Homeostasis Throughout the Body
Each body system contributes to the homeostasis of other systems and of the entire organism. No system of the body works in isolation, and the well-being of the person depends upon the well-being of all the interacting body systems. A disruption within one system generally has consequences for several additional body systems. Here are some brief explanations of how various body systems contribute to the maintenance of homeostasis:

Nervous System
Since the nervous system does not store nutrients, it must receive a continuous supply from blood. Any interruption to the flow of blood may bring brain damage or death. The nervous system maintains homeostasis by controlling and regulating the other parts of the body. A deviation from a normal set point acts as a stimulus to a receptor, which sends nerve impulses to a regulating center in the brain. The brain directs an effector to act in such a way that an adaptive response takes place. If, for example, the deviation was a lowering of body temperature, the effector acts to increase body temperature. The adaptive response returns the body to a state of normalcy and the receptor, the regulating center, and the effector temporarily cease their activities. Since the effector is regulated by the very conditions it produced, this process is called control by negative feedback (fig. 2). This manner of regulating normalcy results in a fluctuation between two extreme levels. Not until body temperature drops below normal do receptors stimulate the regulating center and effectors act to raise body temperature. Regulating centers are located in the central nervous system, consisting of the brain and spinal cord (fig. 3a, 3b). The hypothalamus is a portion of the brain particularly concerned with homeostasis; it influences the action of the medulla oblongata, a lower part of the brain, the autonomic nervous system, and the pituitary gland.

The nervous system has two major portions: the central nervous system and the peripheral nervous system (table 3). The peripheral nervous system consists of the cranial and spinal nerves. The autonomic nervous system is a part of peripheral nervous system and contains motor neurons that control internal organs. It operates at the subconscious level and has two divisions, the sympathetic and parasympathetic systems. In general, the sympathetic system brings about those results we associate with emergency situations, often called fight or flight reactions, and the parasympathetic system produces those effects necessary to our everyday existence.

Endocrine System
The endocrine system consists of glands which secrete hormones into the bloodstream. Each hormone has an effect on one or more target tissues. In this way the endocrine system regulates the metabolism and development of most body cells and body systems. To be more specific, the Endocrine system has sex hormones that can activate sebaceous glands, development of mammary glands, alter dermal blood flow and release lipids from adipocytes and MSH can stimulate melanocytes on our skin. Our bone growth is regulated by several hormones, and the endocrine system helps with the mobilization of calcitonin and calcium. In the muscular system, hormones adjust muscle metabolism, energy production, and growth. In the nervous system, hormones affect neural metabolism, regulate fluid/electrolyte balance and help with reproductive hormones that influence CNS development and behaviors. In the Cardiovascular system, we need hormones that regulate the production of RBC's, which elevate and lower blood pressure. Hormones also have anti-inflammatory effects and stimulate the lymphatic system. In summary, the endocrine system has a regulatory effect on basically every other body system.

Integumentary System
The integumentary system (the skin) is involved in protecting the body from invading microbes (mainly by forming a thick impenetrable layer), regulating body temperature through sweating and vasodilation, or shivering and piloerection (goose bumps), and regulating ion balances in the blood. Stimulation of mast cells also produce changes in blood flow and capillary permeability which can effect the blood flow in the body and how it is regulated. It also helps synthesize vitamin D which interacts with calcium and phosphorus absorption needed for bone growth, Human Physiology/Homeostasis 5 maintenance, and repair. Hair on the skin guards entrance into the nasal cavity or other orifices preventing invaders of getting further into our bodies. Our skin also helps maintain balance by excretion of water and other solutes (i.e.) the keratinized epidermis limits fluid loss through skin. It also provides mechanical protection against environmental hazards. We need to remember that our skin is integumentary; it is our first line of defense.
Skeletal System
As the structural framework for the human body, the skeletal system consists mainly of the 206 or so bones of the skeletal system but also includes cartilages, ligaments, and other connective tissues that stabilize and interconnect them. Bones work in conjunction with the muscular system to aid in posture and locomotion. Many bones of the skeleton function as levers, which change the magnitude and direction of forces generated by skeletal muscle. Protection is a pivotal role occupied by the skeletal system, as many vital organs are encased within the skeletal cavities (cranial, and spinal “or dorsal”), and bones form much of the structural basis for other body cavities (ex: thoracic and pelvic cavities). The skeletal system also serves as an important mineral reserve. For example, if blood levels of calcium or magnesium are low and the minerals are not available in the diet, they will be taken from the bones. Also, the skeletal system provides calcium needed for all muscular contraction. Finally, red blood cells, lymphocytes and other cells relating to the immune response are produced and stored in the bone marrow.

Muscular System
The muscular system is one of the most versatile systems in the body. The muscular system contains the heart, which constantly pumps blood through the body. The muscular system is also responsible for involuntary (e.g. goosebumps, digestion, breathing) and voluntary (e.g. walking, picking up objects) actions. Muscles also help protect organs in the body's cavities.

Cardiovascular System
The cardiovascular system, in addition to needing to maintain itself within certain levels, plays a role in maintenance of other body systems by transporting hormones (heart secretes ANP and BNP) and nutrients (oxygen, EPO to bones, etc.), taking away waste products, and providing all living body cells with a fresh supply of oxygen and removing carbon dioxide. Homeostasis is disturbed if the cardiovascular or lymphatic systems are not functioning correctly. Our skin, bones, muscles, lungs, digestive tract, and nervous, endocrine, lymphatic, urinary and reproductive systems use the cardiovascular system as its "road" or "highway" as far as distribution of things that go on in our body. There are many risk factors for an unhealthy cardiovascular system. Some diseases associated are typically labeled "uncontrollable" or "controllable." The main uncontrollable risk factors are age, gender, and a family history of heart disease, especially at an early age.

Lymphatic System
The lymphatic system has three principal roles. First is the maintenance of blood and tissue volume. Excess fluid that leaves the capillaries when under pressure would build up and cause edema. Secondly, the lymphatic system absorbs fatty acids and triglycerides from fat digestion so that these components of digestion do not enter directly into the blood stream. Third, the lymphatic system is involved in defending the body against invading microbes, and the immune response. This system assists in maintenance, such as bone and muscle repair after injuries. Another defense is maintaining the acidic pH of urine to fight infections in the urinary system. The tonsils are our bodies "helpers" to defend us against infections and toxins absorbed from the digestive tract. The tonsils also protect against infections entering into our lungs.

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Respiratory System
The respiratory system works in conjunction with the cardiovascular system to provide oxygen to cells within every body system for cellular metabolism. The respiratory system also removes carbon dioxide. Since CO2 is mainly transported in the plasma as bicarbonate ions, which act as a chemical buffer, the respiratory system also helps maintain proper blood pH levels, a fact that is very important for homeostasis. As a result of hyperventilation, CO2 is decreased in blood levels. This causes the pH of body fluids to increase. If acid levels rise above 7.45, the result is respiratory alkalosis. On the other hand, too much CO2 causes pH to fall below 7.35 which results in respiratory acidosis. The respiratory system also helps the lymphatic system by trapping pathogens and protecting deeper tissues within. Note that when you have increased thoracic space it can provide abdominal pressure through the contraction of respiratory muscles. This can assist in defecation. Remember the lungs are the gateway for our breath of life.

Digestive System
Without a regular supply of energy and nutrients from the digestive system, all body systems would soon suffer. The digestive system absorbs organic substances, vitamins, ions, and water that are needed all over the body. In the skin, the digestive tract provides lipids for storage in the subcutaneous layer. Note that food undergoes three types of
processes in the body: digestion, absorption, and elimination. If one of these is not working, you will have problems that will be extremely noticeable. Mechanics of digestion can include chemical digestion, movements, ingestion absorption, and elimination. In order to maintain a healthy and efficient digestive system, we have to remember the components involved. If these are disturbed, digestive health may be compromised.

**Urinary System**
Toxic nitrogenous wastes accumulate as proteins and nucleic acids are broken down and used for other purposes. The urinary system rids the body of these wastes. The urinary system is also directly involved in maintaining proper blood volume (and indirectly blood pressure) and ion concentration within the blood. One other contribution is that the kidneys produce a hormone (erythropoietin) that stimulates red blood cell production. The kidneys also play an important role in maintaining the correct water content of the body and the correct salt composition of extracellular fluid. External changes that lead to excess fluid loss trigger feedback mechanisms that act to inhibit fluid loss.

**Reproductive System**
The Reproductive System is unique in that it does little to contribute to the homeostasis of the organism. Rather than being tied to the maintenance of the organism, the reproductive system relates to the maintenance of the species. Having said that, the sex hormones do have an effect on other body systems, and an imbalance can lead to various disorders (e.g., a woman whose ovaries are removed early in life is at much higher risk of osteoporosis).