Joints part 2

JOINTS

Synovial or Non Synovial (Fibrous or Cartilaginous)

Non Synovial:

Characteristics	Fibrous	Cartilaginous
Designed for Stability	Suture Jts of Skull No motion protects brain	Vert. Body w/ disc Allow very limited motion
Simple	Tib-Fib Joint Maintains relationship between tib & fib	Symphysis Pubis Only moves during labor & delivery

Joint Motions

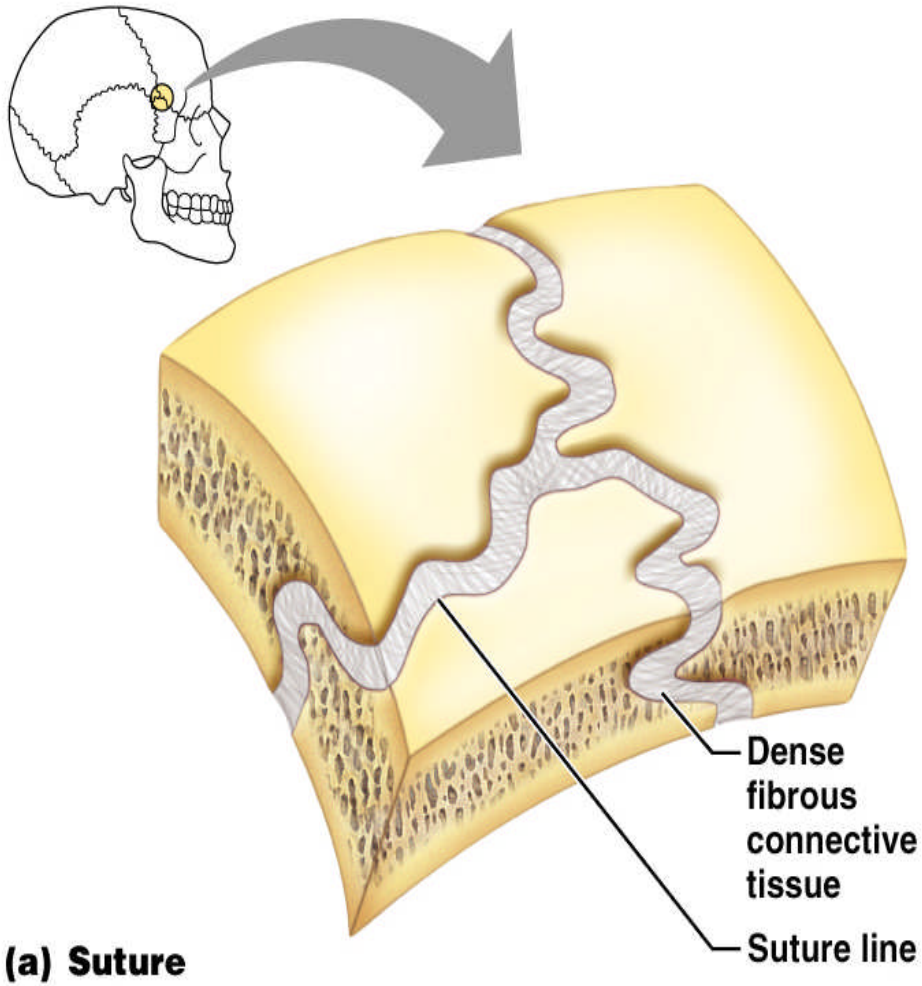
Flexion	Extension	Hyperextension	lat flexion
DF	PF	Eversion	Inversion
Abd	Add	Horiz Abd	Horiz Add
IR	ER	Pronation	Supination
Protraction		Retraction	
Elevation		Depression	

Classification of Joints: Functional

- Functional classification is based on the amount of movement allowed by the joint
- The three functional classes of joints are:
  - Synarthroses – immovable
  - Amphiarthroses – slightly movable
  - Diarthroses – freely movable

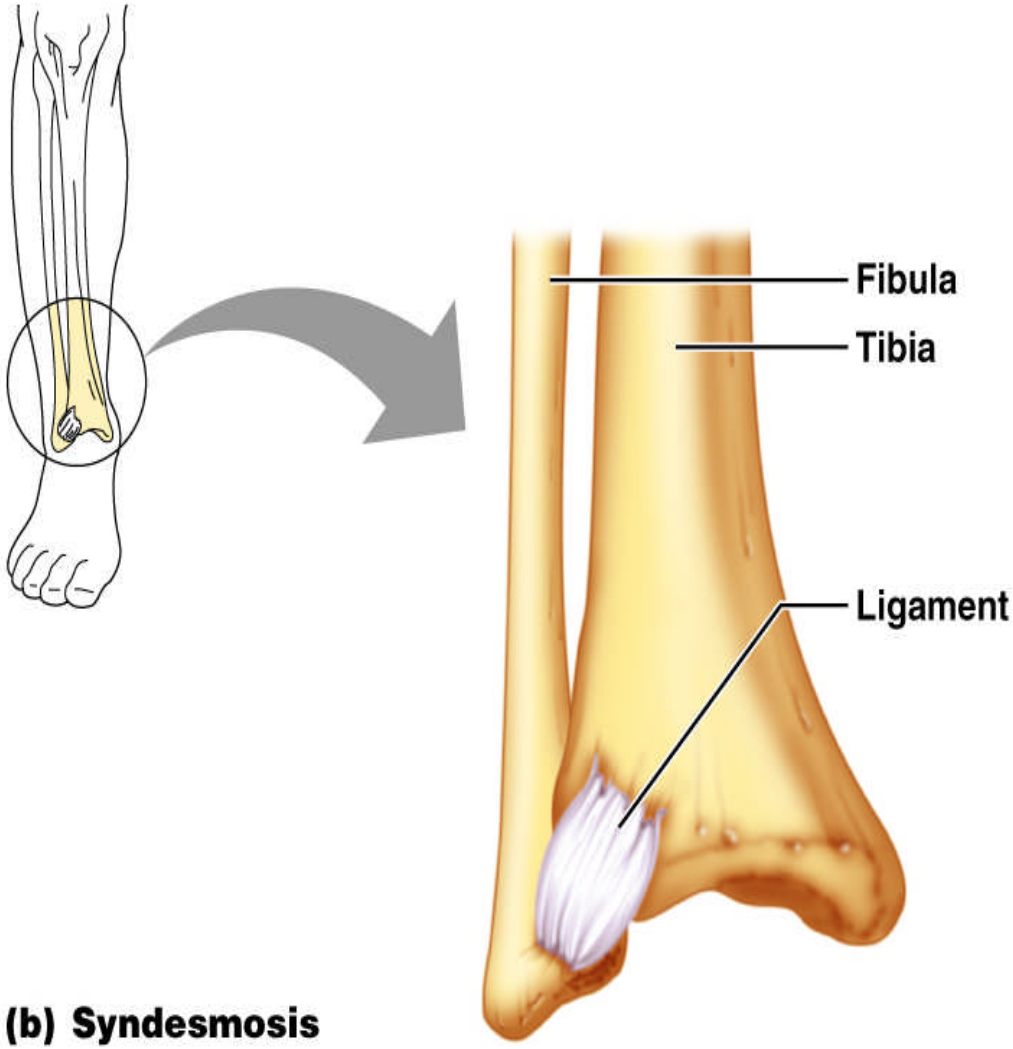
Fibrous Structural Joints:
Sutures

- Occur between the bones of the skull
- Comprised of interlocking junctions completely filled with connective tissue fibers
- Bind bones tightly together, but allow for growth during youth
- **In middle age, skull bones fuse and are called synostoses**



Fibrous Structural Joints:
Syndesmoses

- Bones are connected by a fibrous tissue ligament
- Movement varies from immovable to slightly variable
- Examples include the **connection between the tibia and fibula, and the radius and ulna**

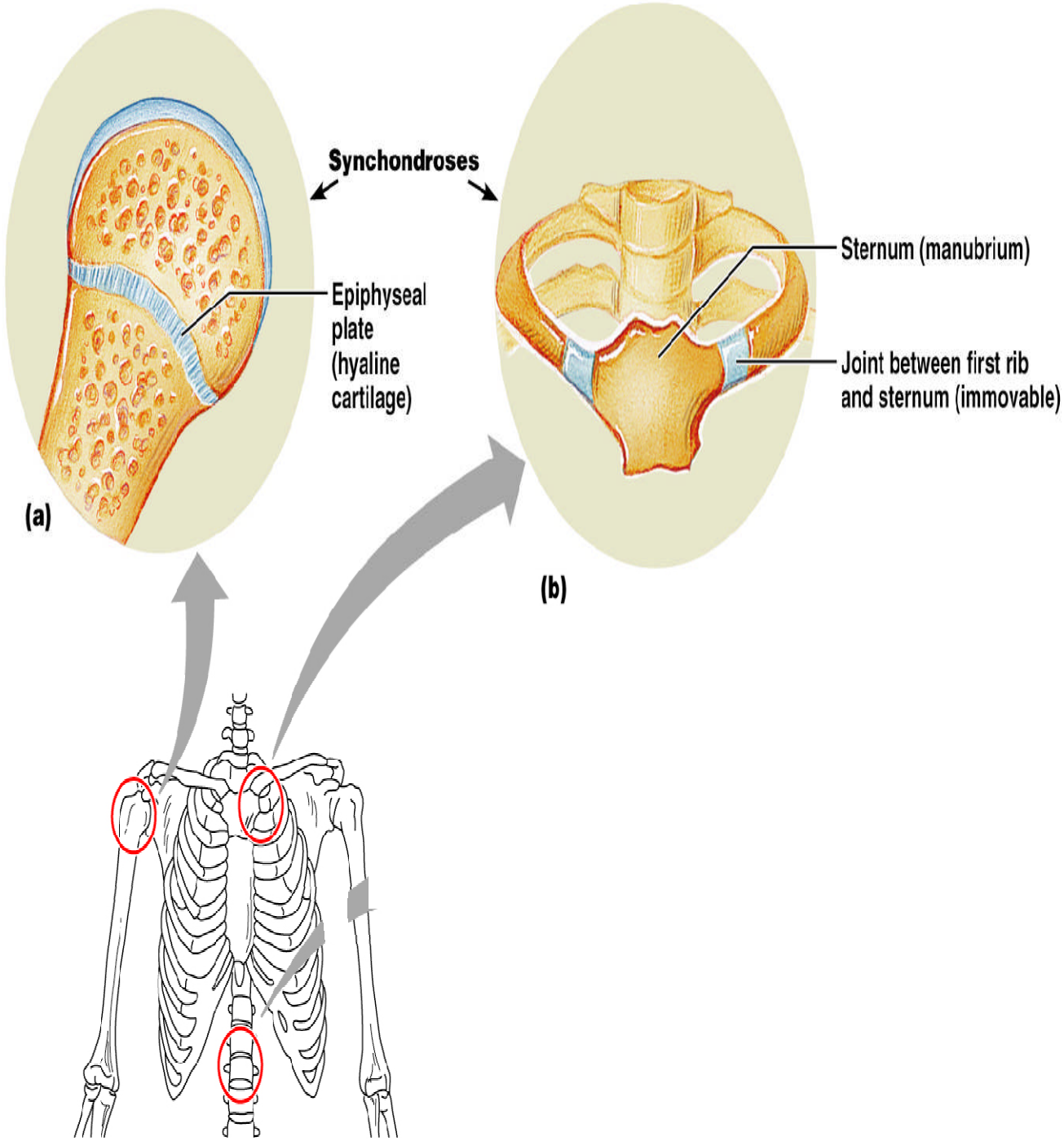


Fibrous Structural Joints: Gomphoses

- The peg-in-socket fibrous joint between a tooth and its alveolar socket
- The fibrous connection is the periodontal ligament

Cartilaginous Joints

- Articulating bones are united by cartilage
- Lack a joint cavity
- Two types – **synchondroses and symphyses**



Cartilaginous Joints: Synchondroses

- A bar or plate of hyaline cartilage unites the bones
- All synchondroses are synarthrotic
- Examples include:
  - **Epiphyseal plates of children**
  - **Joint between the costal cartilage of the first rib and the sternum**

Cartilaginous Joints:

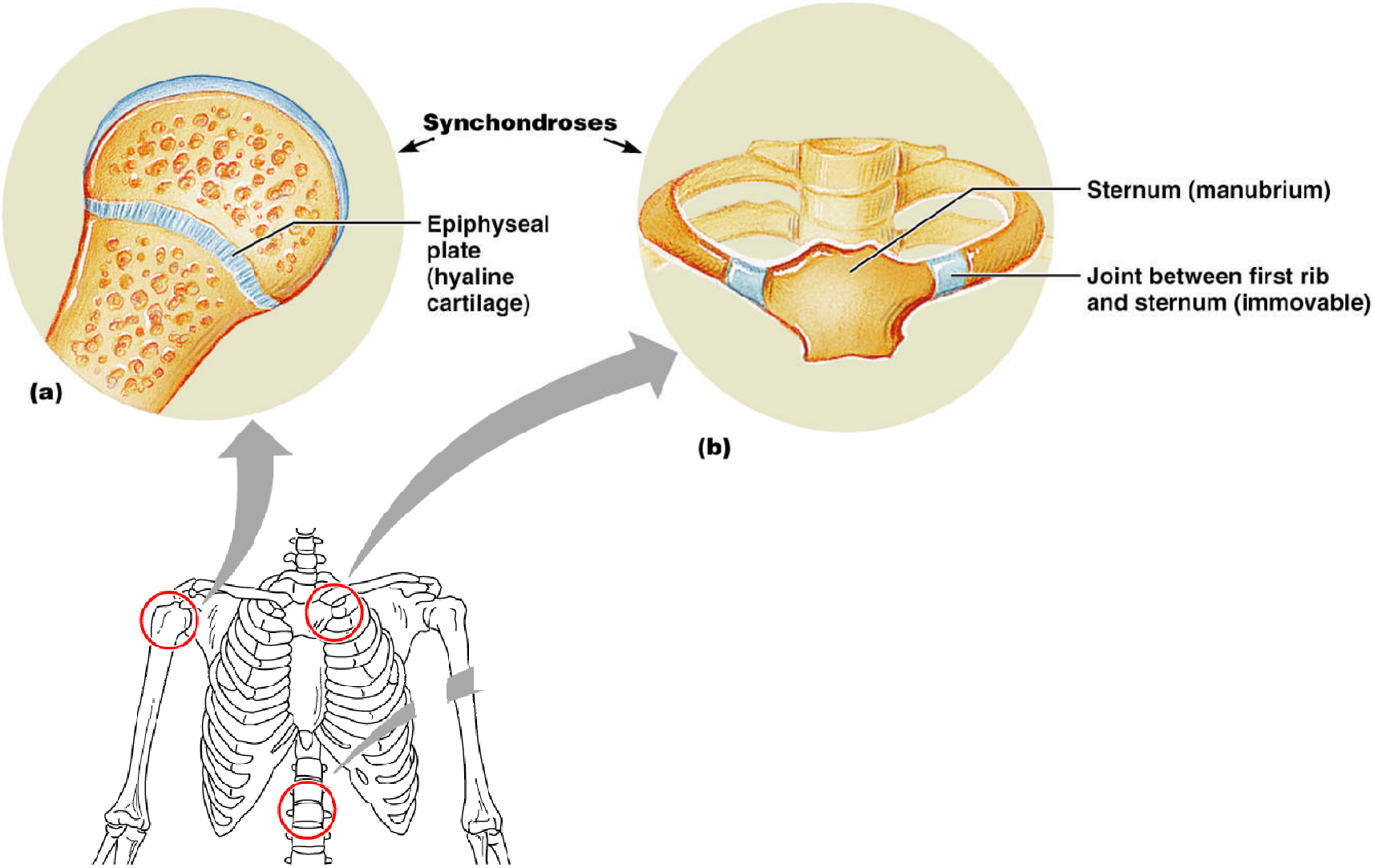


Figure 8.2a, b

Cartilaginous Joints: Symphyses

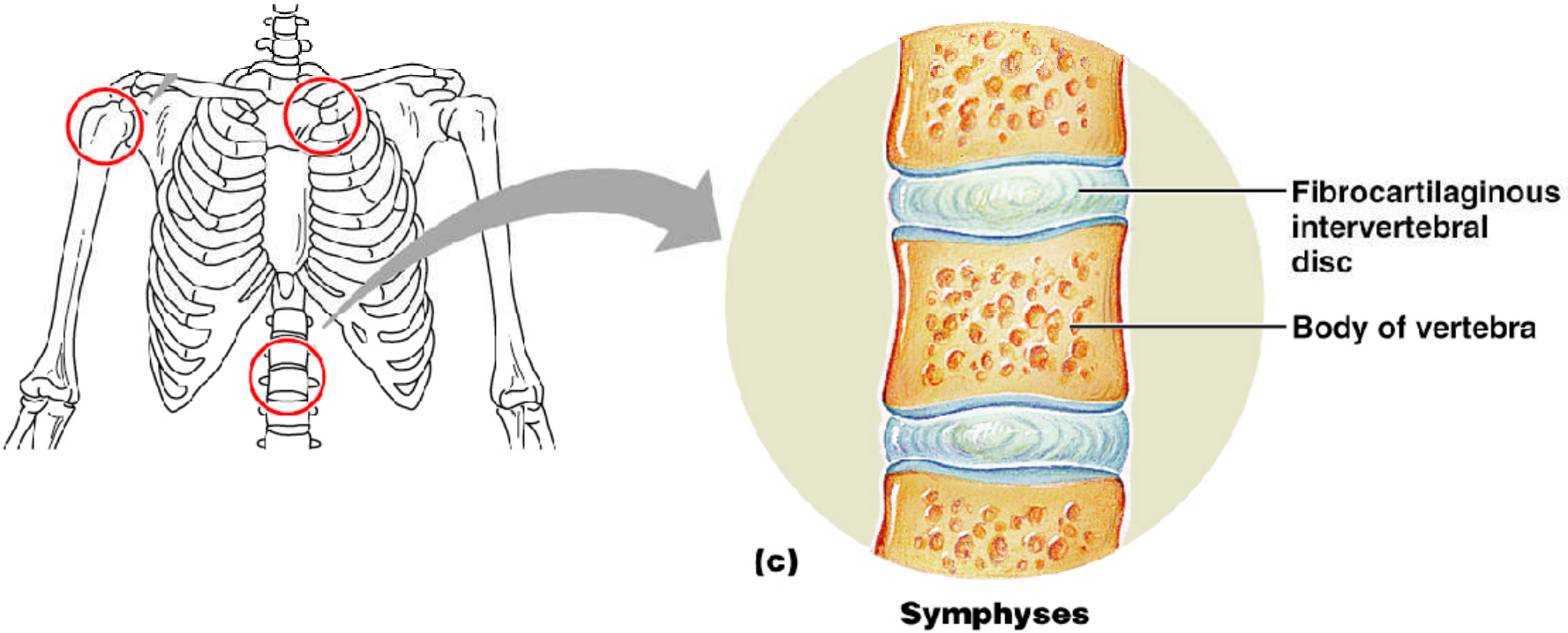


Figure 8.2c

Synovial Joints: General

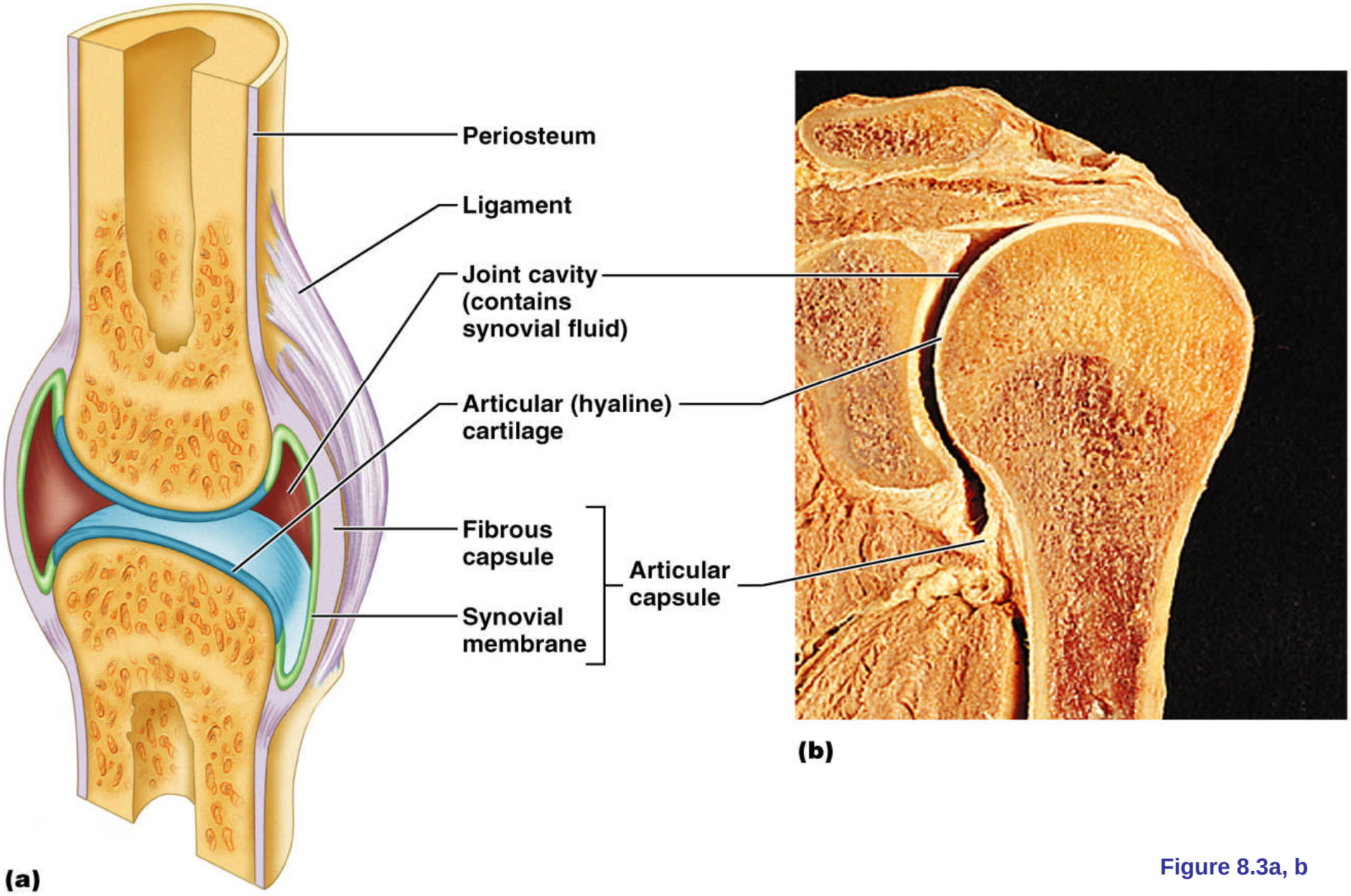
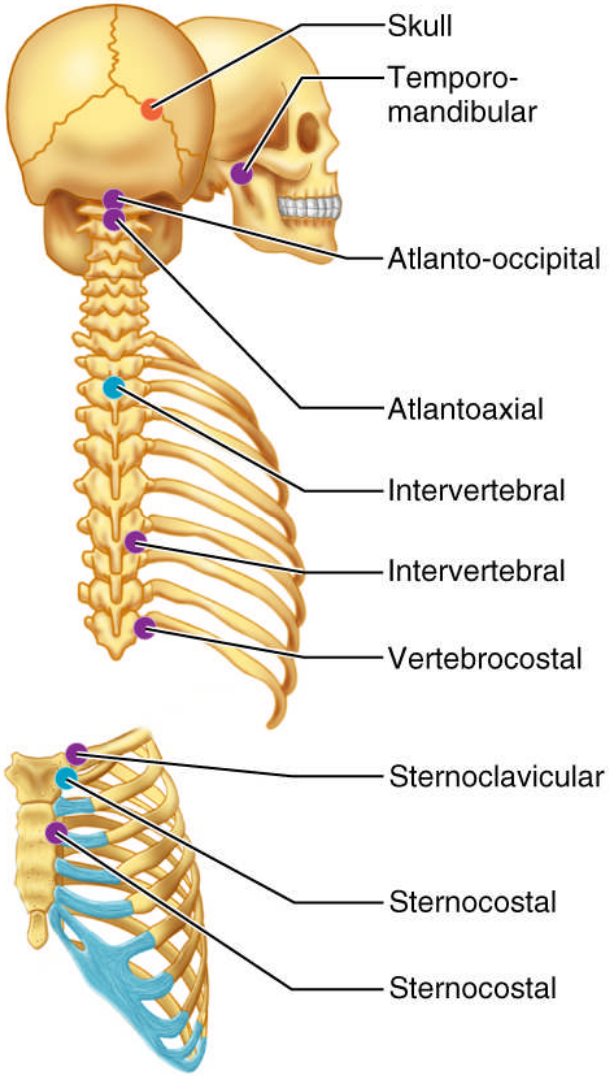


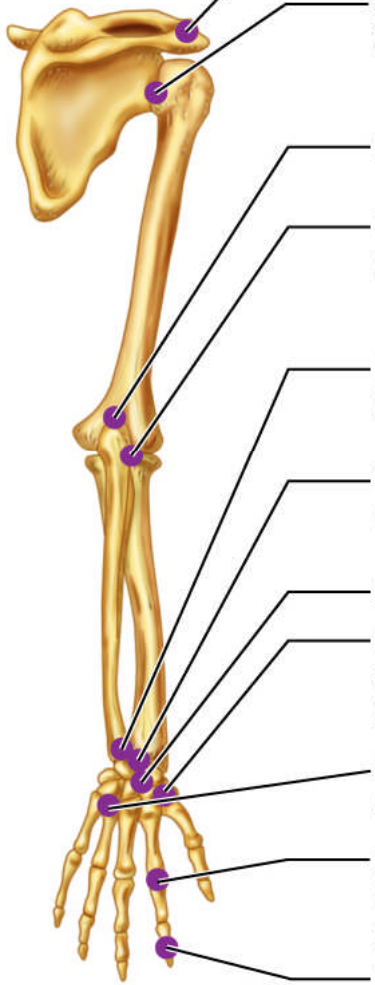
Figure 8.3a, b

TABLE 8.2 Structural and Functional Characteristics of Body Joints

ILLUSTRATION	JOINT	ARTICULATING BONES	STRUCTURAL TYPE*	FUNCTIONAL TYPE; MOVEMENTS ALLOWED
	Skull	Cranial and facial bones	Fibrous; suture	Synarthrotic; no movement
	Temporo-mandibular	Temporal bone of skull and mandible	Synovial; modified hinge† (contains articular disc)	Diarthrotic; gliding and uniaxial rotation; slight lateral movement, elevation, depression, protraction, and retraction of mandible
	Atlanto-occipital	Occipital bone of skull and atlas	Synovial; condyloid	Diarthrotic; biaxial; flexion, extension, lateral flexion, circumduction of head on neck
	Atlantoaxial	Atlas (C_1) and axis (C_2)	Synovial; pivot	Diarthrotic; uniaxial; rotation of the head
	Intervertebral	Between adjacent vertebral bodies	Cartilaginous; symphysis	Amphiarthrotic; slight movement
	Intervertebral	Between articular processes	Synovial; plane	Diarthrotic; gliding
	Vertebrocostal	Vertebrae (transverse processes or bodies) and ribs	Synovial; plane	Diarthrotic; gliding of ribs
	Sternoclavicular	Sternum and clavicle	Synovial; shallow saddle (contains articular disc)	Diarthrotic; multiaxial (allows clavicle to move in all axes)
	Sternocostal	Sternum and rib 1	Cartilaginous; synchondrosis	Synarthrotic; no movement
	Sternocostal	Sternum and ribs 2–7	Synovial; double plane	Diarthrotic; gliding

***Fibrous joints** indicated by orange circles; **cartilaginous joints** by blue circles; **synovial joints** by purple circles.
†These modified hinge joints are structurally bicondylar.

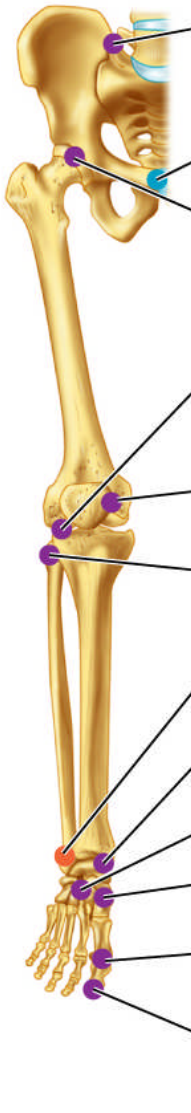
TABLE 8.2 Structural and Functional Characteristics of Body Joints



JOINT	ARTICULATING BONES	STRUCTURAL TYPE*	FUNCTIONAL TYPE; MOVEMENTS ALLOWED
Acromio-clavicular	Acromion of scapula and clavicle	Synovial; plane (contains articular disc)	Diarthrotic; gliding and rotation of scapula on clavicle
Shoulder (glenohumeral)	Scapula and humerus	Synovial; ball and socket	Diarthrotic; multiaxial; flexion, extension, abduction, adduction, circumduction, rotation of humerus
Elbow	Ulna (and radius) with humerus	Synovial; hinge	Diarthrotic; uniaxial; flexion, extension of forearm
Radioulnar (proximal)	Radius and ulna	Synovial; pivot	Diarthrotic; uniaxial; rotation of radius around long axis of forearm to allow pronation and supination
Radioulnar (distal)	Radius and ulna	Synovial; pivot (contains articular disc)	Diarthrotic; uniaxial; rotation (convex head of ulna rotates in ulnar notch of radius)
Wrist (radiocarpal)	Radius and proximal carpals	Synovial; condyloid	Diarthrotic; biaxial; flexion, extension, abduction, adduction, circumduction of hand
Intercarpal	Adjacent carpals	Synovial; plane	Diarthrotic; gliding
Carpometacarpal of digit 1 (thumb)	Carpal (trapezium) and metacarpal 1	Synovial; saddle	Diarthrotic; biaxial; flexion, extension, abduction, adduction, circumduction, opposition of metacarpal 1
Carpometacarpal of digits 2–5	Carpal(s) and metacarpal(s)	Synovial; plane	Diarthrotic; gliding of metacarpals
Knuckle (metacarpo-phalangeal)	Metacarpal and proximal phalanx	Synovial; condyloid	Diarthrotic; biaxial; flexion, extension, abduction, adduction, circumduction of fingers
Finger (interphalangeal)	Adjacent phalanges	Synovial; hinge	Diarthrotic; uniaxial; flexion, extension of fingers

***Fibrous joints** indicated by orange circles; **cartilaginous joints** by blue circles; **synovial joints** by purple circles.
†These modified hinge joints are structurally bicondylar.

TABLE 8.2 Structural and Functional Characteristics of Body Joints

ILLUSTRATION	JOINT	ARTICULATING BONES	STRUCTURAL TYPE*	FUNCTIONAL TYPE; MOVEMENTS ALLOWED
	Sacroiliac	Sacrum and coxal bone	Synovial; plane in childhood, increasingly fibrous in adult	Diarthrotic in child; amphiarthrotic in adult; (more movement during pregnancy)
	Pubic symphysis	Pubic bones	Cartilaginous; symphysis	Amphiarthrotic; slight movement (enhanced during pregnancy)
	Hip (coxal)	Hip bone and femur	Synovial; ball and socket	Diarthrotic; multiaxial; flexion, extension, abduction, adduction, rotation, circumduction of thigh
	Knee (tibiofemoral)	Femur and tibia	Synovial; modified hinge† (contains articular discs)	Diarthrotic; biaxial; flexion, extension of leg, some rotation allowed
	Knee (femoropatellar)	Femur and patella	Synovial; plane	Diarthrotic; gliding of patella
	Tibiofibular	Tibia and fibula (proximally)	Synovial; plane	Diarthrotic; gliding of fibula
	Tibiofibular	Tibia and fibula (distally)	Fibrous; syndesmosis	Synarthrotic; slight "give" during dorsiflexion
	Ankle	Tibia and fibula with talus	Synovial; hinge	Diarthrotic; uniaxial; dorsiflexion, and plantar flexion of foot
	Intertarsal	Adjacent tarsals	Synovial; plane	Diarthrotic; gliding; inversion and eversion of foot
	Tarsometatarsal	Tarsal(s) and metatarsal(s)	Synovial; plane	Diarthrotic; gliding of metatarsals
	Metatarsophalangeal	Metatarsal and proximal phalanx	Synovial; condyloid	Diarthrotic; biaxial; flexion, extension, abduction, adduction, circumduction of great toe
	Toe (interphalangeal)	Adjacent phalanges	Synovial; hinge	Diarthrotic; uniaxial; flexion; extension of toes

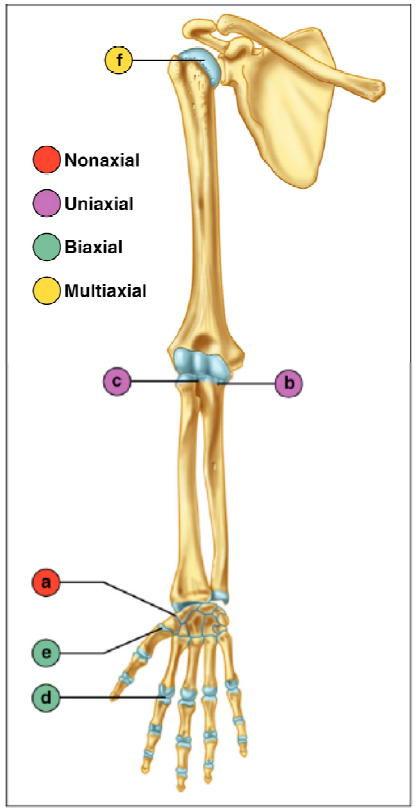
***Fibrous joints** indicated by orange circles; **cartilaginous joints** by blue circles; **synovial joints** by purple circles.
†These modified hinge joints are structurally bicondylar.

Synovial Joints: Friction-Reducing Structures

- Bursae – flattened, fibrous sacs lined with synovial membranes and containing synovial fluid
- Common where ligaments, muscles, skin, tendons, or bones rub together
- Tendon sheath – elongated bursa that wraps completely around a tendon

Plane Joint

- Plane joints
  - Articular surfaces are essentially flat
  - Allow only slipping or gliding movements
  - Only examples of nonaxial joints



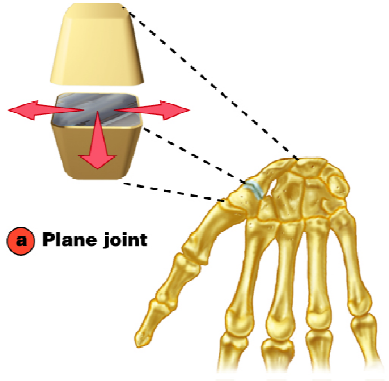
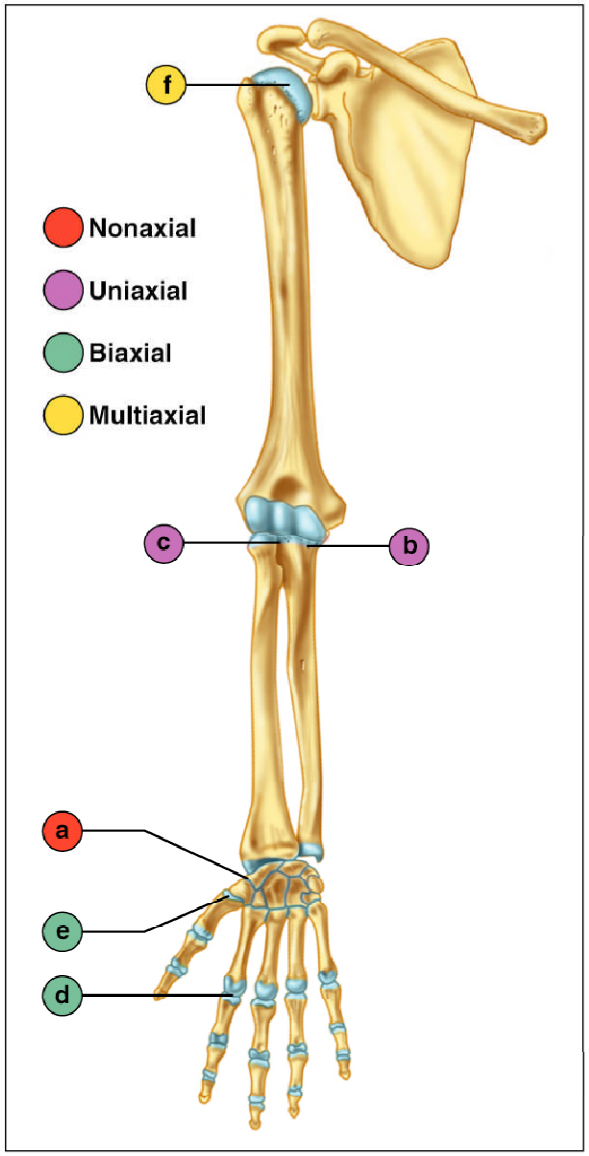


Figure 8.7a

Types of Synovial Joints

- Hinge joints
  - Cylindrical projections of one bone fits into a trough-shaped surface on another
  - Motion is along a single plane
  - Uniaxial joints permit flexion and extension only
  - Examples: elbow and interphalangeal joints

Hinge Joints



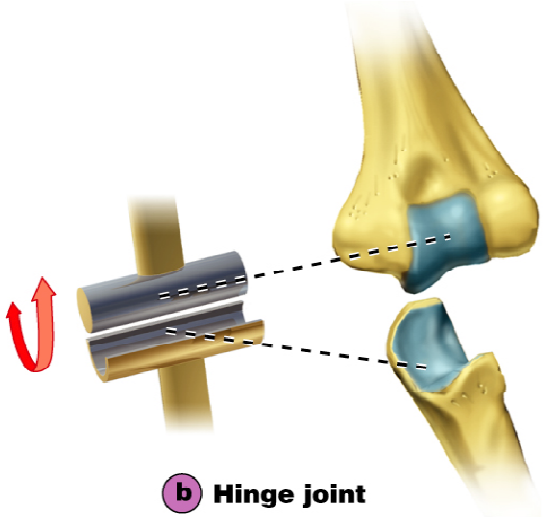
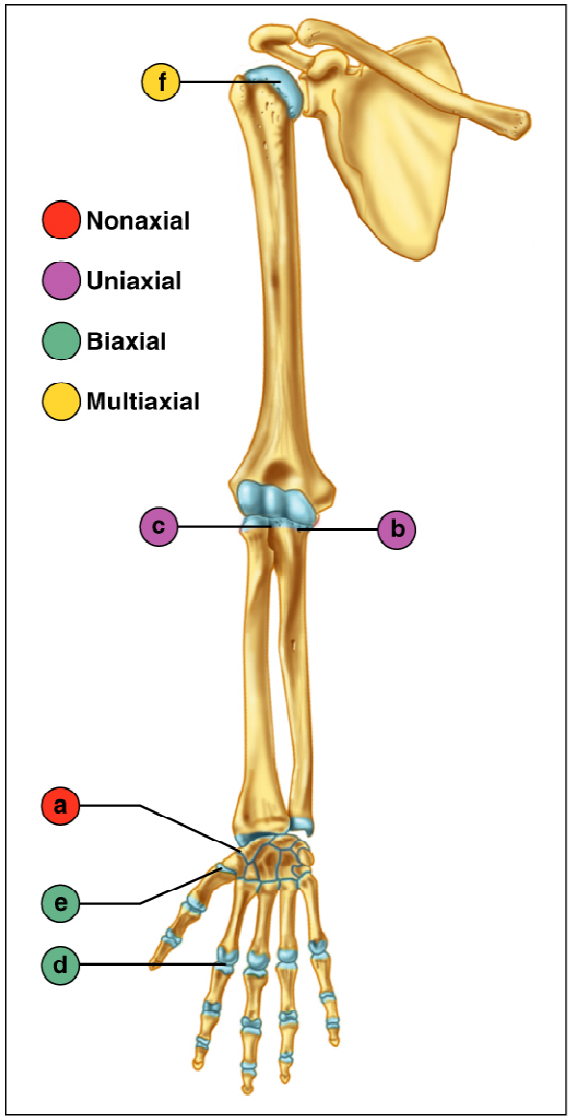


Figure 8.7b

Pivot Joints

- Rounded end of one bone protrudes into a “sleeve,” or ring, composed of bone (and possibly ligaments) of another
- Only uniaxial movement allowed
- Examples: joint between the axis and the dens, and the proximal radioulnar joint

Pivot Joints



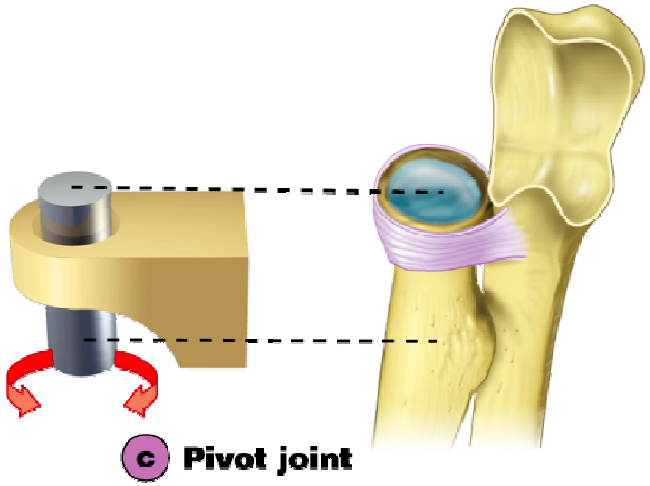
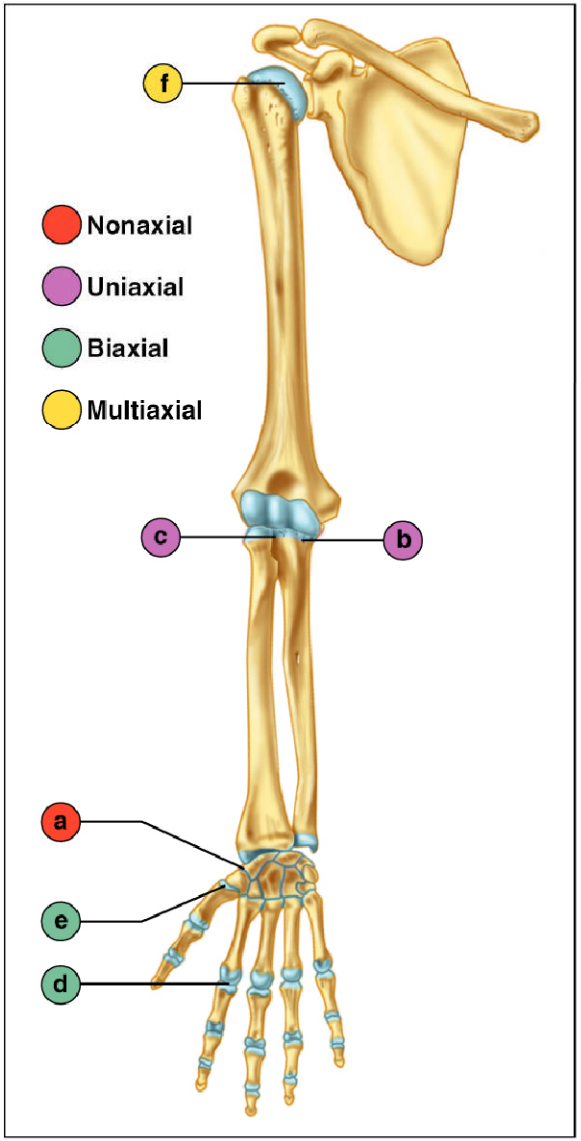


Figure 8.7c

Condyloid or Ellipsoidal Joints

- Oval articular surface of one bone fits into a complementary depression in another
- Both articular surfaces are oval
- Biaxial joints permit all angular motions
- Examples: radiocarpal (wrist) joints, and metacarpophalangeal (knuckle) joints

Condyloid or Ellipsoidal Joints



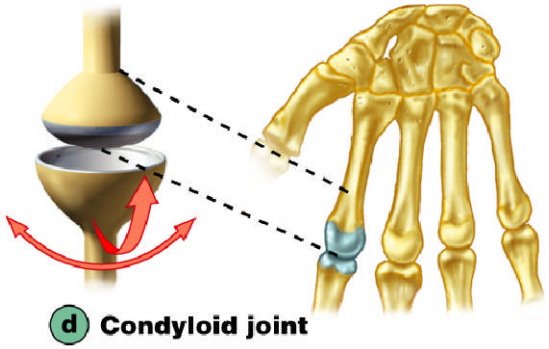
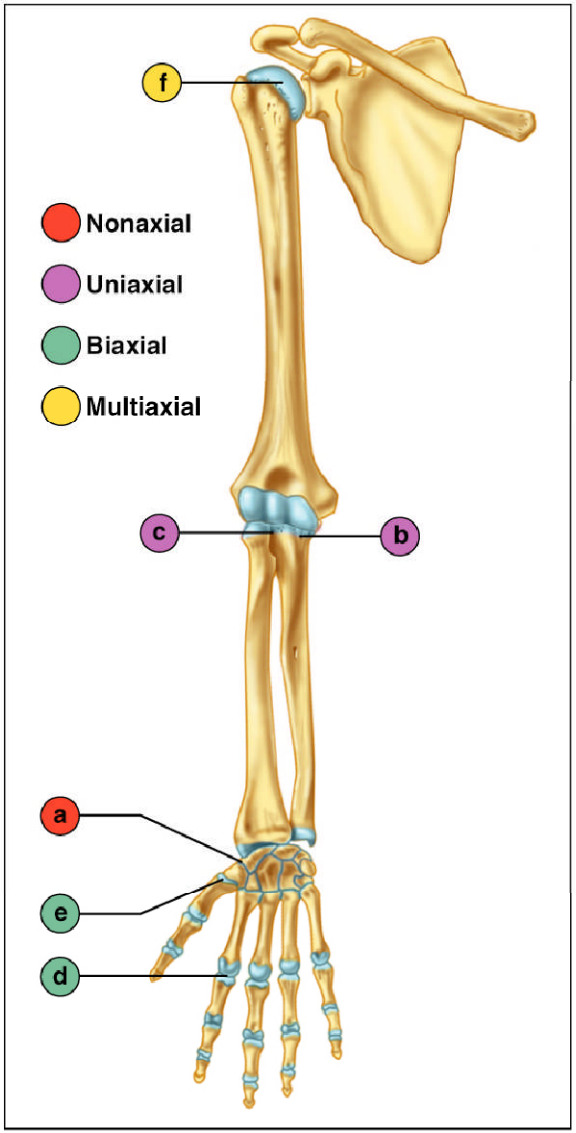


Figure 8.7d

Saddle Joints

- Similar to condyloid joints but allow greater movement
- Each articular surface has both a concave and a convex surface
- Example: carpometacarpal joint of the thumb

Saddle Joints



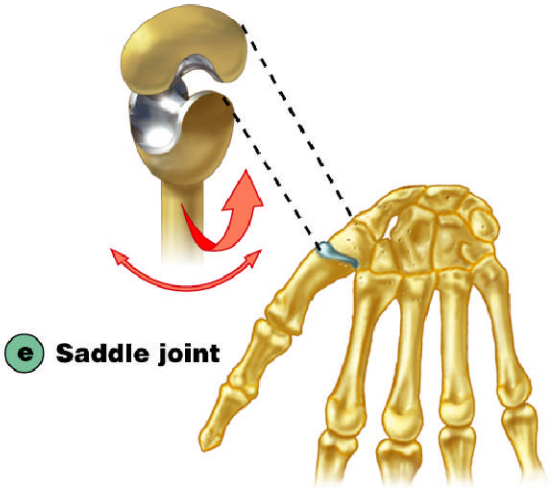
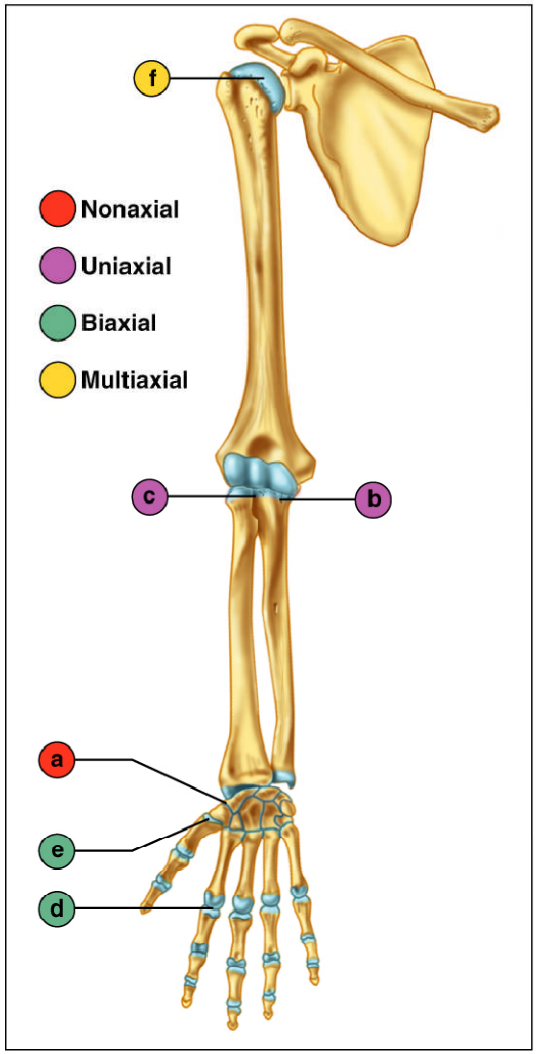


Figure 8.7e

Ball-and-Socket Joints

- A spherical or hemispherical head of one bone articulates with a cuplike socket of another
- Multiaxial joints permit the most freely moving synovial joints
- Examples: shoulder and hip joints

Ball-and-Socket Joints



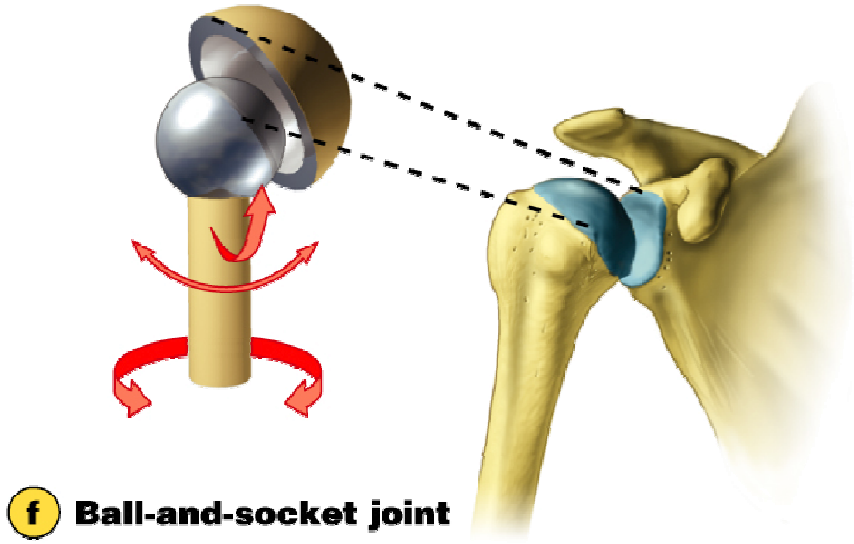


Figure 8.7f

Synovial Joints: Knee

- Largest and most complex joint of the body
- Allows flexion, extension, and some rotation
- Three joints in one surrounded by a single joint cavity
  - Femoropatellar joint
  - Lateral and medial tibiofemoral joints

Synovial Joints: Movement

- The two muscle attachments across a joint are:
  - Origin – attachment to the immovable bone
  - Insertion – attachment to the movable bone
- Described as movement along transverse, frontal, or sagittal planes

Synovial Joints: Range of Motion

- Nonaxial – slipping movements only
- Uniaxial – movement in one plane
- Biaxial – movement in two planes
- Multiaxial – movement in or around all three planes

Synovial Joints: Elbow

- Annular ligament
- Ulnar collateral ligament
- Radial collateral ligament

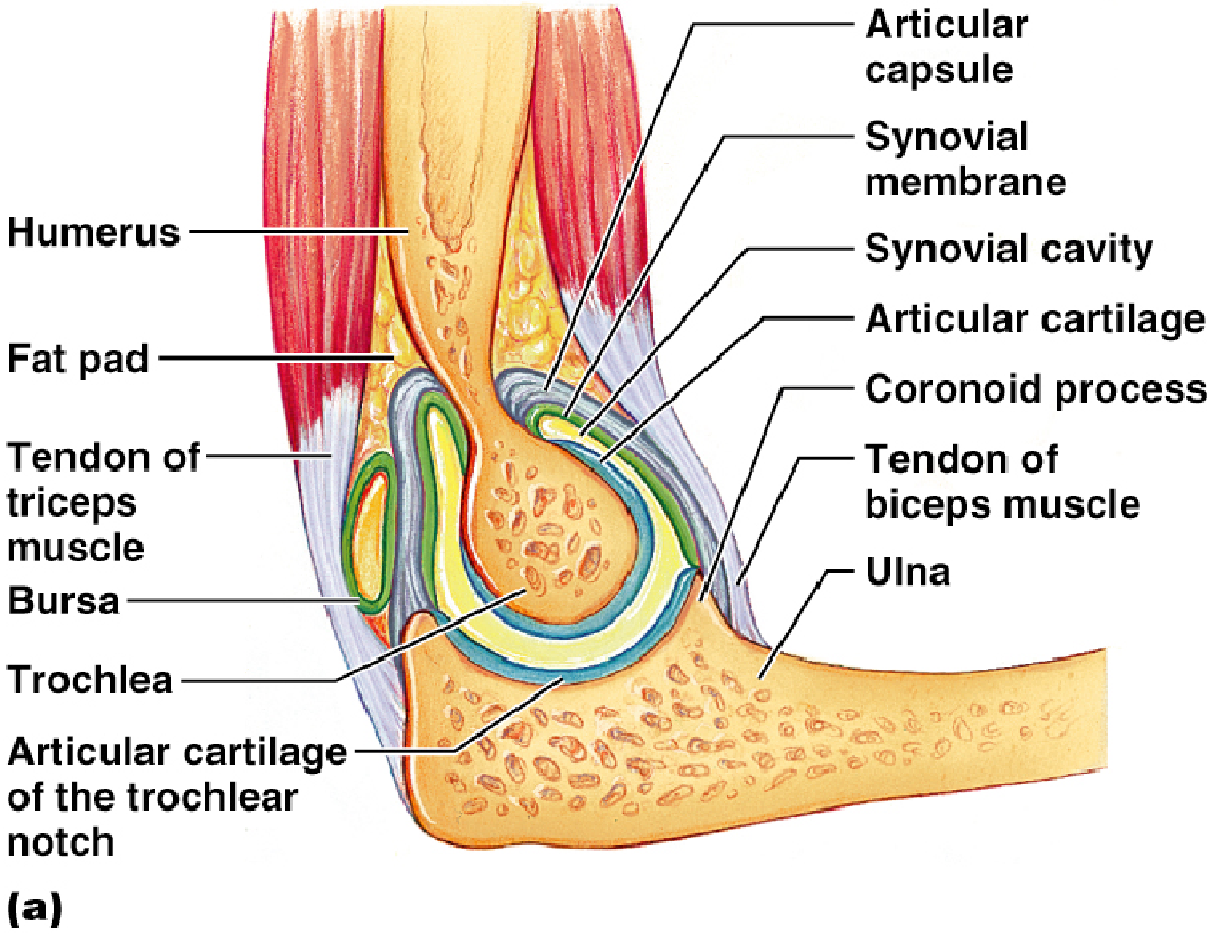
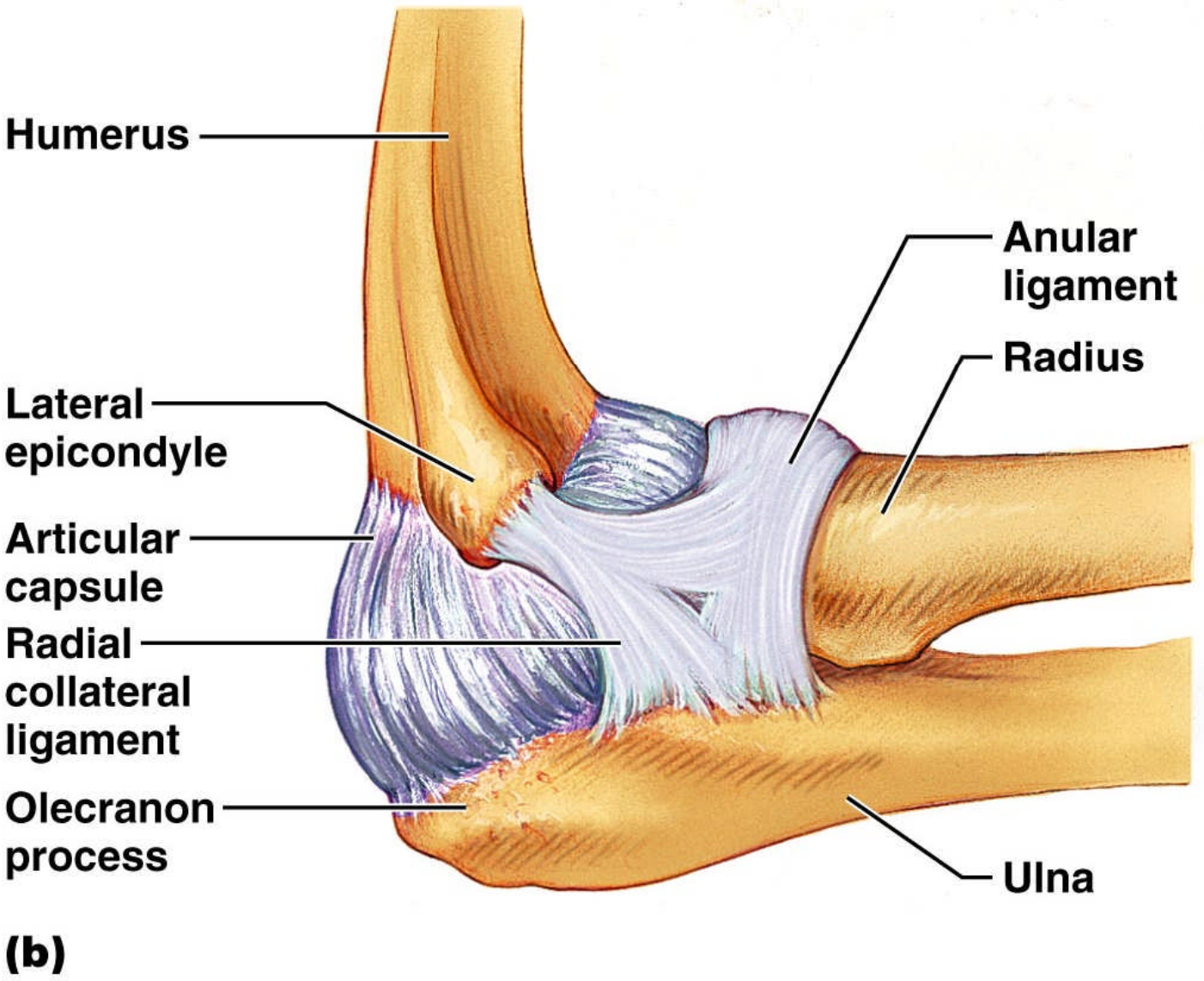


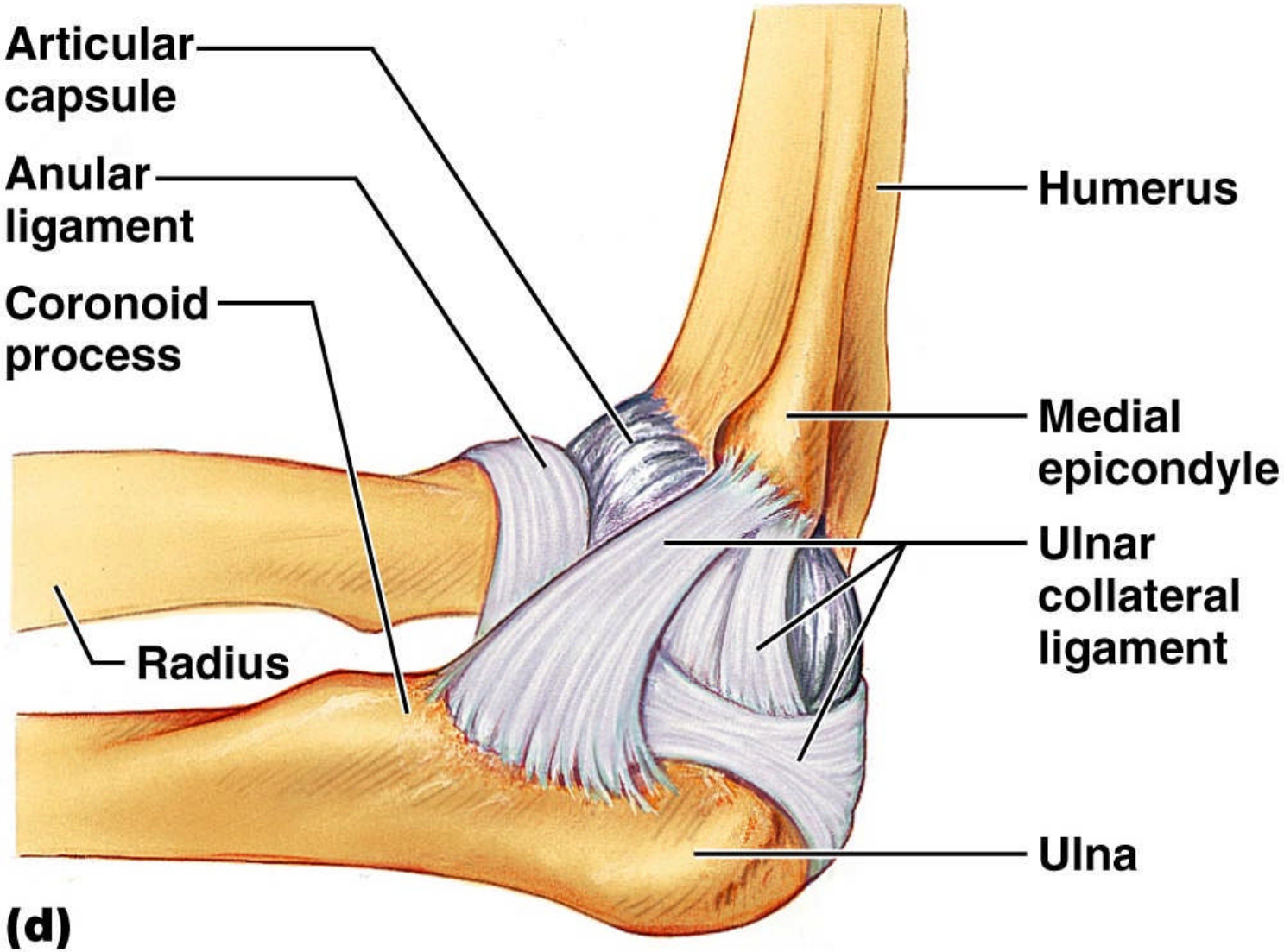
Figure 8.10a

Synovial Joints: Elbow



gure 8.10b

Synovial Joints: Elbow



e 8.10d

Synovial Joints: Shoulder Stability

- Weak stability is maintained by:
  - Thin, loose joint capsule
  - Four ligaments – coracohumeral, and three glenohumeral
  - Tendon of the long head of biceps, which travels through the intertubercular groove and secures the humerus to the glenoid cavity
  - Rotator cuff (four tendons) that encircles the shoulder joint and blends with the articular capsule

Synovial Joints: Shoulder

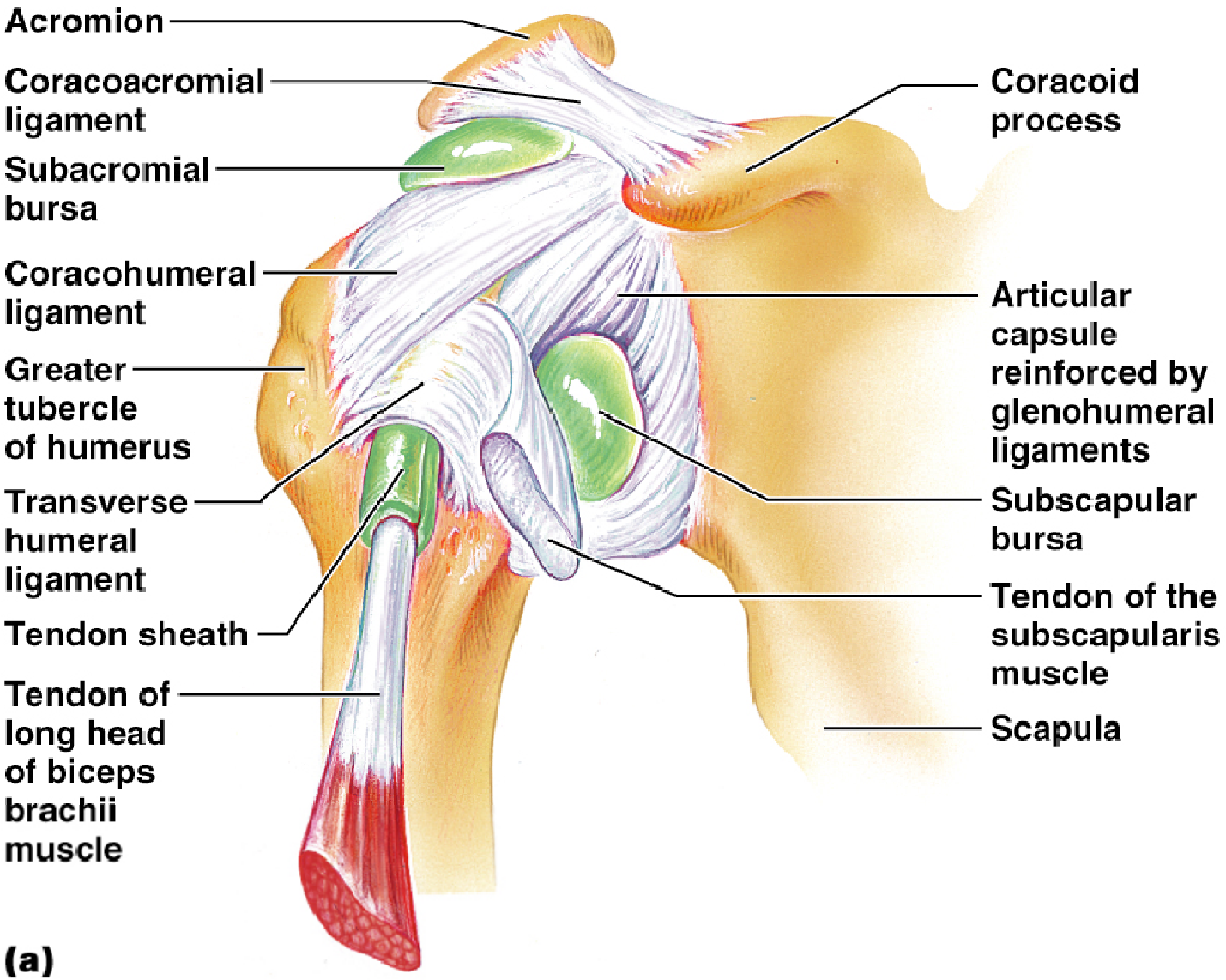


Figure 8.11a

Synovial Joints: Shoulder

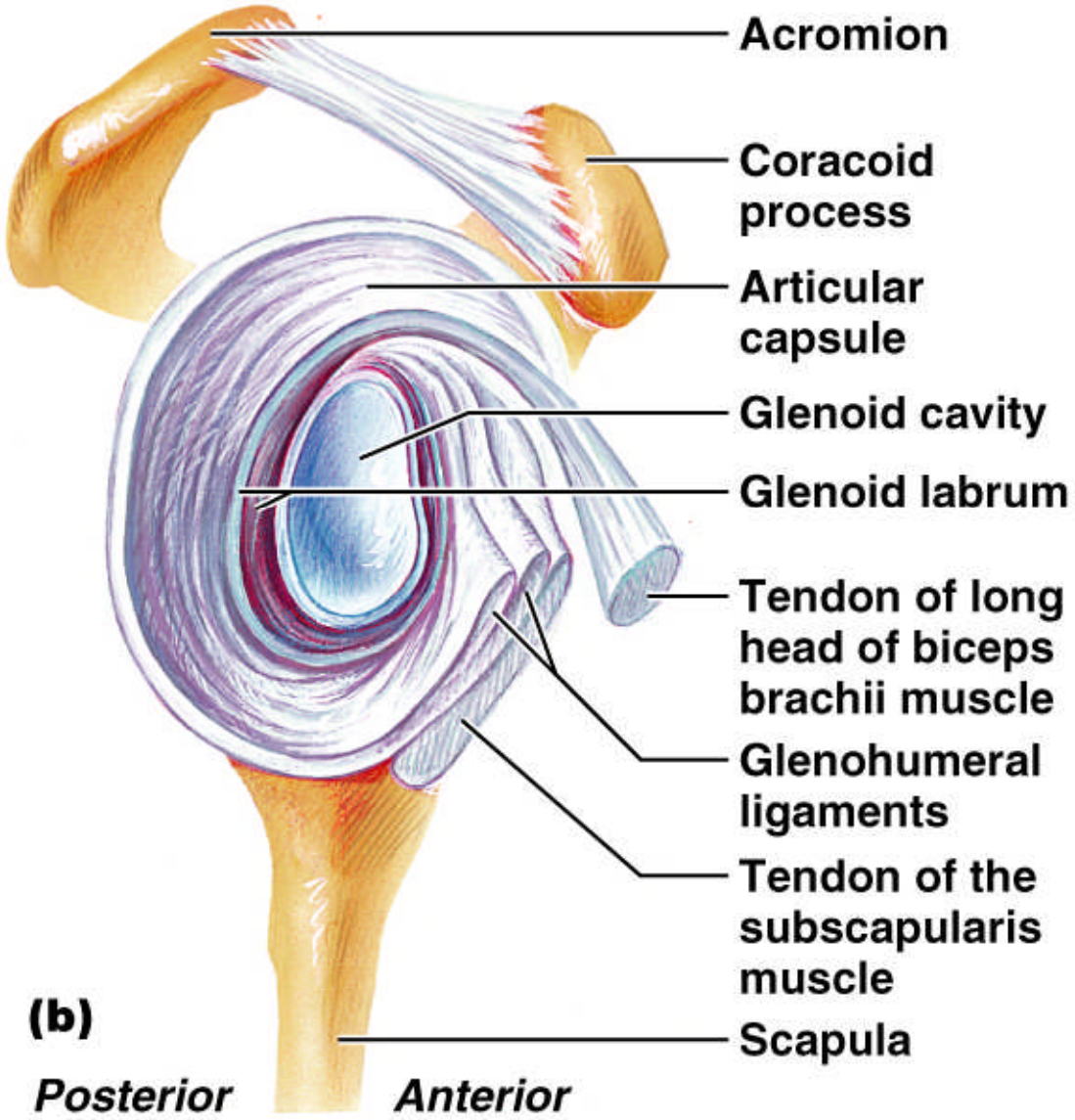


Figure 8.11b

Synovial Joints: Hip (Coxal) Joint

- Ball-and-socket joint
- Head of the femur articulates with the acetabulum
- Good range of motion, but limited by the deep socket and strong ligaments

Synovial Joints: Hip Stability

- Acetabular labrum
- Iliofemoral ligament
- Pubofemoral ligament
- Ischiofemoral ligament
- Ligamentum teres

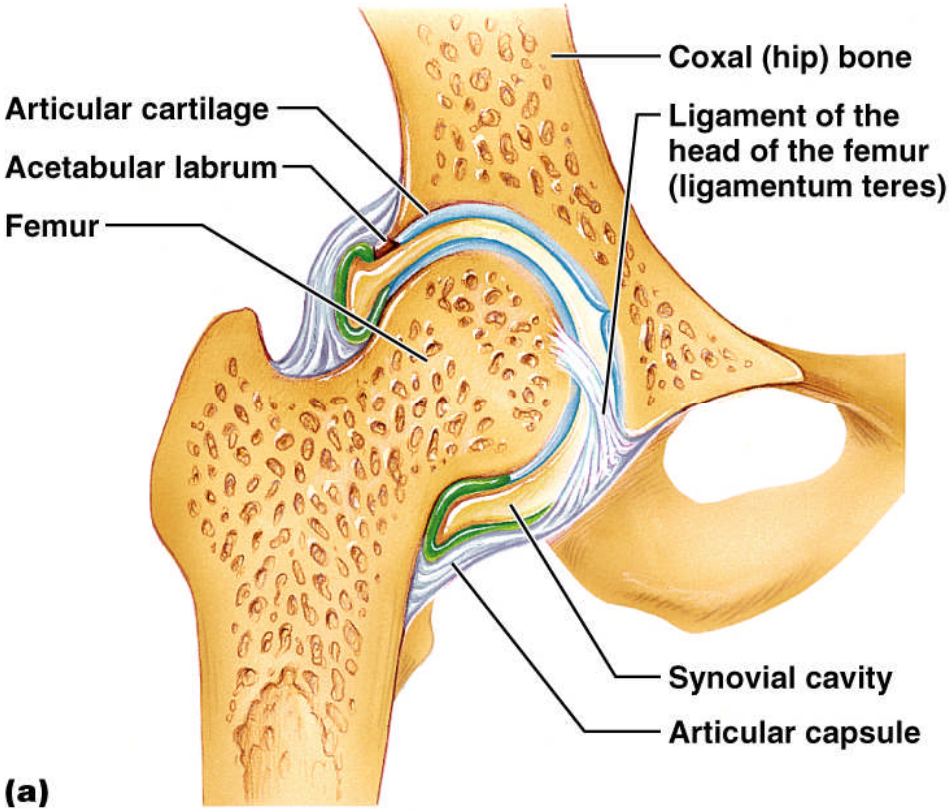


Figure 8.12a

Synovial Joints: Hip Stability

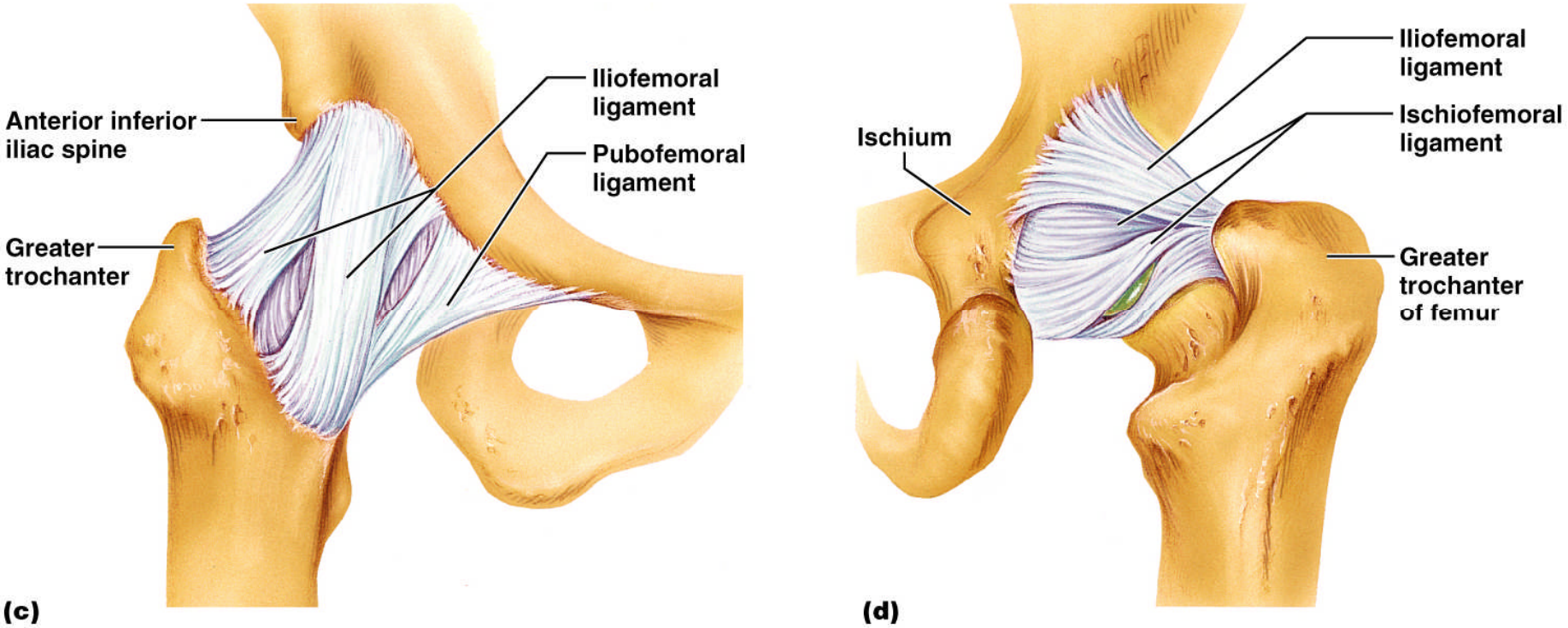


Figure 8.12c, d

X-ray of hand affected by arthritis