutrients needed for good nutrition are carbohydrates, fats, proteins, vitamins, minerals, and water. Each is important for the bodily functions it supports. Carbohydrates, fats, and proteins also provide energy to your body.

Carbohydrates

Carbohydrates are nutrients made up of carbon, hydrogen, and oxygen molecules. These nutrients are high in energy and can be divided into two types: simple and complex. Plant products, especially grains, are good sources of carbohydrates.

Simple carbohydrates are sugars, such as granulated sugar, honey, and those natural sugars found in fruits. The natural sugars found in fruits also contain other important nutrients.



FIGURE 1. Foods high in fats and sugars contain more calories and fewer nutrients than fresh fruits and vegetables. Fruits and vegetables are better choices for snacks than foods high in fats and sugars.



FIGURE 2. Which foods in this picture are the simple carbohydrates? Which foods are the complex carbohydrates?

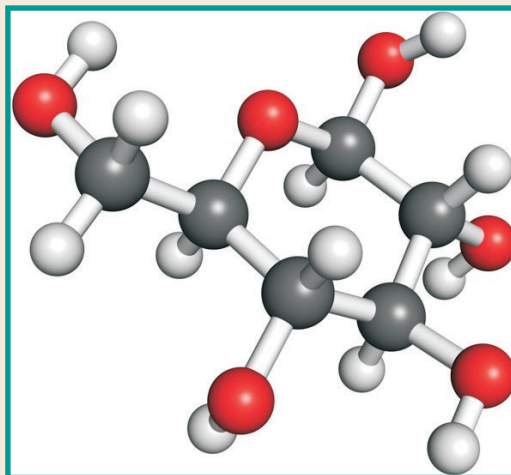


UNDER INVESTIGATION...

LAB CONNECTION:

The Breakdown of Food to Glucose

You can experience the breakdown of food into glucose with an unsalted soda cracker. Place the unsalted soda cracker in your mouth. Chew but do not swallow. Keep the chewed cracker in your mouth for several minutes. You will begin to taste sugar instead of the starchy taste of the cracker. As the cracker breaks down from your saliva, the starch converts to glucose or a sugar. When you can't stand the mushy cracker in your mouth any longer, swallow it. You are experiencing the first stage of digestion, the chemical breakdown of foods into glucose.



A rendering of a glucose molecule—glucopyranose.

Complex carbohydrates are starches and fibers, such as grains, pasta, breads, dried beans, vegetables, potatoes, and corn.

Simple carbohydrates are carbohydrates made up of three or fewer sugar molecules linked together. Simple carbohydrates are termed as such because they are simple (easy) to digest. Only one bond has to be broken before the sugar can be absorbed by the villi of the small intestine. Glucose is the most important simple carbohydrate, because it is a major source of energy for the body. Glucose not needed by the body is stored as glycogen in the liver and muscles.

Complex carbohydrates are polymers of simple sugar molecules. A **polymer** is a long-chained molecule made up of similar molecules linked together—repeated structural units. Starches and fibers are two examples of complex carbohydrates. Complex carbohydrates release energy slowly.



FIGURE 3. Complex carbohydrates are typically starches and fibers. Foods that contain fiber are often made from whole grains. Which foods in this picture are high in fiber?



DIGGING DEEPER...

UNCOVERING ADDITIONAL FACTS: Carbohydrates and the Structures of Saccharides

Carbohydrates are organic compounds. Every carbohydrate is made up of glucose, the basic sugar molecule. A glucose molecule is 6 carbon atoms, 12 hydrogen atoms, and 6 oxygen atoms, or $C_6H_{12}O_6$. A saccharide is a simple sugar or a substance made from sugar. A saccharide is classified as a monosaccharide, disaccharide, or polysaccharide. The prefix indicates the type of saccharide.

Monosaccharide means one saccharide. Monosaccharides are glucose (the building block of all sugars), fructose (fruit sugar), and galactose (tree sap).

Disaccharides are two saccharides. The disaccharide sucrose (table sugar) is made from glucose and fructose. Lactose (milk sugar) is made from glucose and galactose. Maltose (cereal) is made from two glucose molecules.

Polysaccharides have many saccharides or many glucose molecules linked together. A polysaccharide is an example of a natural polymer. A polymer is small glucose molecules chained together. There may be anywhere from 400 to 400,000 molecules in the chain. Polysaccharides are found in common starches, such as bread, flour, pasta, potatoes, tapioca, and cereal. Glycogen is another polysaccharide. Glycogen is stored energy in the muscle that is easily converted to glucose for energy.

Fats

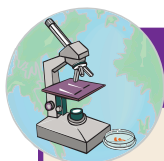
Fats are nutrients made up of carbon, hydrogen, and oxygen molecules. Fats have the same components as carbohydrates but in different amounts. Fats have more calories than carbohydrates. They supply concentrated sources of energy and essential fats needed by the body. The two forms of fats are saturated and unsaturated.

Saturated fats are fatty acids that contain the most hydrogen atoms they can hold. Saturated fats are usually solids at room temperature. To make foods healthier, some manufacturers are replacing saturated fats with unsaturated fats. Hydrogenated unsaturated fats are called trans fats. The fewer saturated fats and trans fats in the diet, the better the diet. Lower fat means lower cholesterol. **Cholesterol** is a waxy, fat-like substance found in animal cells. High levels of cholesterol in the body can lead to health problems.

Unsaturated fats are fatty acids that have at least one bond missing: a hydrogen atom. Unsaturated fats are usually liquid at room temperature. Examples of unsaturated fats are safflower, sunflower, and soybean oils.



FIGURE 4. This buffalo mozzarella and pepperoni both contain saturated fats from animal sources: hogs and cow's milk. Both foods contain saturated fats even though you cannot "see" the fat as easily in the mozzarella cheese as in the pepperoni.



EXPLORING OUR WORLD...

SCIENCE CONNECTION: Trans Fats

Trans fats are produced when oils or unsaturated fats are hydrogenated. Hydrogenation is a chemical process that bubbles hydrogen gas through the liquid oils to allow the molecules to accept more hydrogen atoms. Trans fats increase the shelf life of processed foods and are used to improve their taste and texture. You find trans fats in frozen pizza, packaged cookies, crackers, and many fried foods, such as French fries and donuts. Partially hydrogenated foods include peanut butter. Trans fat levels were placed on Nutrition Facts labeling in 2006. Excessive trans fats in your diet are linked to an increase in LDL—bad cholesterol. Doctors recommend less than 1 percent of your calories come from trans fats. Doctors worry that trans fats will cause an increased risk of heart disease.

Proteins

Proteins are nutrients made up of nitrogen, carbon, hydrogen, and oxygen molecules. Proteins have several functions in the body, including growth, repair, maintenance, and energy. Proteins are composed of chains of amino acids. **Amino acids** are the building blocks of proteins. Proteins are found in meats, eggs, dairy products, and different types of beans.

Vitamins

Vitamins are complex chemical substances that are essential to the body. They are required only in small amounts, and the body itself can make some of them. For example, in the presence of sunlight, the skin can produce vitamin D. There are two types of vitamins: fat-soluble and water-soluble.

Fat-soluble vitamins are vitamins that can be dissolved in the fatty material in the body. Examples of fat-soluble vitamins are A, D, E, and K. These are commonly found in vegetable oil, liver, and eggs.

Water-soluble vitamins are vitamins that can be dissolved in water. Examples of water-soluble vitamins are C and B. These are commonly found in fruits and vegetables.

Minerals

Minerals are nutrients that occur naturally in rocks and soil. As with vitamins, the body requires only small amounts of minerals, which become part of the body's bones, tissues, and fluids. Calcium and iron are two important minerals for good nutrition. A diet deficient, or lacking, in these two minerals can cause health problems. Osteoporosis is caused by a lack of calcium, and anemia is caused by a lack of iron.

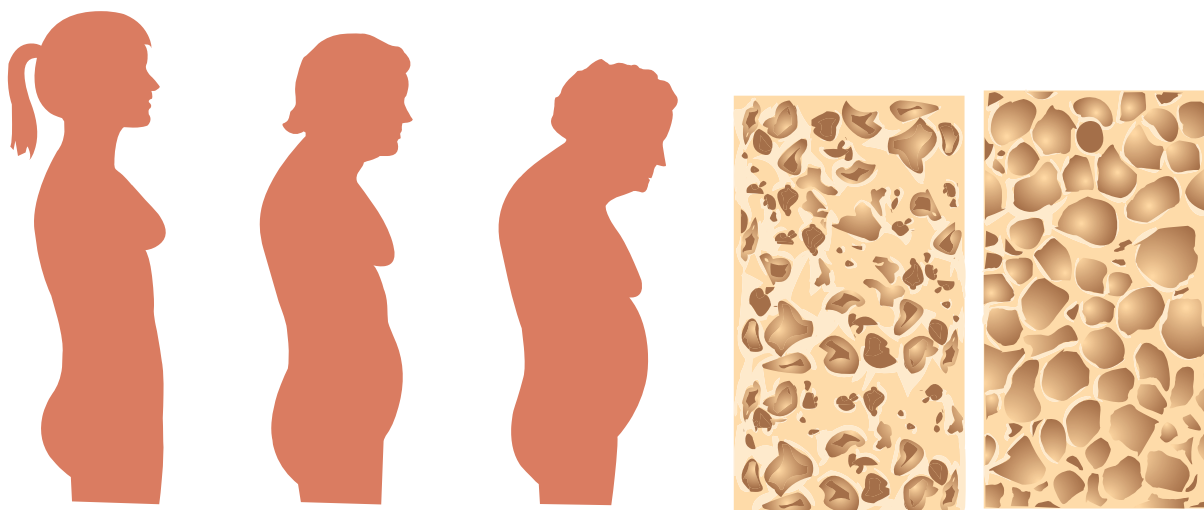


FIGURE 5. Osteoporosis is a disease of porous bones, or loss of bone density. Notice the difference in height as the woman ages, and then notice the difference in the bone density. Calcium is necessary to help prevent osteoporosis.



FURTHER EXPLORATION...

ONLINE CONNECTION: Six Classes of Nutrients Online Quiz

Use the website <http://quizlet.com/7711308/6-classes-of-nutrients-flash-cards/> for review or to play a fast-paced game about the six classes of nutrients.

Water

Water is used in every chemical reaction in the body. Without water, the body cannot function. Water is necessary for homeostasis in the body. **Homeostasis** is the process of maintaining balance within the body. Most people require at least eight cups, or two liters, of water per day. Any less can cause dehydration. Dehydration may lead to death if not treated. Symptoms of dehydration include weakness and rapid breathing.

Summary:



Each of the six classes of nutrients is required for the body to maintain homeostasis—balance within the body. Carbohydrates provide energy. Simple carbohydrates provide quick energy, and complex carbohydrates release energy slowly. Fats supply concentrated sources of energy and essential fats needed by the body. Proteins provide energy and are the building blocks for growth and repair. Vitamins are needed in small amounts and are critical for chemical reactions in the body. Minerals, found in rocks and soil, are used in very small amounts by the body and are part of the body's bones, tissues, and fluids. Water is used in every chemical reaction in the body. Follow MyPlate recommended daily allowances of the six nutrient classes to maintain a healthy lifestyle.

Checking Your Knowledge:



1. What is the difference between simple and complex carbohydrates?
2. What is the difference between unsaturated and saturated fats?
3. How are amino acids related to proteins?
4. What is the difference between fat-soluble and water-soluble vitamins?
5. What are two health issues related to an insufficient intake of minerals?

Expanding Your Knowledge:



Nutrition, or the science of how organisms consume nutrients to complete bodily functions, has been studied since 400 BC. Hippocrates is called the father of medi-

cine. He used diet and exercise to cure health issues. The twentieth century is called the Golden Era of Nutrition when most of the nutrients were discovered. Nutrition research continues today. The Beltsville Human Nutrition Research Center is the U.S. Department of Agriculture's largest human research facility focusing on nutrition. Research Hippocrates and the history of nutrition. Use the web links below to find out more.

Web Links:



A History of Nutrition

http://www.nutritionbreakthroughs.com/html/a_history_of_nutrition.html

Carbohydrate ID Lab Analysis Write-Up

<http://manditaylorjebe.wordpress.com/2011/10/13/carbohydrate-id-lab-analysis-write-up/>

Beltsville Human Nutrition Research Center

http://www.ars.usda.gov/main/site_main.htm?modecode=12-35-00-00

History Highlights of Nutrition

<http://www.ansc.purdue.edu/courses/ansc221v/histnote.htm>

Understanding Trans Fats

<http://www.webmd.com/food-recipes/understanding-trans-fats>

What Is Hydrogenation?

<http://www.wisegeek.com/what-is-hydrogenation.htm>