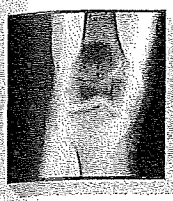

EXERCISES

Most bones in the body form **articulations**, or **joints**, with another bone. These articulations allow you to perform the wide variety of motions involved in everyday movement. You probably don't realize just how many joints are articulating when you perform routine activities such as answering the phone, walking to the door, or holding a model in A&P lab. In the following exercises you will identify and classify joints according to structure, function, and amount of motion; examine the knee joint; and determine which joints are involved in simple everyday movements.

Exercise 9-1

Classification of Joints

MATERIALS

- ❑ Skeleton, articulated
- ❑ Skull

Structurally, joints are classified as (Figure 9.3):

1. **Fibrous joints.** Fibrous joints consist of bones joined by short connective tissue fibers. Most fibrous joints allow no motion and are synarthroses.
2. **Cartilaginous joints.** Cartilaginous joints consist of bones united by cartilage rather than fibrous connective tissue. Most cartilaginous joints allow some motion and are amphiarthroses. However, the epiphyseal plate, a structure composed of hyaline cartilage found in growing bones, is a cartilaginous joint that is a synarthrosis. When the epiphyseal plate ossifies, it becomes a type of immovable joint called a **synostosis**.
3. **Synovial joints.** Synovial joints have a true joint cavity and consist of two bones whose articular ends are covered with hyaline cartilage. The joint cavity is lined by a **synovial membrane** that secretes a watery fluid called **synovial fluid** similar in composition to blood plasma without the proteins. The fluid bathes the joint to permit frictionless motion. We discuss synovial joints further in Exercise 9-2.

Joints are classified according to both their structure and their function. Functionally, joints are classified as:

1. **Synarthroses**—immovable joints,
2. **Amphiarthroses**—joints that allow some motion, or
3. **Diarthroses**—freely moveable joints.

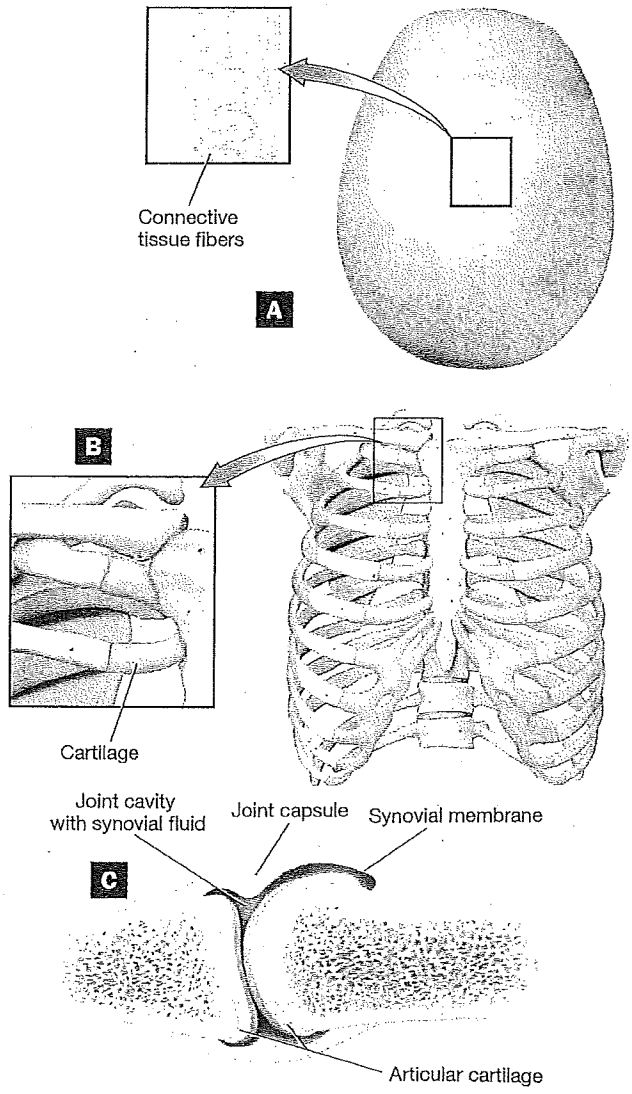

FIGURE **9.3** The three classes of joints: (**A**) fibrous joint; (**B**) cartilaginous joint; (**C**) synovial joint

Procedure Classifying Joints by Structure and Function

Classify each joint listed in Table 9.1 by its structure. Then examine and manipulate the joint to determine the amount of motion allowed at the joint. When you have determined how much movement is allowed at the joint, classify it functionally. After you have completed the activity, answer Check Your Understanding questions 1 and 2 (p. 221).

TABLE **9.1** Structural and Functional Classification of Joints

Joint	Structural Classification	Amount of Motion	Functional Classification
Intervertebral joint			
Shoulder (glenohumeral) joint			
Intercarpal joint			
Coronal suture			
Pubic symphysis			
Interphalangeal joint			

Exercise 9-2

Synovial Joints

MATERIALS

- ❑ Fresh pig or chicken joints
- ❑ Dissection trays and kits
- ❑ Skeleton, articulated
- ❑ Knee joint model

Synovial joints have a fluid-filled cavity lined by a synovial membrane. Features common to synovial joints are the following:

- **Joint capsule.** The joint capsule is made of dense irregular collagenous connective tissue and provides strength and structural reinforcement for the joint. It is lined by the synovial membrane.
- **Articular cartilage.** The articulating ends of the bones are covered with articular cartilage, usually hyaline cartilage. The cartilage provides a smooth, nearly frictionless surface for articulation.
- **Ligaments.** The bones in a synovial joint are held together by ligaments that further reinforce the joint. Some ligaments (called extrinsic ligaments) are within the joint cavity, whereas others (intrinsic ligaments) are embedded in the capsule (they are called "intrinsic" because they are an intrinsic part of the capsule).
- **Articular discs.** Also known as menisci, articular discs are fibrocartilage pads that improve the fit of two bones to prevent dislocation.

Synovial joints typically are surrounded by tendons that move the bones involved in the joint. The tendons generally are wrapped in a sheath of connective tissue in which they can slide with a minimum of friction. Fluid-filled sacs called bursae are often located between tendons and joints, and this also reduces friction.

9

Procedure Identifying Structures of Synovial Joints

Identify the following structures on fresh specimens such as pigs' feet. If fresh specimens are not available, use anatomical models instead. When you have completed the activity, answer Check Your Understanding question 3 (p. 221).

- ☐ Joint cavity
- ☐ Joint capsule
- ☐ Articular cartilage
- ☐ Articular discs (menisci)
- ☐ Synovial membrane
- ☐ Synovial fluid
- ☐ Bursae
- ☐ Tendon with tendon sheath
- ☐ Ligaments
  - Intrinsic
  - Extrinsic

Types of Synovial Joints

The range of motion of a synovial joint is described conventionally in terms of an invisible *axis* about which the bone moves. Synovial joints are classified according to the number of planes of motion in which the bones can move around this axis. The classes are as follows:

1. **Nonaxial joints.** As implied by its name, a nonaxial joint does not move around an axis. Instead, the bones in a nonaxial joint simply glide past one another. An example of a nonaxial joint is the vertebrocostal joint.
2. **Uniaxial joints.** Joints that allow motion in one plane or direction only are called uniaxial joints. A classic example is the elbow, which permits only flexion and extension.
3. **Biaxial joints.** Joints that allow motion in two planes are called biaxial joints. An example of a biaxial joint is the wrist, which allows both flexion/extension and abduction/adduction.
4. **Multiaxial joints.** The joints with the greatest range of motion are multiaxial joints, which allow motion in multiple planes. An example of a multiaxial joint is the shoulder joint.

In addition to this classification scheme, synovial joints are classified according to their structure. The structural classes are illustrated in Figure 9.4 and include the following:

- Plane. The bones of plane joints have flat articular surfaces that allow the bones to glide past one another.
- Condyloid. Condyloid joints consist of one bone that fits into the concave surface of another bone.
- Saddle. Note in Figure 9.4 that saddle joints somewhat resemble condyloid joints but permit a greater range of motion.
- Hinge. In a hinge joint, the bones fit together much like the hinge of a door. Generally, the convex articular surface of one bone fits into a concave articular surface of another bone.
- Pivot. In a pivot joint, one bone rotates or "pivots" around another bone. Generally, pivot joints consist of one bone with a rounded projection that fits into a groove of another bone.
- Ball and socket. Ball-and-socket joints are named for the rounded, ball-like end of one bone that fits into the concave "socket" of another bone.

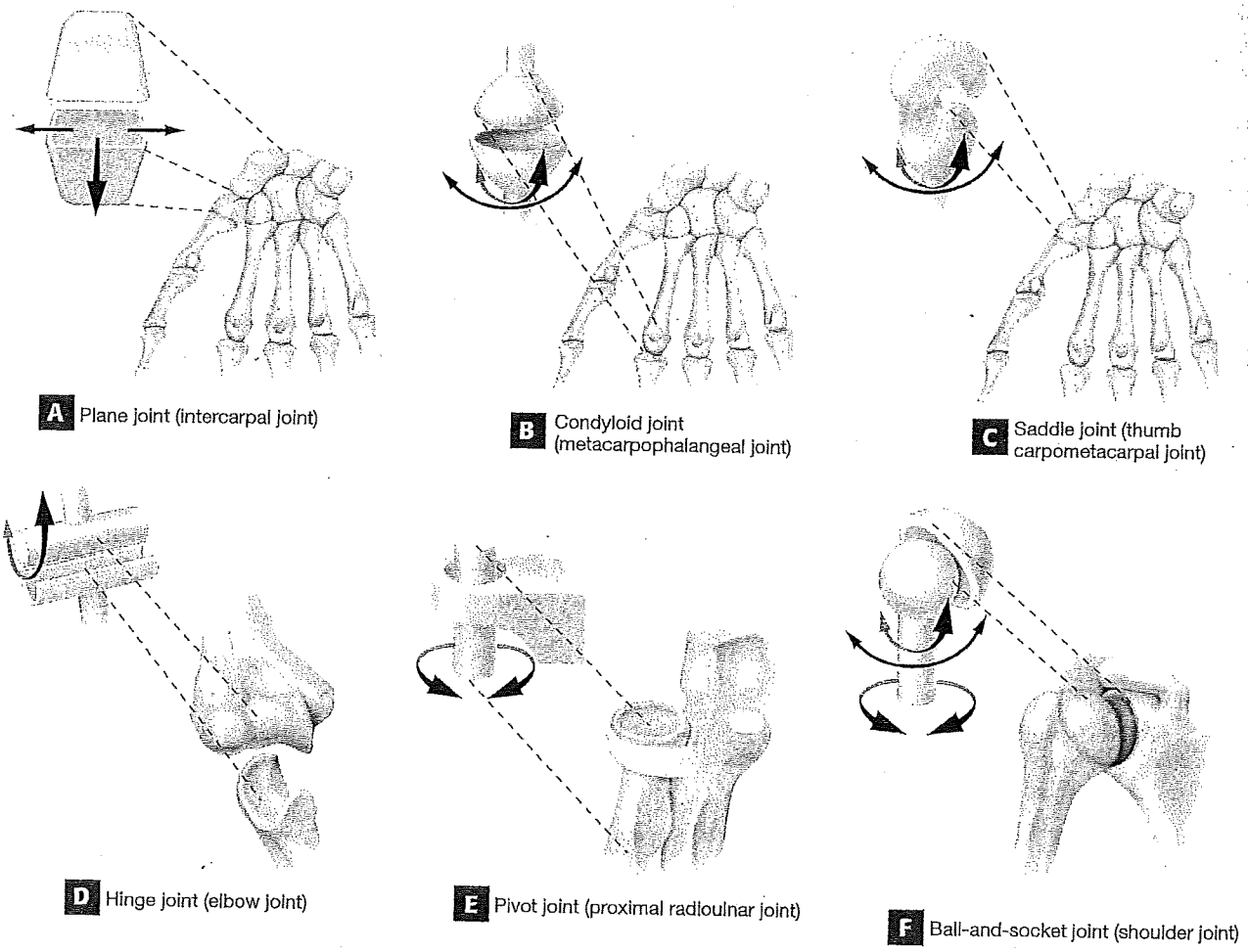

FIGURE 9.4 The structural classes of synovial joints

Procedure Classifying Synovial Joints

For each of the following joints, first list the joint's structural classification in Table 9.2. Then obtain an articulated skeleton so you can manipulate each joint and determine if the joint is nonaxial, uniaxial, biaxial, or multiaxial. When you have completed this activity, answer Check Your Understanding question 4 (p. 221).

TABLE 9.2 Classification of Synovial Joints

Joint	Structural Classification	Range of Motion (nonaxial, uniaxial, biaxial, or multiaxial)
Shoulder joint		
Intercarpal joint		
Proximal radioulnar joint		
Radiocarpal joint		
Thumb carpometacarpal joint		
Interphalangeal joint		
Knee joint		
Atlantoaxial joint		
Hip joint		