9. Skeletal System: Articulations

Although it is important to know the forms and functions of individual bones, it is also important to remember that, with one exception (the hyoid bone), every bone in the body articulates with at least one other bone. Furthermore, the skeleton is a dynamic structure, in that many bones are able to move at their articulations (or joints). Some joints are designed for strength, some are designed for mobility, and others reflect compromises of strength and mobility.

I. Classification of Joints
Joints can be classified according to their structures or according to their functions.

With regards to structure, joints are either fibrous, cartilaginous, or synovial.

With regards to function, joints are either immovable, slightly moveable, or freely moveable.

Your text organizes joints according to the structural classification, but pay attention to function as well!

II. Fibrous Joints
Fibrous joints are held together with dense fibrous connective tissue. Most are immovable, but some are slightly moveable.

Sutures are immovable joints found in the skull. The bones involved in these joints interlock and are held together by dense fibrous connective tissue. During middle age the bones of the skull tend to completely fuse.

Some joints are held together exclusively by ligaments. The amount of movement allowed varies depending upon the length and arrangement of the ligaments. For example, the tibia and fibula are held together by a broad ligamentous sheet called an interosseus ligament. This joint is considered slightly moveable.

III. Cartilaginous Joints
Cartilaginous joints are held together with cartilage. As with fibrous joints, movement is generally limited.

Epiphyseal plates are immovable joints made of hyaline cartilage.

A symphysis is a slightly moveable joint held together with fibrocartilage. Examples are the intervertebral discs and the pubic symphysis. Under what condition might the pubic symphysis allow some movement?

**Classify sutures, the joint between the tibia and fibula, epiphyseal plates, and symphyses according to their functions.
IV. Synovial Joints
Synovial joints are characterized by a fluid-filled cavity between the two articulating bones. Although many do not allow a very wide range of movement, all synovial joints are nonetheless considered freely movable.

General structure
Synovial joints have five characteristic features (Fig. 9.4):

A. The articular surfaces of the bones are covered with articular cartilage.

B. There is a “space” called the joint cavity between the two articulating bones. The joint cavity is filled with synovial fluid. What is the function of synovial fluid?

C. A membranous articular capsule surrounds the synovial joint. There is an outer fibrous layer composed of dense connective tissue, and this is continuous with the periosteum. There is an inner synovial membrane composed of loose connective tissue.

D. Synovial joints are stabilized by reinforcing ligaments.

E. Synovial joints are richly supplied with nerves and blood vessels.

Movements allowed by synovial joints
Different joints are designed to allow different types of motion. The different motions can generally be described as gliding, angular motion, or rotation.

Gliding occurs when two surfaces slide past each other. A good example is the femoropatellar joint, in which the patella glides across the patellar surface of the femur. Gliding joints can also be seen at the intercarpal joints.

Angular motion takes a variety of forms, and it is important to keep these terms in their proper frames of reference based on a body in the anatomical position. Flexion is movement in the anterior/posterior plane that reduces the angle between the articulating elements. Extension occurs in the same plane but increases the angle between articulating elements. Note that when a person is in the anatomical position all major joints (except the ankle) are considered to be at full extension. Extension beyond the anatomical position is considered hyperextension. Abduction is movement away from the longitudinal axis of the body. Adduction is movement toward the longitudinal axis of the body. The terms abduction and adduction apply only to the appendicular skeleton. Circumduction is movement of the arm or leg in a loop independent of actually rotating the limb in its socket.

Rotational movements involve the rotation of a portion of the body on an axis. Rotations of the head are considered left or right. Rotations of a limb are either medial or lateral.
Types of synovial joints
Synovial joints can be classified on the basis of their structures (Fig. 9.6):

A. **Plane joints** have flattened or only slightly curved faces, and they allow gliding movements. As mentioned previously, examples include the femoropatellar and intercarpal joints.

B. **Hinge joints** permit angular motion in a single plane. Examples are the elbow, knee, and ankle.

C. **Pivot joints** allow rotation about a single axis. An example is the joint between the atlas and the axis.

D. **Condylar joints** allow angular motion in two planes and circumduction. Note the way the wrist moves on the radius from side to side or front to back, but the wrist cannot rotate on the radius.

E. **Saddle joints** also allow angular motion in two planes and circumduction, but not rotation. An example is the carpometacarpal joint at the base of the thumb.

F. **Ball-and-socket** joints allow various combinations of angular and rotational movement. Examples are the shoulder and hip joints.