13.2: Musculoskeletal Basic Concepts

Skeleton

The skeleton is composed of 206 bones that provide the internal supporting structure of the body. See Figure \( \PageIndex{1} \) for an illustration of the major bones in the body. The bones of the lower limbs are adapted for weight-bearing support, stability, and walking. The upper limbs are highly mobile with large range of movements, along with the ability to easily manipulate objects with our hands and opposable thumbs.

Note

For additional information about the bones in the body, visit the OpenStax Anatomy and Physiology book.
Bones are connected together by ligaments. **Ligaments** are strong bands of fibrous connective tissue that strengthen and support the joint by anchoring the bones together and preventing their separation. Ligaments allow for normal movements of a joint while also limiting the range of these motions to prevent excessive or abnormal joint movements. [3]

**Muscles**

There are three types of muscle tissue: skeletal muscle, cardiac muscle, and smooth muscle. **Skeletal muscle** produces movement, assists in maintaining posture, protects internal organs, and generates body heat. Skeletal muscles are voluntary, meaning a person is able to consciously control them, but they also depend on signals from the nervous system to work properly. Other types of muscles are involuntary and are controlled by the autonomic nervous system, such as the smooth muscle within our bronchioles. [4] See Figure \(\PageIndex{2}\) [5] for an illustration of skeletal muscle.

To move the skeleton, the tension created by the contraction of the skeletal muscles is transferred to the **tendons**, strong bands of dense, regular connective tissue that connect muscles to bones. [6]

**Note**

For additional information about skeletal muscles, visit the OpenStax *Anatomy and Physiology* book.
Figure \(\PageIndex{2}\): Skeletal Muscle
Muscle Atrophy

Muscle atrophy is the thinning or loss of muscle tissue. See Figure \(\PageIndex{3}\)\(^{[7]}\) for an image of muscle atrophy. There are three types of muscle atrophy: physiologic, pathologic, and neurogenic.

Physiologic atrophy is caused by not using the muscles and can often be reversed with exercise and improved nutrition. People who are most affected by physiologic atrophy are those who:

- Have seated jobs, health problems that limit movement, or decreased activity levels
- Are bedridden
- Cannot move their limbs because of stroke or other brain disease
- Are in a place that lacks gravity, such as during space flights

Pathologic atrophy is seen with aging, starvation, and adverse effects of long-term use of corticosteroids. Neurogenic atrophy is the most severe type of muscle atrophy. It can be from an injured or diseased nerve that connects to the muscle. Examples of neurogenic atrophy are spinal cord injuries and polio.\(^{[8]}\)

Although physiologic atrophy due to disuse can often be reversed with exercise, muscle atrophy caused by age is irreversible. The effects of age-related atrophy are especially pronounced in people who are sedentary because the loss of muscle results in functional impairments such as trouble with walking, balance, and posture. These functional impairments can cause decreased quality of life and injuries due to falls.\(^{[9]}\)

![Figure \(\PageIndex{3}\): Muscle Atrophy](image)

Joints

Joints are the location where bones come together. Many joints allow for movement between the bones. Synovial joints are the most common type of joint in the body. Synovial joints have a fluid-filled joint cavity where the articulating surfaces of the bones contact and move smoothly against each other. See Figure \(\PageIndex{4}\)\(^{[10]}\) for an illustration of a synovial joint. Articular cartilage is smooth, white tissue that covers the ends of bones where they come together and allows the bones to glide over each other with very little friction. Articular cartilage can be damaged by injury or normal wear and tear. Lining the inner surface of the articular capsule is a thin synovial membrane. The cells of this membrane secrete synovial fluid, a thick, slimy fluid that provides lubrication to further reduce friction between the...
bones of the joint. 

Figure \(\PageIndex{4}\): Synovial Joint

**Types of Synovial Joints**

There are six types of synovial joints. See Figure \(\PageIndex{5}\) for an illustration of the types of synovial joints. Some joints are relatively immobile but stable. Other joints have more freedom of movement but are at greater risk of injury. For example, the hinge joint of the knee allows flexion and extension, whereas the ball and socket joint of the hip and shoulder allows flexion, extension, abduction, adduction, and rotation. The knee, hip, and shoulder joints are commonly injured and are discussed in more detail in the following subsections.
**Shoulder Joint**

The shoulder joint is a ball-and-socket joint formed by the articulation between the head of the humerus and the glenoid cavity of the scapula. This joint has the largest range of motion of any joint in the body. See Figure \( \text{Figure Index(6)} \) to review the anatomy of the shoulder joint. Injuries to the shoulder joint are common, especially during repetitive abductive use of the upper limb such as during throwing, swimming, or racquet sports.
**Hip Joint**

The hip joint is a ball-and-socket joint between the head of the femur and the acetabulum of the hip bone. The hip carries the weight of the body and thus requires strength and stability during standing and walking.¹⁵

See Figure \(\PageIndex{7}\) for an illustration of the hip joint.

A common hip injury in older adults, often referred to as a “broken hip,” is actually a fracture of the head of the femur. Hip fractures are commonly caused by falls.¹⁷

See more information about hip fractures under the “Common Musculoskeletal Conditions” section.

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**Articular cartilage**

**Coxal (hip) bone**

**Acetabular labrum**

**Ligament of the head of the femur**

**Femur**

**Synovial cavity**

**Articular capsule**

(a) Frontal section through the right hip joint

**Anterior inferior iliac spine**

**Iliofemoral ligament**

**Greater trochanter**

**Pubofoemoral ligament**

(b) Anterior view of right hip joint, capsule in place

**Ischium**

**Iliofemoral ligament**

**Greater trochanter of femur**

**Ischiofemoral ligament**

(c) Posterior view of right hip joint, capsule in place

Figure \(\PageIndex{7}\): Hip Joint
Knee Joint

The knee functions as a hinge joint that allows flexion and extension of the leg. In addition, some rotation of the leg is available when the knee is flexed, but not when extended. See Figure \(\PageIndex{8}\)\(^{[18]}\) for an illustration of the knee joint. The knee is vulnerable to injuries associated with hyperextension, twisting, or blows to the medial or lateral side of the joint, particularly while weight bearing.

![Knee Joint Diagram](https://med.libretexts.org/Bookshelves/Nursing/Nursing_Skills_(OpenRN)/13%3A_Musculoskeletal_Assessment/13.02%3A__...)

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Figure \(\PageIndex{8}\): Knee Joint

The knee joint has multiple ligaments that provide support, especially in the extended position. On the outside of the knee joint are the lateral collateral, medial collateral, and tibial collateral ligaments. The lateral collateral ligament is on the lateral side of the knee and spans from the lateral side of the femur to the head of the fibula. The medial collateral ligament runs from the medial side of the femur to the medial tibia. The tibial collateral ligament crosses the knee and is attached to the articular capsule and to the medial meniscus. In the fully extended knee position, both collateral ligaments are taut and stabilize the knee by preventing side-to-side or rotational motions between the femur and tibia. \(^{[20]}\)

Inside the knee joint are the anterior cruciate ligament and posterior cruciate ligament. These ligaments are anchored inferiorly to the tibia and run diagonally upward to attach to the inner aspect of a femoral condyle. The posterior cruciate ligament supports the knee when it is flexed and weight-bearing such as when walking downhill. The anterior cruciate ligament becomes tight when the knee is extended and resists hyperextension. \(^{[21]}\)

The patella is a bone incorporated into the tendon of the quadriceps muscle, the large muscle of the anterior thigh. The patella protects the quadriceps tendon from friction against the distal femur. Continuing from the patella to the anterior tibia just below the knee is the patellar ligament. Acting via the patella and patellar ligament, the quadriceps is a powerful muscle that extends the leg at the knee and provides support and stabilization for the knee joint.

Located between the articulating surfaces of the femur and tibia are two articular discs, the medial meniscus and lateral meniscus. Each meniscus is a C-shaped fibrocartilage that provides padding between the bones. \(^{[22]}\)
Joint Movements

Several movements may be performed by synovial joints. **Abduction** is the movement away from the midline of the body. **Adduction** is the movement toward the middle line of the body. **Extension** is the straightening of limbs (increase in angle) at a joint. **Flexion** is bending the limbs (reduction of angle) at a joint. **Rotation** is a circular movement around a fixed point. See Figures (PagIndex(9)) and (PagIndex(10)) for images of the types of movements of different joints in the body.

![Joint Movements Diagram](https://med.libretexts.org/Bookshelves/Nursing/Nursing_Skills_(OpenRN)/13%3A_Musculoskeletal_Assessment/13.02%3A...)
**Joint Sounds**

Sounds that occur as joints are moving are often referred to as **crepitus**. There are many different types of sounds that can occur as a joint moves, and patients may describe these sounds as popping, snapping, catching, clicking, crunching, cracking, crackling, creaking, grinding, grating, and clunking. There are several potential causes of these noises such as bursting of tiny bubbles in the synovial fluid, snapping of ligaments, or a disease condition. While assessing joints, be aware that joint noises are common during activity and are usually painless and harmless, but if they are associated with an injury or are accompanied by pain or swelling, they should be reported to the health care provider for follow-up.

**Note**

View Physitutor’s YouTube video for a review of crepitus sounds:

Physitutor’s "Why Your Knees Crack | Joint Crepitations"

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