An Overview of Anatomy and Physiology

Most of us are naturally curious about our bodies; we want to know what makes us tick. This curiosity is even seen in infants, who can keep themselves happy for a long time staring at their own hands or pulling their mother's nose. Older children wonder where food goes when they swallow it, and some believe that they will grow a watermelon in their belly if they swallow the seeds. They scream loudly when approached by medical personnel (fearing shots that sting), but they like to play doctor. Adults become upset when their hearts pound, when they have uncontrollable hot flashes, or when they cannot keep their weight down.

Anatomy and physiology, subdivisions of biology, explore many of these topics as they describe how our bodies are put together and how they work.

Anatomy

Anatomy (ah-nat′o-me) is the study of the structure and shape of the body and body parts and their relationships to one another. Whenever we look at our own body or study large body structures such as the heart or bones, we are observing *gross anatomy;* that is, we are studying large, easily observable structures. Indeed, the term *anatomy,* derived from the Greek words meaning to cut (*tomy*) apart (*ana*), is related most closely to gross anatomical studies because in such studies preserved animals or their organs are dissected (cut up) to be examined. On the other hand, if a microscope or magnifying instrument is used to see very small structures in the body, we are studying *microscopic anatomy.* The cells and tissues of the body can only be seen through a microscope.

Physiology

Physiology (fiz″e-ol′o-je) is the study of how the body and its parts work or function (*physio* = nature; *ology* = the study of). Like anatomy, physiology has many subdivisions. For example, *neurophysiology* explains the workings of the nervous system, and *cardiac physiology* studies the function of the heart, which acts as a muscular pump to keep blood flowing throughout the body.

Relationship between Anatomy and Physiology

In the real world, anatomy and physiology are always related. The parts of your body form a well-organized unit, and each of those parts has a job to do to make the body operate as a whole. Structure determines what functions can take place. For example, the lungs are not muscular chambers like the heart and cannot pump blood through the body, but because the walls of their air sacs are very thin, they *can* exchange gases and provide oxygen to the body. The intimate relationship between anatomy and physiology is stressed throughout this book to make your learning meaningful.

Levels of Structural Organization

From Atoms to Organisms

The human body exhibits many levels of structural complexity (Figure 1.1). The simplest level of the structural ladder is the *chemical level,* which we will study in Chapter 2. At this level, **atoms,** tiny building blocks of matter, combine to form *molecules* such as water, sugar, and proteins. Molecules, in turn, associate in specific ways to form microscopic **cells,** the smallest units of all living things. The *cellular level* is examined in Chapter 3. Individual cells vary widely in size and shape, reflecting their particular functions in the body.

The simplest living creatures are composed of single cells, but in complex organisms like trees or human beings, the structural ladder continues on to the *tissue level.* **Tissues** consist of groups of similar cells that have a common function. As we will discuss in Chapter 3, each of the four basic tissue types (epithelial, connective, muscular, and neural) plays a definite but different role in the body.

An **organ** is a structure that is composed of two or more tissue types and performs a specific function for the body. At the *organ level* of organization, extremely complex functions become possible. For example, the small intestine, which digests and absorbs food, is composed of all four tissue types. All the body's organs are grouped so that a number of organ systems are formed. An **organ system** is a group of organs that cooperate to accomplish a common purpose. For example,

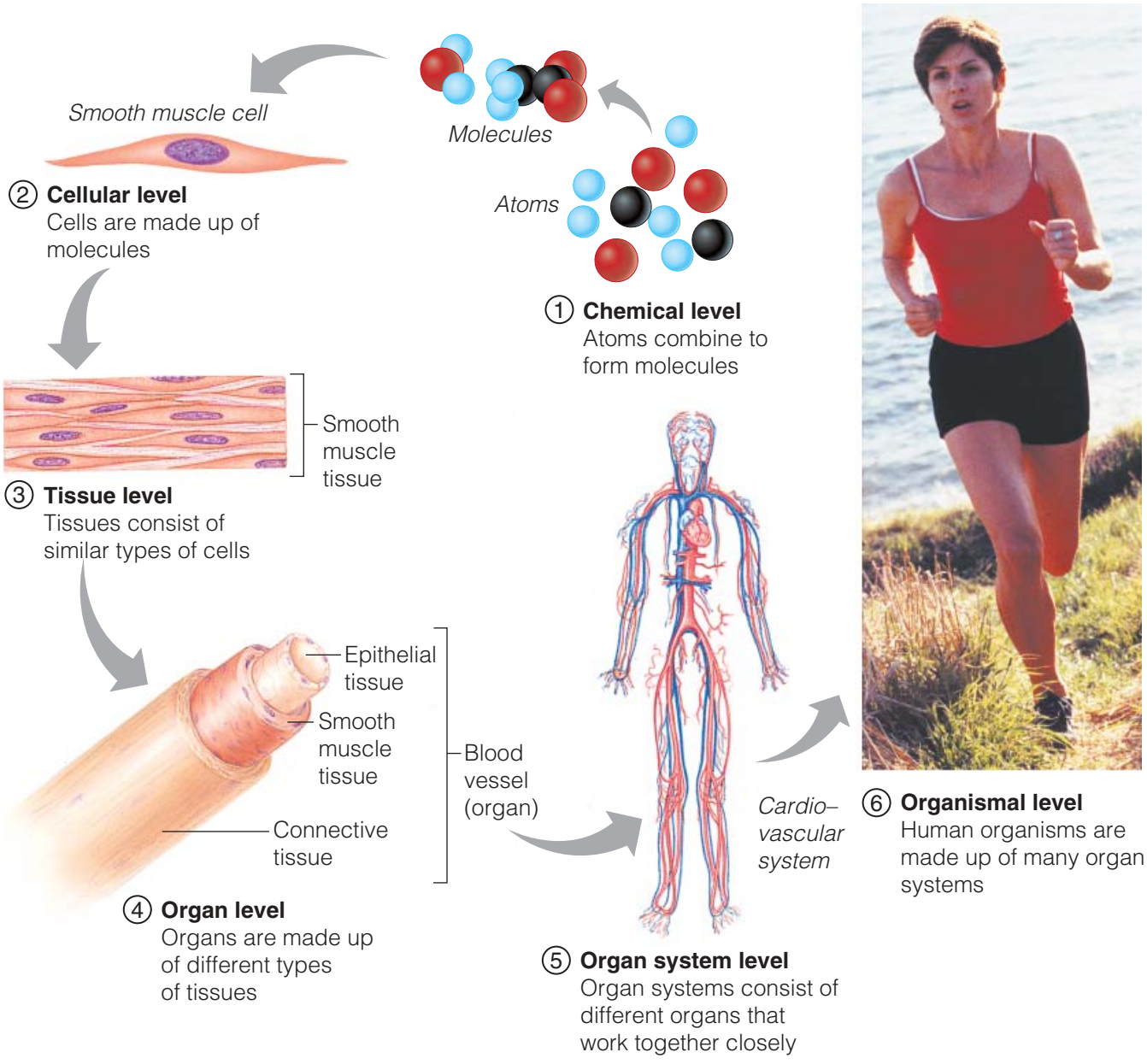

FIGURE 1.1 Levels of structural organization. In this diagram, components of the cardiovascular system are used to illustrate the various levels of structural organization in a human being.

the digestive system includes the esophagus, the stomach, and the small and large intestines (to name a few of its organs). Each organ has its own job to do, and, by working together, they keep food moving through the digestive system so that it is properly broken down and absorbed into the blood, providing fuel for all the body's cells. In all, 11 organ systems make up the living body, or the **organism,** which represents the highest level of structural organization, the *organismal level*. The major organs of each of the systems are shown in Figure 1.2. Refer to the figure as you read through the following descriptions of the organ systems.

Organ System Overview

Integumentary System

The **integumentary** (in-teg″u-men′tar-e) **system** is the external covering of the body, or the skin. It waterproofs the body and cushions and protects