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SPEAKING OF NUTRITION . . . SOME BASICS

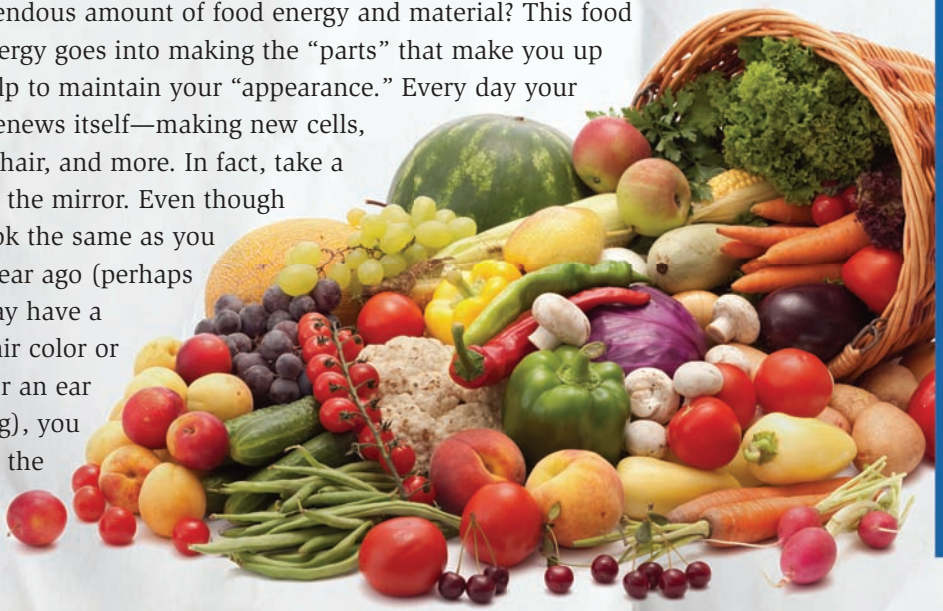
Welcome to the world of nutrition, the study of food and health. Taking this class means you have an interest in your health and fitness. I applaud you for wanting to take charge of your body—learning about what your body needs for optimal health for today and a lifetime. Your food choices impact your performance today as well as set the stage for health and disease prevention later in life.

In this course, you will learn that while many people tend to categorize foods as "good" or "bad," such as carrots and oranges versus burgers and fries, that all foods fit in your diet. Some do provide you with an array of substances better for your health than others, but eating and living well is about making balanced choices. During this course, you will have the opportunity to assess your food choices by completing the Diet Project. As you learn about the roles of protein, fiber, fat, vitamins, and more in your body, you can compare how your diet rates with recommendations for optimal health, and then learn how to best meet your needs through foods and understand where supplements may be an option.

Before we can explore specifics about what's best for you to eat, a few basics must be introduced. So let's get started!

WHAT ARE NUTRIENTS, THEIR BASIC FUNCTIONS, AND HOW MUCH DO YOU NEED (THE RDA)?

How much food do you eat in a year's time? Or, what about the amount of food you may eat over the next four decades? Like many college students, you most likely average about 1 million calories a year or in 45 years almost 70,000 pounds of food. So where is all this food going? What could your body possibly be doing with such a tremendous amount of food energy and material? This food and energy goes into making the "parts" that make you up and help to maintain your "appearance." Every day your body renews itself—making new cells, tissue, hair, and more. In fact, take a look in the mirror. Even though you look the same as you did a year ago (perhaps you may have a new hair color or style, or an ear piercing), you are not the



same person. You actually have an entirely new skin surface, newly remodeled bones, and fresh lining to your intestinal tract. In fact:

- About 1% of your blood cells are new every day.
- The cells in your intestine renew themselves every three to five days.
- Your skin is sloughed daily (which is some of the dust in your dorm room or apartment!).
- You're busy growing new body hair daily.

The food that you eat supplies you with the parts and fuel—nutrients—needed to keep up this type of rebuilding and renewing schedule. Food supplies nutrients that:

- provide energy
- serve as building materials
- help to maintain or repair body parts

There are six categories of nutrients (all totaled there are 50 nutrients):

1. Proteins (made of 20 different subunits)
2. Carbohydrates (simple and complex)
3. Fats (two categories with several types)
4. Minerals (15 plus minterals)
5. Vitamins (13 different ones)
6. Water (a single nutrient in a class by itself)

Foods, such as fruits, vegetables and whole grains, contain other substances that may have biological activity in disease prevention and health promotion. These substances, called **phytochemicals**, of which there are thousands in whole foods, help protect the plants we eat from UV light, insects, and other pests. Once we eat these colorful phytochemicals in carrots, peppers, oranges and the like, these substances promote better health and help protect us from chronic diseases, such as cancer. Scientific studies show that phytochemicals in soybeans called isoflavones help lower risks for certain cancers.

All six categories of nutrients are present in the body but in differing amounts or percent of your body weight as follows:

1. **50–60% water**—males generally have about 60%, and females have 50% due to differences in body fat and muscle content.
2. **15–25% fat**
   - Desirable levels: 15% for males and 22–25% for females
   - Body fat levels influence body water content because fat tissue is very low in water content (about 23%) compared to muscle or brain tissue (70%).
   - As body fat increases, body water decreases; as body fat decreases, body water increases. This explains why most males have a higher percentage of body water than females.
3. **18–20% protein**—males have more than females due to higher lean or muscle mass.
4. **4–5% minerals**—the body's mineral content is primarily in bones and teeth. This varies by gender (males have higher levels than females) and race (blacks have more than whites, who have more than Asians).

Nutrition Bite

Fun fact about your hair—you grow over 350 miles of hair in a lifetime!

Nutrition Bite

Is there a best body fat level for athletes?

Here are some numbers for body fat in collegiate athletes (see Figure 1.1). And as you'll see in Chapter 7, there is not a perfect or ideal body fat level that depicts optimal health but rather there are ranges.

PERCENT BODY FAT VALUES IN ATHLETES		
	MALES	FEMALES
Basketball	7–12	18–27
Distance Running	3–8	8–18
Gymnastics	7–12	16–22
Soccer	4–10	14–25
Swimming	5–12	10–20
Tennis	12–16	15–22
Nonathlete, avg.	15–16.9	20–26.9

Figure 1.1

5. **Less than 1% carbohydrates**—storage of carbohydrates in the muscles and liver is vital for fuel during exercise and rest (especially for the brain).
6. **Less than 1% vitamins**—very trace amounts exist in each cell.

Foods, as well as the body, contain all six categories of nutrients in varying amounts. Must you eat all 50 nutrients or only some?

Essential nutrients are those nutrients that the body cannot make or cannot make at a rate sufficient to meet your needs. Therefore, the diet requires them. For example, calcium is a mineral that originates in soil (rocks), gets into plants that cows eat, and then gets into milk, and eventually gets into our bodies. We are incapable of making calcium, so we must get it from the food we eat.

On the other hand, water is made every day in our bodies as we metabolize food for energy. However, we only make about a cup each day, which falls short of the several cups we need. Therefore, water is essential in the diet.

How Do Nutrients Function in the Body?

1. **Energy**—Only proteins, carbohydrates, and fats (the macronutrients) contain potential energy. Elements, primarily carbon, are connected to each other via chemical bonds that are much like tiny stretched rubber bands. When let go, the energy is released. The energy released from chemical bonds is measured as calories. (We'll learn more about this in Chapter 3.)
2. **Structure**—Nutrients, such as protein and calcium, are the building material and structure for bone and teeth.
3. **Regulation**—As regulators, nutrients help manage and oversee many processes in the body such as building new hormones, regulating fluid balance, or catalyzing a reaction such as enzymes, which are made of protein. Regulatory nutrients are much like traffic lights that help regulate the flow of vehicles on busy streets.

How Do We Express Our Nutrient Needs or Requirements?

The amount of protein, Vitamin C or other nutrients a person needs depends on a host of factors including:

- Gender
- Age
- Physiological state (e.g., pregnant or breastfeeding)
- Illness
- Genetics traits

While we all need the same nutrients, the amounts vary depending on these and other factors. Setting nutrient standards is the task of an arm of the government—the Food and Nutrition Board. Health professionals and others call these standards **Dietary Reference Intakes (DRI)** (see Figure 1.2) and use them in establishing nutrient intakes for planning and assessing the diets of healthy individuals.

These nutrient requirements are designed to prevent deficiency diseases, such as scurvy from too little Vitamin C or rickets (a bone deformity) due to too little calcium and Vitamin D. The DRIs are also designed to promote optimal health and the reduction of chronic disease risks, such as cancer, potentially from a marginal intake of Vitamins C, D, and calcium.

Under the umbrella term of DRI, there are four separate nutrient standard values of which the Recommended Dietary Allowance (RDA) is one.

In addition, the DRIs are designed to set an upper limit of intake to avoid the risk of adverse reaction due to overdose.

You are probably familiar with or at least heard of this term before. In this course, we will make reference to the RDA, what it means, how the RDA for a given nutrient is determined, and how best to meet your needs. While the other nutrient standard values are important in the world of nutrition, in this course we will not utilize these except for making reference to the Tolerable Upper Intake Level or UL. This standard represents the highest level of daily nutrient intake that is likely to be safe and not pose any adverse health effects to most people in the population. But

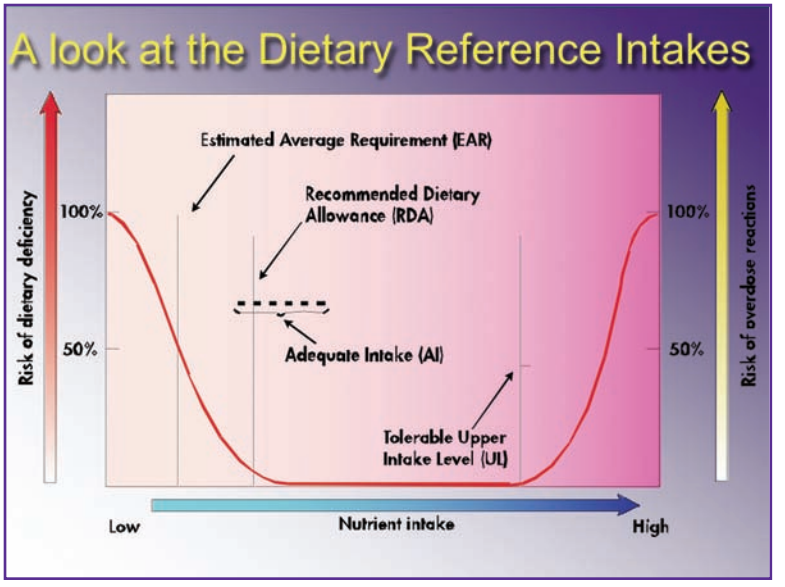


Figure 1.2

dietary or supplement intake exceeding the UL for a certain nutrient, such as iron, may present some health problems. As we will cover in the topic of supplements in Chapter 9, not only can we get too little of a nutrient, but excessive intake through foods that are fortified with nutrients, such as vitamins as well as supplements, pose health risks.

A Closer Look at the RDA

The RDA is the daily amount of nutrient considered adequate to meet the needs of nearly all healthy people in the population (about 98% of us), while decreasing risk of chronic diseases. The RDA is NOT a minimum amount nor is it an average need but instead a generous value. And the RDA is set based on scientific information.

- The RDA has been determined for protein and other nutrients (vitamins, minerals, etc.).
- The RDA is established for several age groups, gender, and physiological states (pregnancy and lactation).
- The RDA is designed to be an average over several days. (In other words, you don't have to meet the RDA each day, but instead averaged it over several.)
- Adjustments are made when setting the RDA based upon several factors that we will highlight as each nutrient is covered, such as the quality of the diet (as in protein covered in Chapter 2), bioavailability (as with minerals covered in Chapter 8), and losses due to food preparation (as with vitamins covered in Chapter 9).

You will not need to memorize each RDA (except for protein) but instead know what goes into setting the RDA and what it means to you.

HOW DOES YOUR BODY COPE?

Ever wonder why you still function even though you haven't eaten all day, or why your body's internal temperature hovers around 37 degrees Celsius or 98.6 degrees Fahrenheit despite freezing or scorching temperatures outside?

The reason is actually more of a concept or process called **homeostasis**. This is the maintenance of relatively constant internal conditions (such as body temperature and blood sugar levels) through the efforts and control of many systems in the body.

The concept of homeostasis will be emphasized throughout this course to help us predict as well as understand why our bodies respond and perform the way they do. For example, once you grasp the concept of homeostasis, you will soon understand why taking large amounts of a particular supplement such as vitamins or amino acids (components of protein) will not drastically change or alter the way your body or cells work so as not to upset other systems in your body.

Let's use the example of body water content to help understand homeostasis as well as learn more about the nutrient water. Recall that about 50% to 60% of your body weight is water. Figure 1.3 depicts the fluid inside and outside the body cells; the distribution of body water is determined and controlled by several factors such as hormones, the action of the kidneys, and the mineral and protein levels in body fluids.

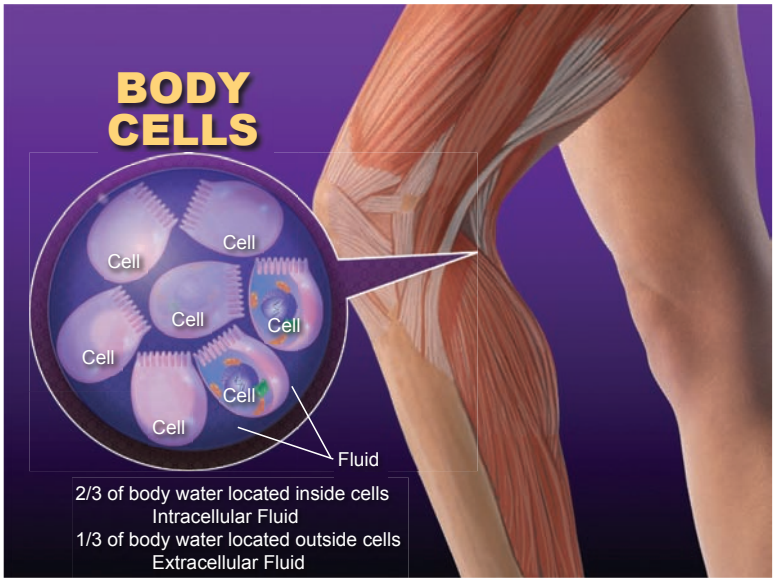


Figure 1.3

Your body water content as fluid homeostasis is regulated well. On average a typical person takes in about 2½ liters of fluid daily and loses the same (see Figure 1.4).

On your final, you will be asked to define homeostasis and give an example of a nutrient under homeostatic control. By the end of the course, you'll surely have many ideas for your answer.

INSIDE WORK—THE PROCESS OF DIGESTION AND ABSORPTION

Nutrition Bite

The surface area of your intestinal tract would cover about a third of a football field.

How do we process food and prepare it to enter our bodies? Our bodies accomplish this task through the process of digestion and absorption. Digestion is the process by which food is broken down into a form that can be absorbed by the intestines. **Absorption** is the process of moving nutrients into the body or bloodstream. Digestion occurs in the digestive tract, which begins at the mouth and is 26 feet long. Visualize the digestive tract as "outside" your body; that is, the digestive tract is a

FLUID BALANCE

INTAKE:		OUTPUT:	
Fluid	1.2 liters	Urine	1.5 liters
Food	1.0 liters	Stool	0.1 liters
Metabolic	0.3 liters	Sweat and breath vapor	0.9 liters
	2.5 liters		2.5 liters

Figure 1.4

tube that runs through your body, but the contents (if you swallow a golf ball, for example) are not really inside of you. Absorption only occurs when the food (its components) is transported from the small intestine into the circulation.

Figure 1.5 illustrates the digestive tract (with each part identified) along with some of the accessory organs, collectively called the digestive system.

There are two phases of digestion.

1. **Physical digestion:** the moving and grinding of food. This starts in the mouth with chewing, though you do not have to chew your food (despite that mom told you to chew your food well before swallowing) to completely digest your food. Once you have chewed (or just swallowed) your food, the bolus (swallowed food) moves down your esophagus into the stomach where it is "blenderized." The stomach, which has a 4-cup capacity, is much like a blender (strong muscles) that makes a smoothie out of your swallowed food.
2. **Chemical digestion:** the chemical breakdown of food through the use of digestive enzymes (actual breaking of chemical bonds in foods and stomach acid). This process starts in the stomach with a majority occurring in the small intestine. The digestive enzymes needed to break these bonds are secreted by the pancreas into the small intestine. Once the process of chemical digestion is complete, the food has been digested and the process of absorption occurs.

Absorption is the process of taking these small food fragments from the small intestine and transporting them into the blood. The surface of the small intestine is where absorption occurs. The surface of the small intestine, as shown in Figure 1.6, is designed for maximum surface area. The folds, the folds on these folds called villi, and then hair-like structures on villi called microvilli all contribute to a tremendously large surface area that allows the nutrients an opportunity to be taken up into the body and eventually into the circulation. Figure 1.7 illustrates villi and microvilli structures and the placement of capillaries that allow for transport of absorbed small food units into the body via the circulation.

Urban Myth

Myth: "We should eat food, such as fruit, separately because our digestive tracts can't handle different foods at once."

The design of our digestive enzymes and intestinal tract allows for the processing of different food types, such as fruits, meats and vegetables, all at once. In fact, nutrient absorption improves when a variety of foods are present. There is no need to separate foods when eating.

Figure 1.5

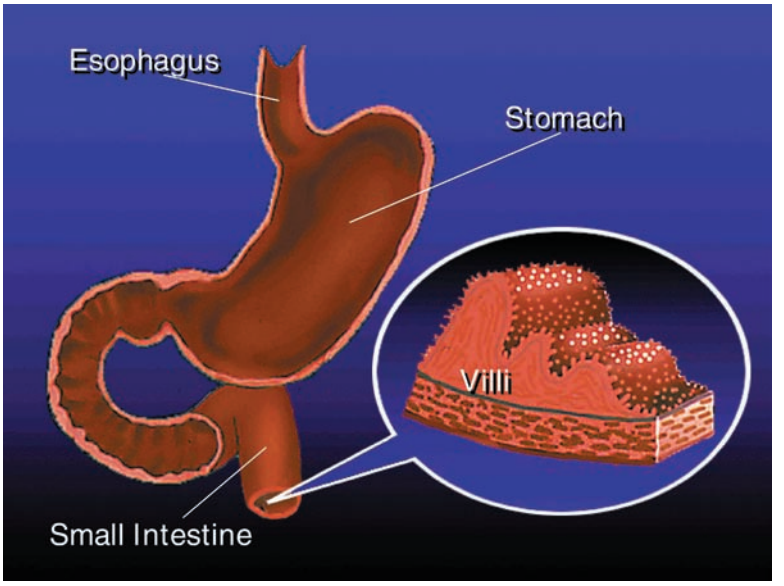


Figure 1.6

However, some food is not digested and absorbed. These items, such as fiber (or if you happened to swallow a food wrapper), move into the large intestine where the body extracts water and minerals, and prepares the remnants as stool. The stool then represents material that never got into the body in the first place, but only passed through the digestive tract. You might have wondered what urine represents. This metabolic waste represents substances, such as excess sodium that the body (kidneys) have filtered from the cells, blood, and elsewhere, and sends out in the urine.

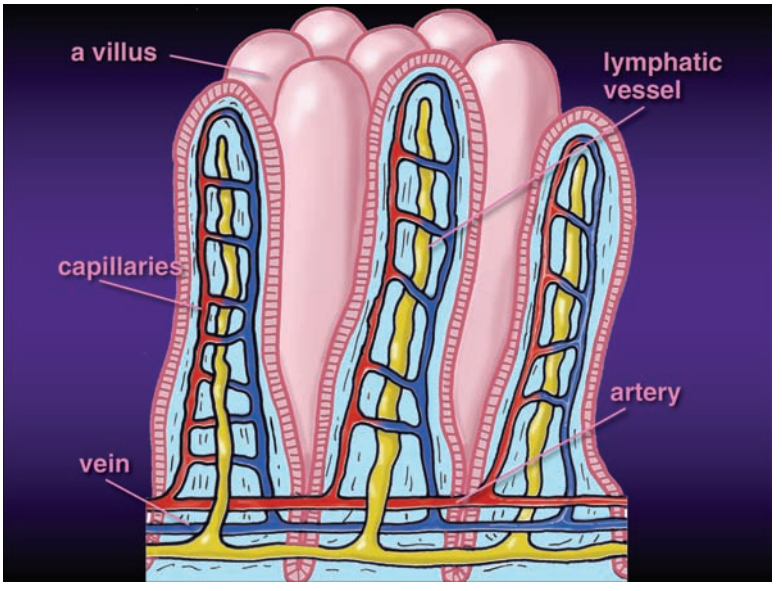


Figure 1.7

Name _____ Student ID# _____

Quiz Yourself

CHAPTER 1

1. Most of the enzymes responsible for the digestion of the energy nutrients come from the:

   a. mouth
   b. stomach
   c. liver
   d. pancreas

2. What is the approximate average body water content of a young adult human expressed as a percent of body weight?

   a. 10–20%
   b. 30–40%
   c. 50–60%
   d. 70–80%
   e. 90%

3. List the six classes of nutrients, give a food source example and note which ones provide energy.

   1. _____
   2. _____
   3. _____
   4. _____
   5. _____
   6. _____

4. What are the three basic functions of nutrients?

   1. _____
   2. _____
   3. _____

5. Most of the body's water occurs in extracellular fluid compartments (outside of the body cells.

   a. true
   b. false

6. Define an essential nutrient.

7. Define the Recommended Dietary Allowance (RDA) and list three factors that are taken into consideration when establishing the RDA.

1.

2.

3.

8. Define digestion and describe the two types of digestion.

9. What is absorption and where does it occur?