

Joints (Articulations)

- **joint (articulation)** – any point where two bones meet, whether or not the bones are movable at that interface

Bony Joint

- **bony joint**
 - an immovable joint formed
 - gap between two bones ossify
 - act as a single bone
 - frontal and mandibular bones in infants
 - cranial sutures in elderly
 - attachment of first rib and sternum with old age
- can occur in either fibrous or cartilaginous joint

Fibrous Joints

- **fibrous joint**
 - adjacent bones are bound by collagen fibers
- **three kinds of fibrous joints**
 - **sutures**
 - **gomphoses**
 - **syndesmoses**

Fibrous Joints - Sutures

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- **sutures** - immovable or slightly movable fibrous joints that closely bind the bones of the skull to each other

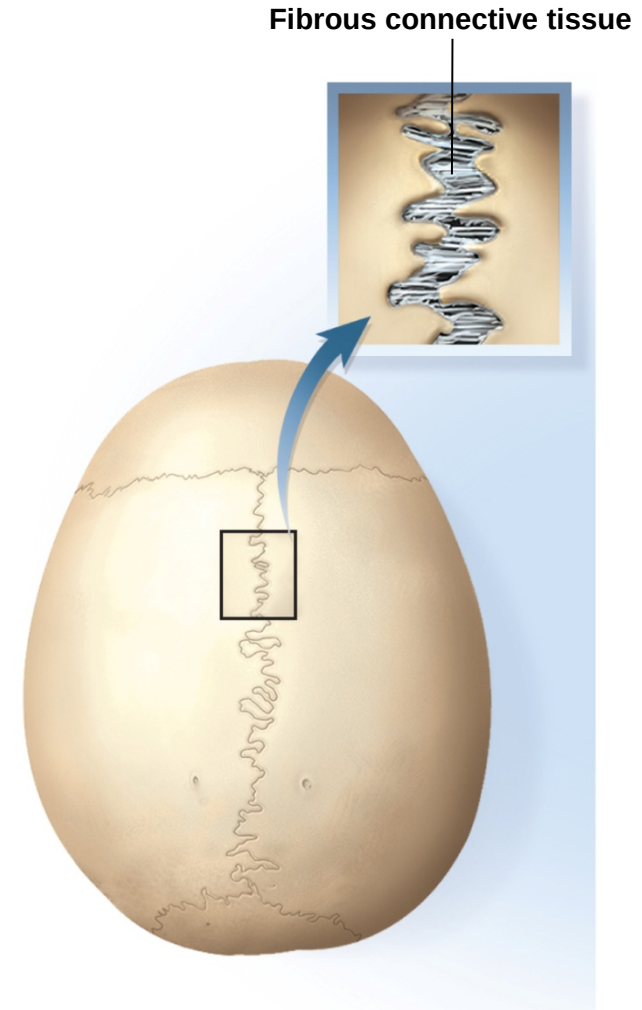
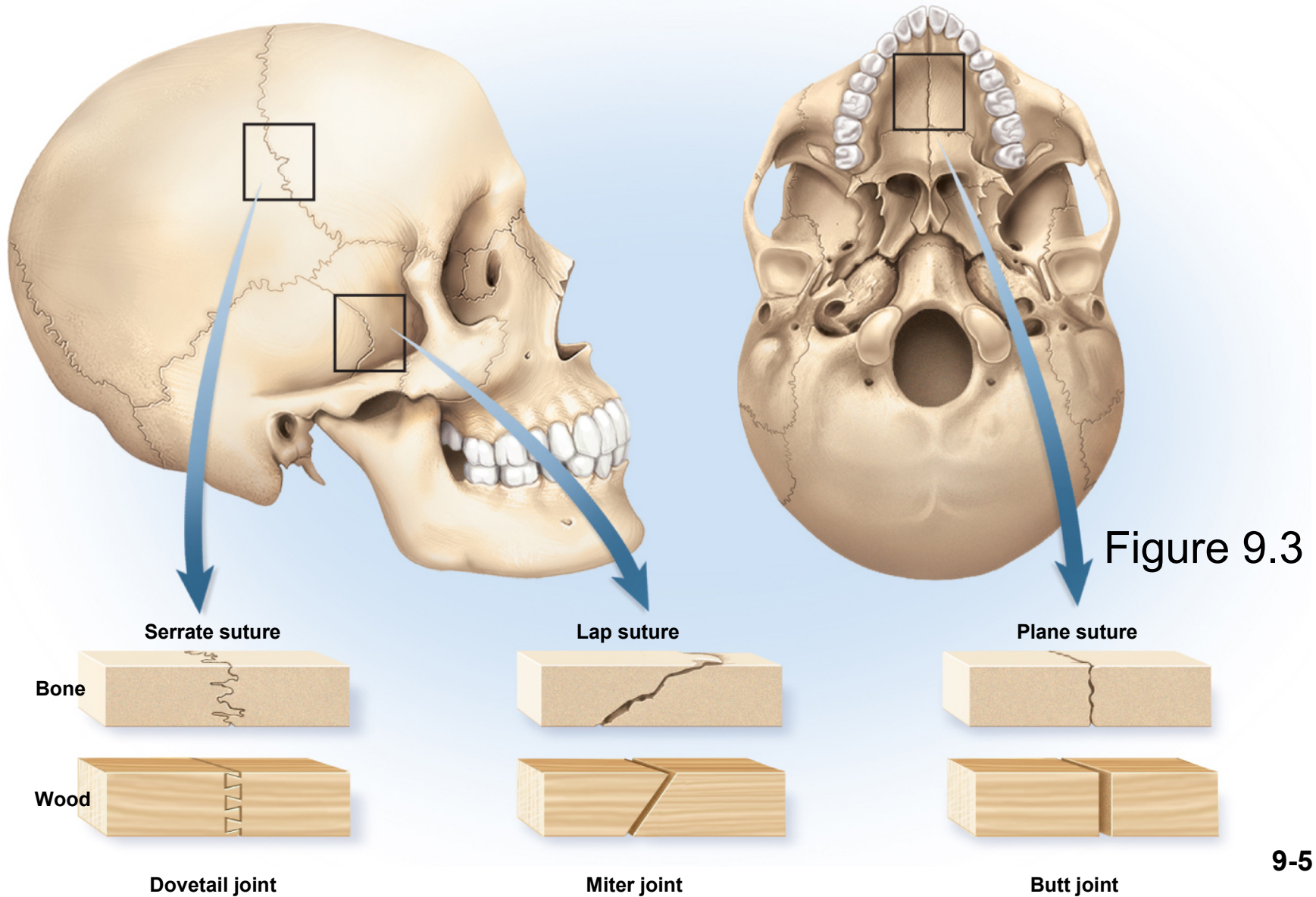


Figure 9.2a

Types of Sutures

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Fibrous Joint - Gomphoses

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- **gomphosis** - attachment of a tooth to its socket
- held in place by fibrous **periodontal ligament**

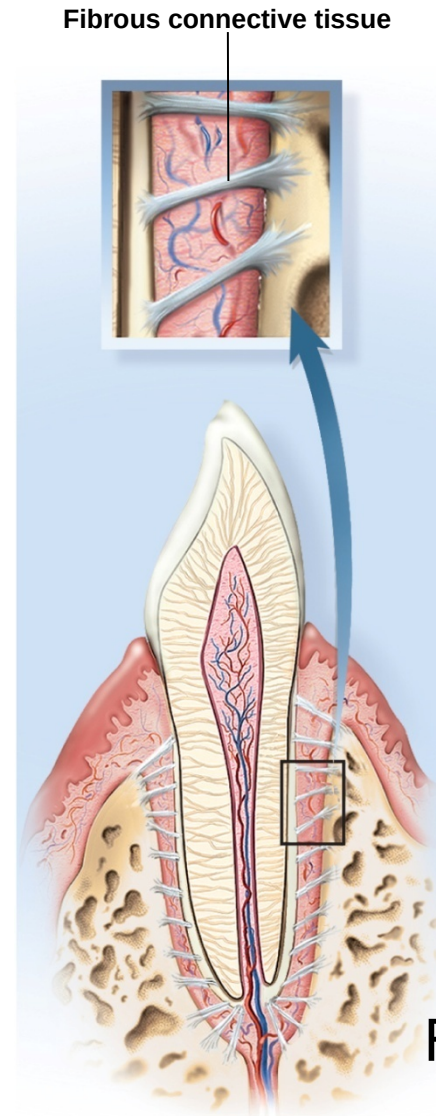


Figure 9.2b

Fibrous Joint - Syndesmosis

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- two bones are bound by longer collagenous fibers
 - **interosseus membrane**
- most movable syndesmosis
 - interosseus membranes unite radius to ulna allowing supination and pronation
- less movable syndesmosis
 - tibia to fibula

Fibrous connective tissue

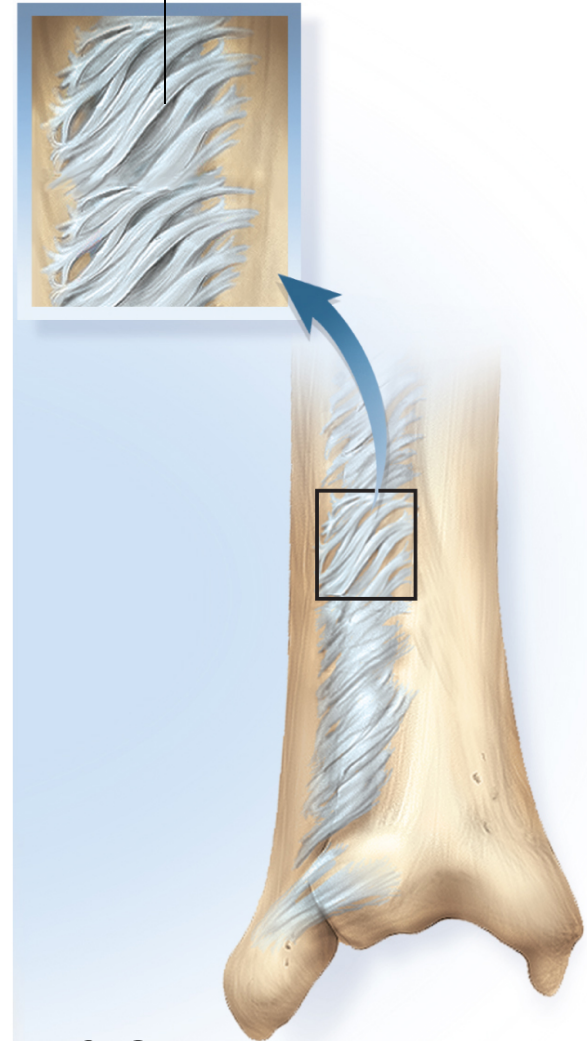


Figure 9.2c

(c) Syndesmosis

Cartilaginous Joints

- **cartilaginous joint**
 - two bones are linked by cartilage
 - **two types** of cartilaginous joints
 - **synchondroses**
 - **symphyses**

Cartilaginous Joint - Synchondrosis

- **synchondrosis** - bones are bound by **hyaline cartilage**
 - temporary joint in the epiphyseal plate in children
 - first rib attachment to sternum

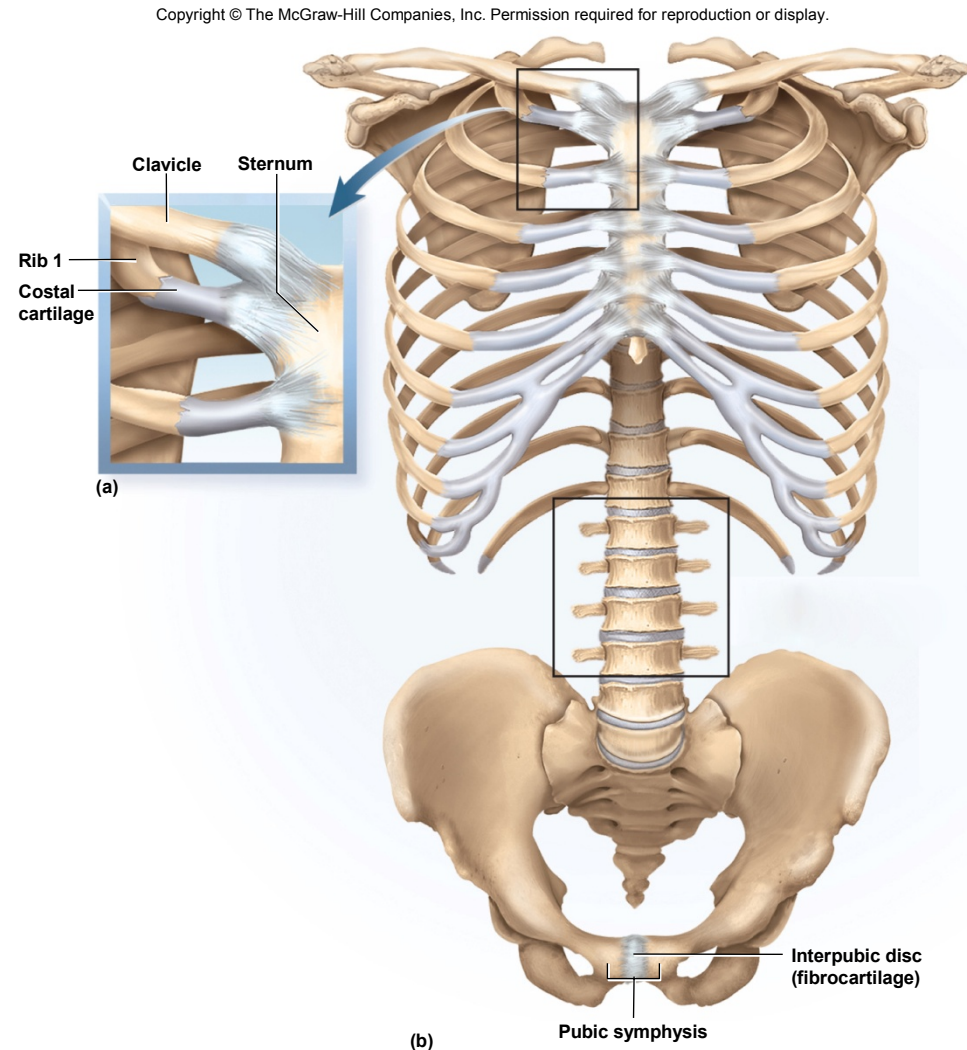


Figure 9.4a,b

Cartilaginous Joint - Symphysis

- **Symphysis**
 - two bones joined by **fibrocartilage**
 - **pubic symphysis**
interpubic disc
 - **bodies of vertebrae** and
intervertebral discs

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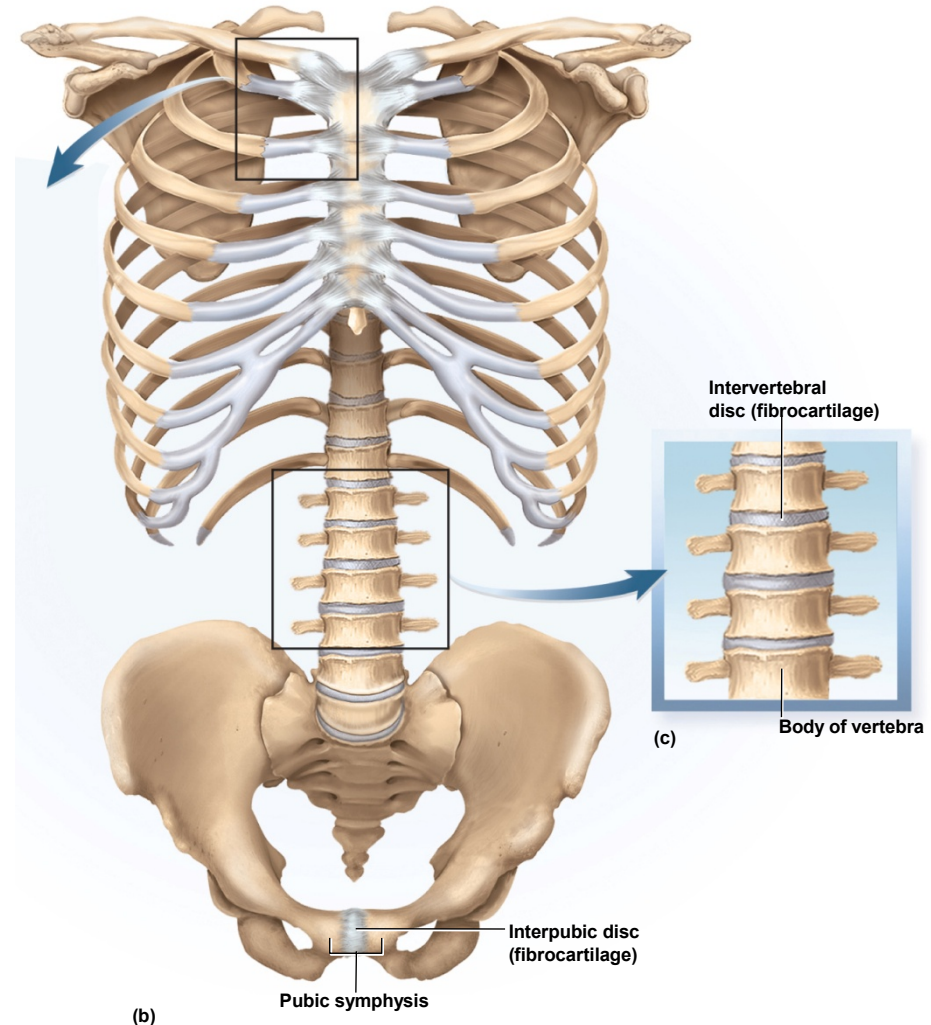
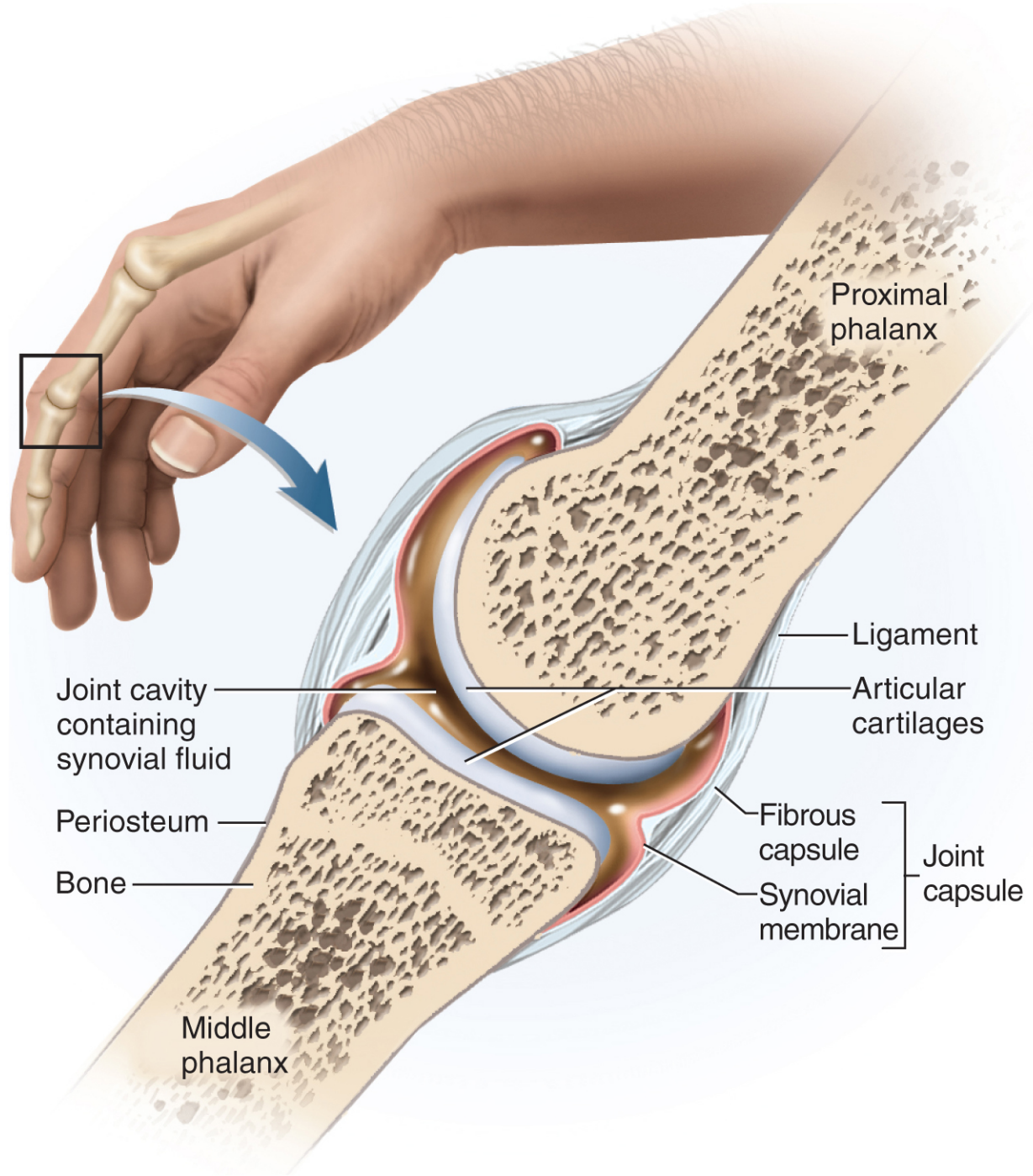
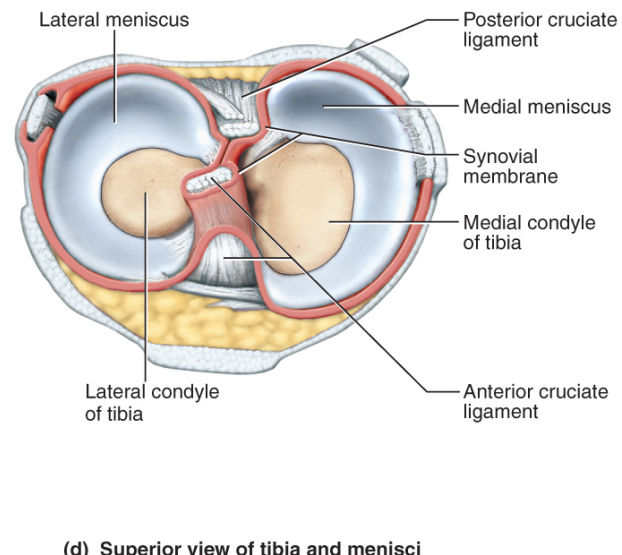
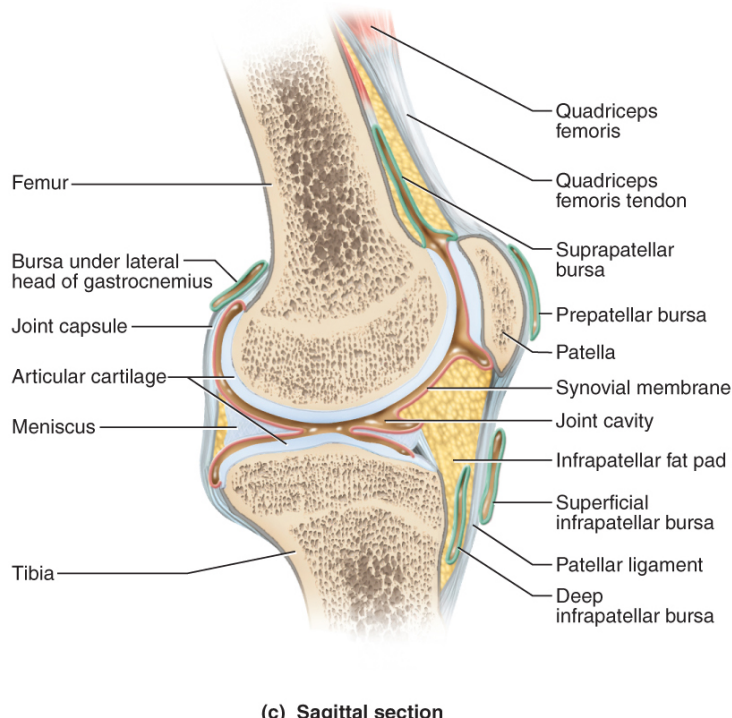
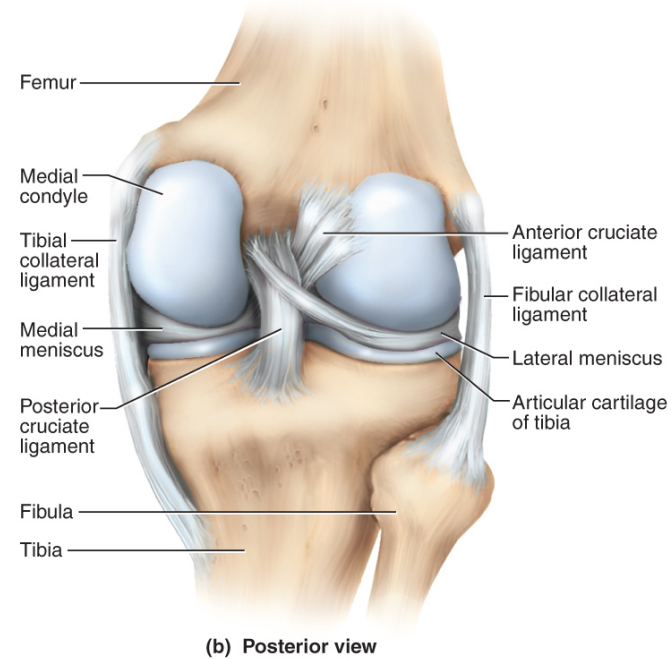
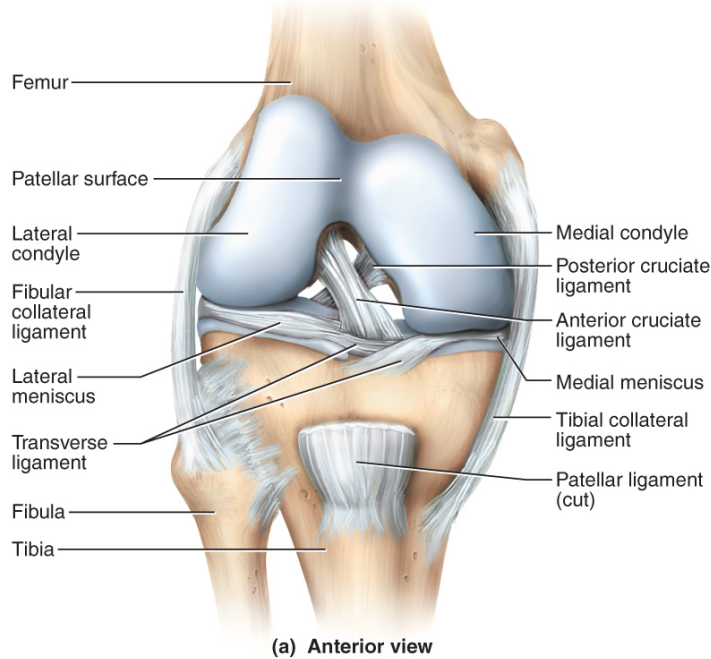


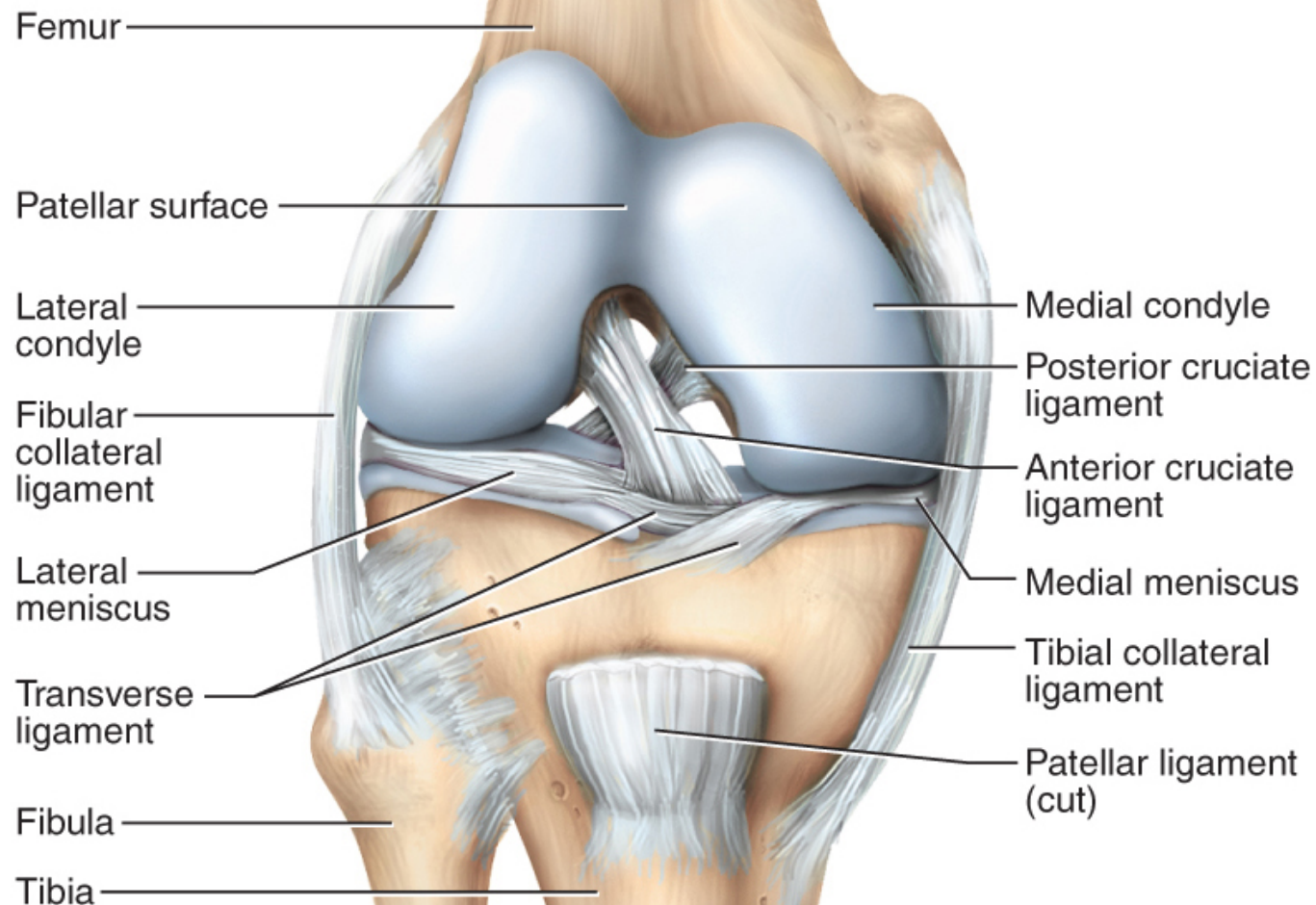
Figure 9.4b,c

Synovial Joint

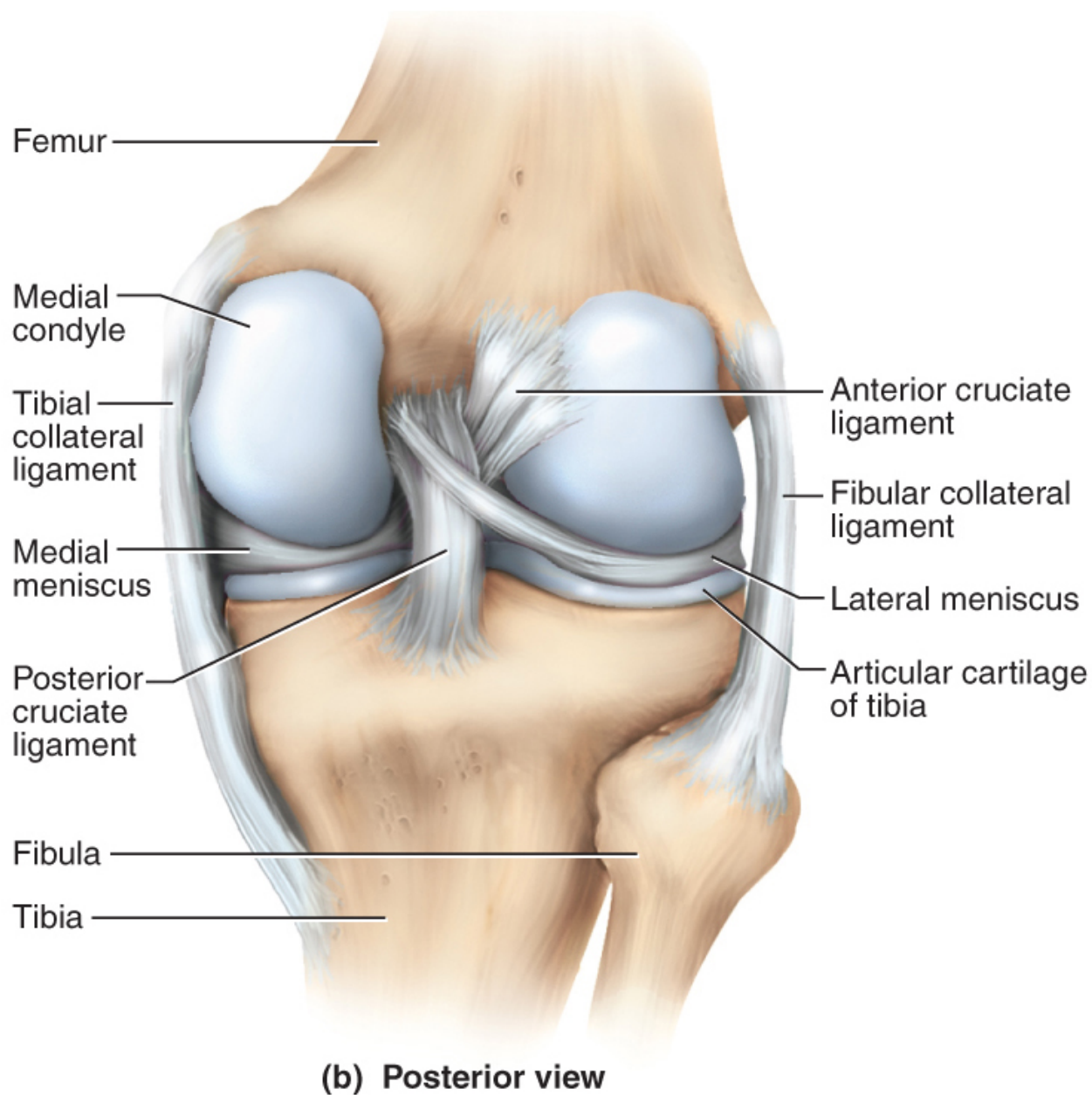
- **synovial joint**
 - two bones are separated by a space called a **joint cavity**
- most are freely movable
- most structurally complex type of joint

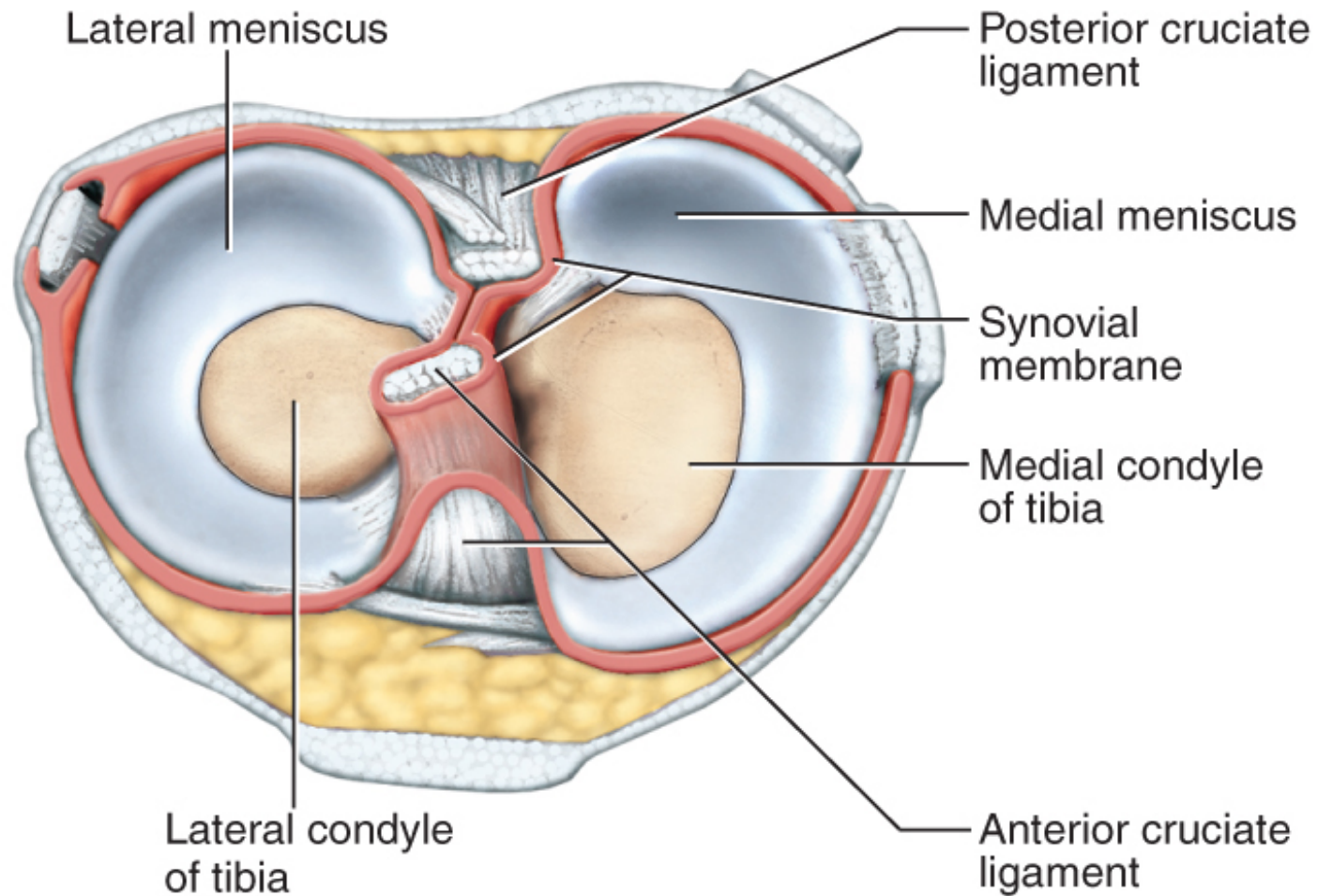






(a) Anterior view





(d) Superior view of tibia and menisci

General Anatomy

- **articular cartilage** – layer of hyaline cartilage that covers the facing surfaces of two bones
- **joint (articular) cavity** – separates articular surfaces
- **synovial fluid** – slippery lubricant in joint cavity
 - rich in albumin and hyaluronic acid
 - nourishes articular cartilage and removes waste
 - makes movement of synovial joints almost friction free
- **joint (articular) capsule** – connective tissue that encloses the cavity and retains the fluid
 - **outer fibrous capsule** – continuous with periosteum of adjoining bones
 - **inner, cellular, synovial membrane**
 - **fibroblast-like cells** that secrete synovial fluid and **macrophages** that remove debris from the joint cavity

General Anatomy

- in a few synovial joints, **fibrocartilage** grows inward from the joint capsule
 - **articular disc** forms a pad between articulating bones that crosses the entire joint capsule
 - temporomandibular joint, distal radioulnar joints, sternoclavicular and acromioclavicular joints
 - **meniscus** – in the knee, two cartilages extend inward from the left and right but do not entirely cross the joint
 - these cartilages absorb shock and pressure
 - guide bones across each other
 - improve the fit between bones
 - stabilize the joints, reducing the chance of dislocation
- **accessory structures** associated with synovial joints
 - **tendon** – a strip or sheet of tough collagenous connective tissue that attaches muscle to bone
 - the most important structures in stabilizing a joint
 - **ligament** – similar tissue that attaches one bone to another
 - **bursa** – a fibrous sac filled with synovial fluid, located between adjacent muscles, where tendon passes over bone, or between bone and skin
 - cushion muscles, helps tendons slide more easily over joints, modify direction of tendon pull
 - **tendon sheaths** – elongated cylindrical bursae wrapped around a tendon
 - in hand and foot

Tendon Sheaths and Bursae

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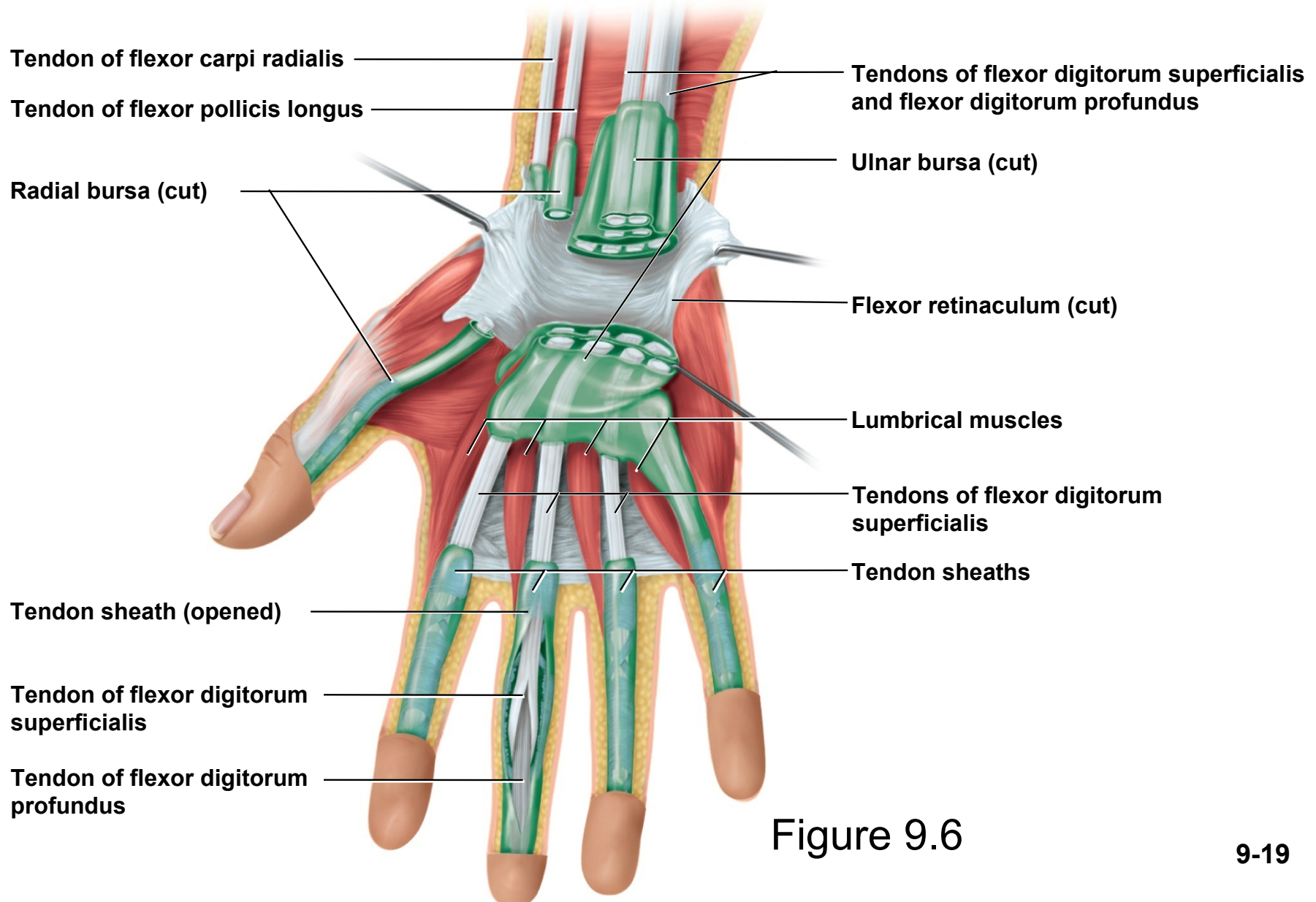
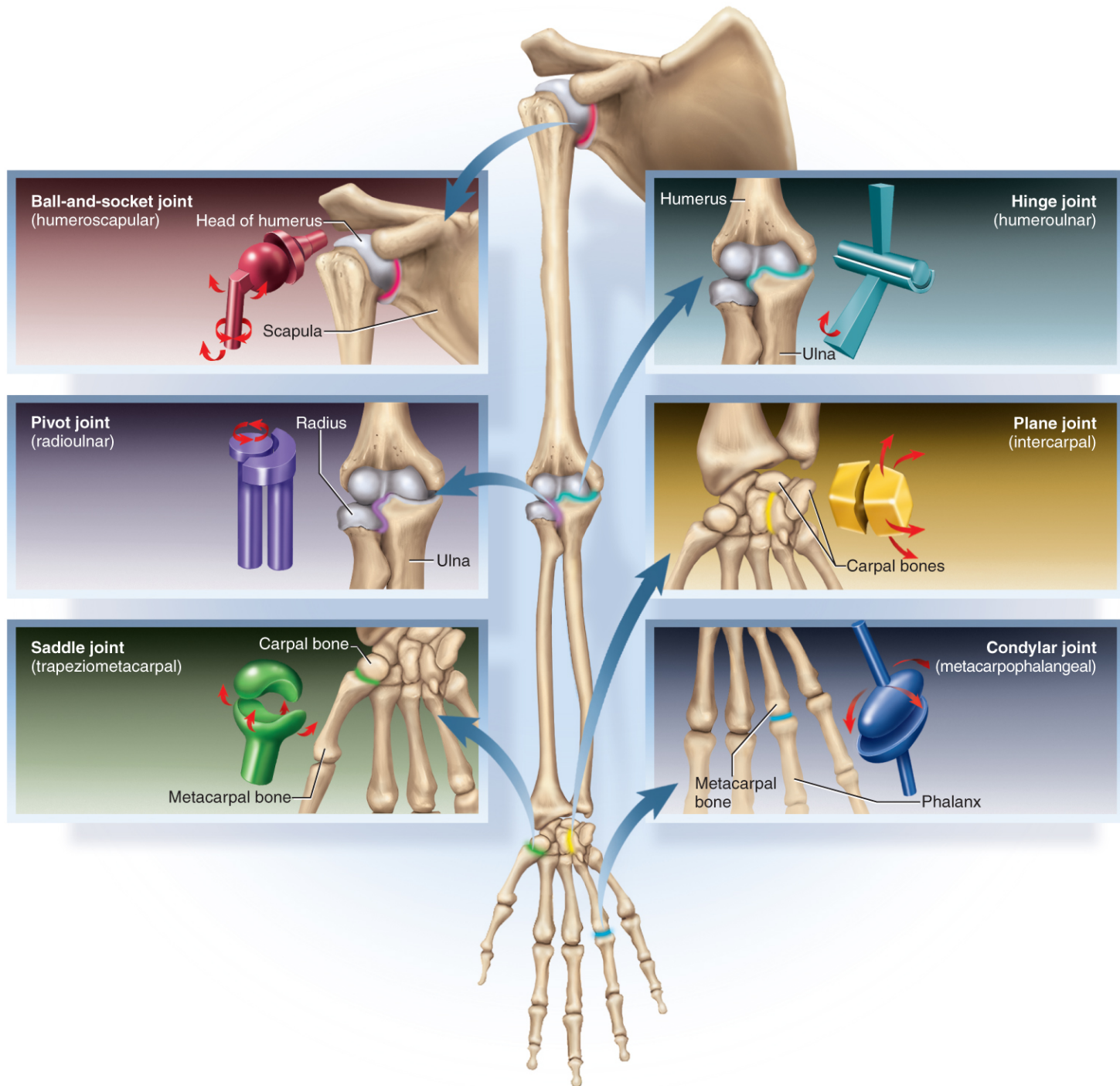


Figure 9.6



Ball-and-Socket Joints

- smooth, hemispherical head fits within a cuplike socket
 - **shoulder joint** - head of humerus into glenoid cavity of scapula
 - **hip joint** - head of femur into acetabulum of hip bone
- the **only multiaxial joints** in the body

Condylloid (ellipsoid) Joints

- oval convex surface on one bone fits into a complementary shaped depression on the other
 - **radiocarpal joint** of the wrist
 - **metacarpophalangeal joints** at the bases of the fingers
- **biaxial joints** – movement in two planes

Saddle Joints

- both bones have an articular surface that is shaped like a saddle, concave in one direction and convex in the other
 - **trapeziometacarpal** joint at the base of the thumb
 - **sternoclavicular joint** – clavicle articulates with sternum
- **biaxial joint**
 - more movable than a condyloid or hinge joint forming the primate **opposable thumb**

Plane (gliding) Joints

- flat articular surfaces in which bones slide over each other with relatively limited movement
- usually **biaxial** joint
 - carpal bones of wrist
 - tarsal bones of ankle
 - articular processes of vertebrae
- although any one joint moves only slightly, the combined action of the many joints in wrist, ankle, and vertebral column allows for considerable movement

Hinge Joints

- one bone with convex surface that fits into a concave depression on other bone
 - elbow joint - ulna and humerus
 - knee joint - femur and tibia
 - finger and toe joints
- **monoaxial** joint – move freely in one plane

Pivot Joints

- one bone has a projection that is held in place by a ring-like ligament
- bone spins on its longitudinal axis
 - atlantoaxial joint (dens of axis and atlas)
 - transverse ligament
 - proximal radioulnar joint allows the radius to rotate during pronation and supination
 - anular ligament
- **monoaxial joint**

Arthritis

- **arthritis** - a broad term for pain and inflammation of a joint
- most common crippling disease in the United States
- **rheumatologists** – physicians who treat arthritis and other joint disorders
- **osteoarthritis (OA)** – most common form of arthritis
 - ‘wear-and-tear arthritis’
 - results from years of joint wear
 - articular cartilage softens and degenerates
 - accompanied by crackling sounds called **crepitus**
 - bone spurs develop on exposed bone tissue causing pain

Arthritis and Artificial Joints

- **rheumatoid arthritis (RA)** - autoimmune attack against the joint tissues
 - misguided antibodies (**rheumatoid factor**) attack synovial membrane, enzymes in synovial fluid degrade the articular cartilage, joint begins to ossify
 - **ankylosis** – solidly fused, immobilized joint
 - remissions occur, steroids and aspirin control inflammation
- **arthroplasty** - the replacement of diseased joint with artificial device called **prosthesis**

Rheumatoid Arthritis

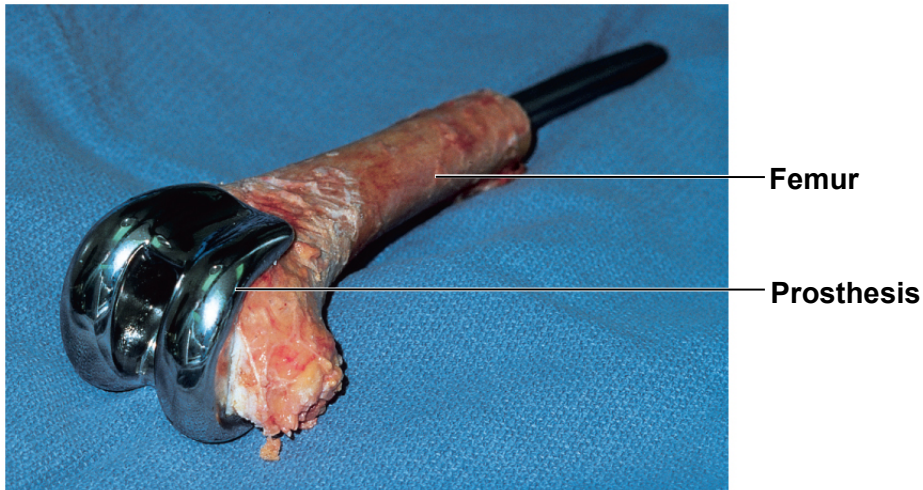
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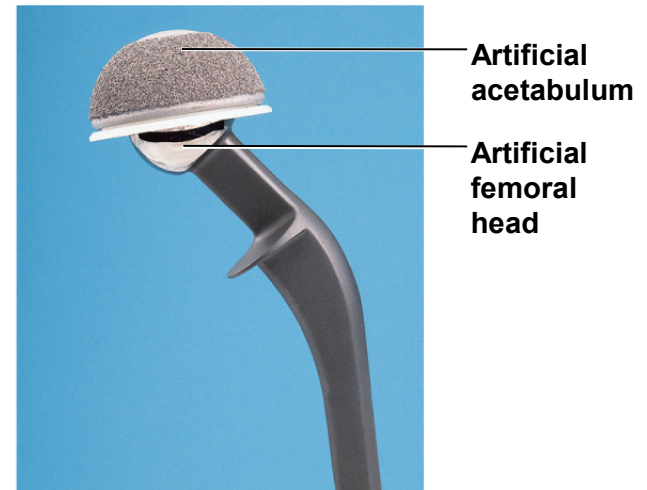
(b)

Joint Prostheses

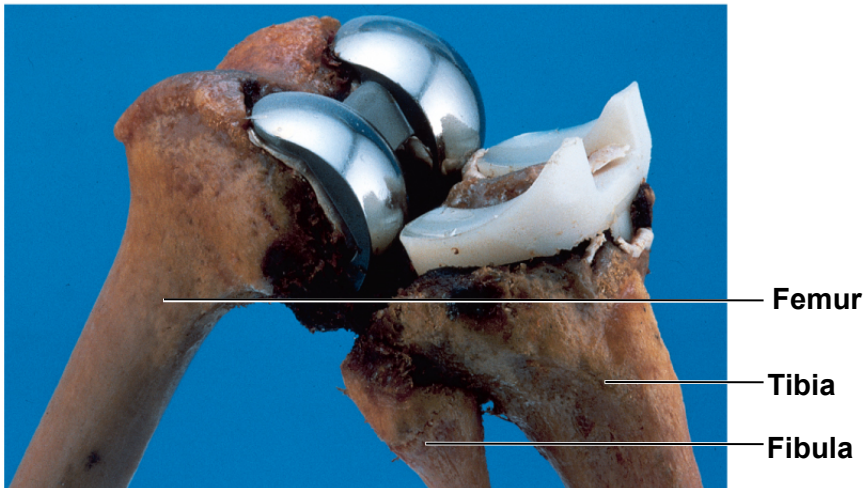
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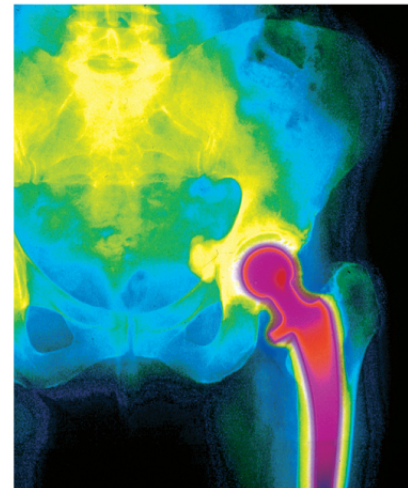
(a)



(c)



(b)



(d)

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Figure 9.33a,b

Figure 9.33c,d