6.1A: Overview of the Musculoskeletal System

The musculoskeletal system is an organ system that enables an organism to move, support itself, and maintain stability during locomotion.

Learning Objectives

• Explain the purpose of the musculoskeletal system

Key Points

• The musculoskeletal system’s primary functions include supporting the body, allowing motion, and protecting vital organs.
• The musculoskeletal system is made up of the body’s bones (the skeleton), muscles, cartilage, tendons, ligaments, joints, and other connective tissue that support and bind tissues and organs together.
• The skeleton serves as the main storage system for calcium and phosphorus.
• The skeleton also contains critical components of the hematopoietic (blood production) system and fat storage. These functions occur in red marrow and yellow marrow, respectively.
• To allow motion, different bones are connected by articulating joints. Cartilage prevents the bone ends from rubbing directly on to each other while the muscles contract to move the bones associated with the joint.

Key Terms

• **red marrow**: Red marrow or medulla ossium rubra, consists mainly of hematopoietic tissue, and gives rise to red blood cells (RBCs), platelets and most white blood cells (WBCs).
- **musculoskeletal system**: An organ system that gives animals (and humans) the ability to move, using the combined actions of the muscular and skeletal systems. It provides form, support, stability, and movement to the body.

- **hematopoeisis**: A biological process in which new blood cells are formed from hematopoietic stem cells (HSCs) within the marrow. All cellular blood components are derived from HSCs.

The musculoskeletal system (also known as the locomotor system) is an organ system that gives animals (including humans) the ability to move, using the muscular and skeletal systems. It provides form, support, stability, and movement to the body.

The musculoskeletal system is made up of the body’s bones (the skeleton), muscles, cartilage, tendons, ligaments, joints, and other connective tissue that supports and binds tissues and organs together.

Its primary functions include supporting the body, allowing motion, and protecting vital organs. The bones of the skeletal system provide stability to the body analogous to a reinforcement bar in concrete construction.

Muscles keep bones in place and also play a role in their movement. To allow motion, different bones are connected by articulating joints, and cartilage prevents the bone ends from rubbing directly onto each other.
The skeletal portion of the system serves as the main storage system for calcium and phosphorus. The importance of this storage is to help regulate mineral balance in the bloodstream. When the fluctuation of minerals is high, these minerals are stored in bone; when it is low, minerals are withdrawn from the bone.

The skeleton also contains critical components of the hematopoietic (blood production) system. Located in long bones are two distinctions of bone marrow: yellow and red. The yellow marrow has fatty connective tissue and is found in the marrow cavity. In times of starvation, the body uses the fat in yellow marrow for energy.

The red marrow of some bones is an important site for hematopoeisis or blood cell production that replaces cells that have been destroyed by the liver. Here, all erythrocytes, platelets, and most leukocytes form in bone marrow from where they migrate to the circulation.
Muscular System

Muscles contract (shorten) to move the bone attached at the joint. Skeletal muscles are attached to bones and arranged in opposing groups around joints. Muscles are innervated—the nerves conduct electrical currents from the central nervous system that cause the muscles to contract.

Three types of muscle tissue exist in the body. These are skeletal, smooth, and cardiac muscle.

- Only skeletal and smooth muscles are considered part of the musculoskeletal system.
- Skeletal muscle is involved in body locomotion.
- Examples of smooth muscles include those found in intestinal and vessel walls.
- Cardiac and smooth muscle are characterized by involuntary movement (not under conscious control).
- Cardiac muscles are found in the heart.

Tendons, Joints, Ligaments, and Bursae

A tendon is a tough, flexible band made of fibrous connective tissue, and functions to connect muscle to bone. Joints are the bone articulations allowing movement. A ligament is a dense, white band of fibrous elastic tissue.

Ligaments connect the ends of bones together in order to form a joint. These help to limit joint dislocation and restrict improper hyperextension and hyperflexion. Also made of fibrous tissue are bursae. These provide cushions between bones and tendons and/or muscles around a joint.
Musculoskeletal system: Image depicting the human muscular system (skeletal muscle)