Human Body Systems
4. Anatomy and Physiology

Central Concepts: There is a relationship between the organization of cells into tissues and the organization of tissues into organs. The structures and functions of organs determine their relationships within body systems of an organism. Homeostasis allows the body to perform its normal functions.

4.1 Explain generally how the digestive system (mouth, pharynx, esophagus, stomach, small and large intestines, rectum) converts macromolecules from food into smaller molecules that can be used by cells for energy and for repair and growth.

4.2 Explain how the circulatory system (heart, arteries, veins, capillaries, red blood cells) transports nutrients and oxygen to cells and removes cell wastes. Describe how the kidneys and the liver are closely associated with the circulatory system as they perform the excretory function of removing waste from the blood. Recognize that kidneys remove nitrogenous wastes, and the liver removes many toxic compounds from blood.

4.3 Explain how the respiratory system (nose, pharynx, larynx, trachea, lungs, alveoli) provides exchange of oxygen and carbon dioxide.

4.4 Explain how the nervous system (brain, spinal cord, sensory neurons, motor neurons) mediates communication among different parts of the body and mediates the body’s interactions with the environment. Identify the basic unit of the nervous system, the neuron, and explain generally how it works.

4.5 Explain how the muscular/skeletal system (skeletal, smooth and cardiac muscles, bones, cartilage, ligaments, tendons) works with other systems to support the body and allow for movement. Recognize that bones produce blood cells.

4.6 Recognize that the sexual reproductive system allows organisms to produce offspring that receive half of their genetic information from their mother and half from their father, and that sexually produced offspring resemble, but are not identical to, either of their parents.

4.7 Recognize that communication among cells is required for coordination of body functions. The nerves communicate with electrochemical signals, hormones circulate through the blood, and some cells produce signals to communicate only with nearby cells.

4.8 Recognize that the body’s systems interact to maintain homeostasis. Describe the basic function of a physiological feedback loop.
Levels of Organization in a Multicellular Organism

*Cells:* The basic unit of structure and function in organisms. In multicellular organisms groups of cells are specialized to perform a particular function.

*Tissues:* A group of cells that perform a single function.
ex. Epithelial, Connective, Nervous, Muscle.

*Organs:* A group of different tissues working together.
ex. Eye, Heart, Stomach

*Organ Systems:* A group of organs that perform closely related functions.
Homeostasis - process by which organisms keep internal conditions relatively constant despite changes in the external environment.

Homeostasis in your body is maintained by FEEDBACK LOOPS.
NON-LIVING EXAMPLE

An Example of Feedback Inhibition

Thermostat senses temperature change and switches off heating system

Room temperature increases

Room temperature decreases

Thermostat senses temperature change and switches on heating system
Homeostasis In the Body

Maintenance of homeostasis requires the integration of all organ systems at all times.

One example is the maintenance of a stable body temperature.

The hypothalamus monitors the temperature of the skin and the temperature of organs.

If core body temperature drops, the hypothalamus:

* causes blood vessels in the skin to constrict reducing heat loss from skin.

* causes the skeletal muscles to contract involuntarily—to “shiver.”

This causes the body temperature to increase.
If the core body temperature increases, the hypothalamus:

* causes blood vessels in the skin to dilate so heat can escape from the skin.

* the body produces sweat, which cools the body by evaporation.

This causes the body temperature to decrease.
Homeostasis and temperature control

Body temperature rises above normal
Nervous system signals dermal blood vessels to dilate and sweat glands to secrete
Body heat is lost to its surroundings

Body temperature drops toward normal
Body heat is conserved

Normal body temperature 37°C (98.6°F)
Hypothalamic set point
hypothesis

Body temperature drops below normal
Nervous system signals dermal blood vessels to constrict and sweat glands to remain inactive

If body temperature continues to drop, nervous system signals muscles to contract involuntarily
Muscle activity generates body heat