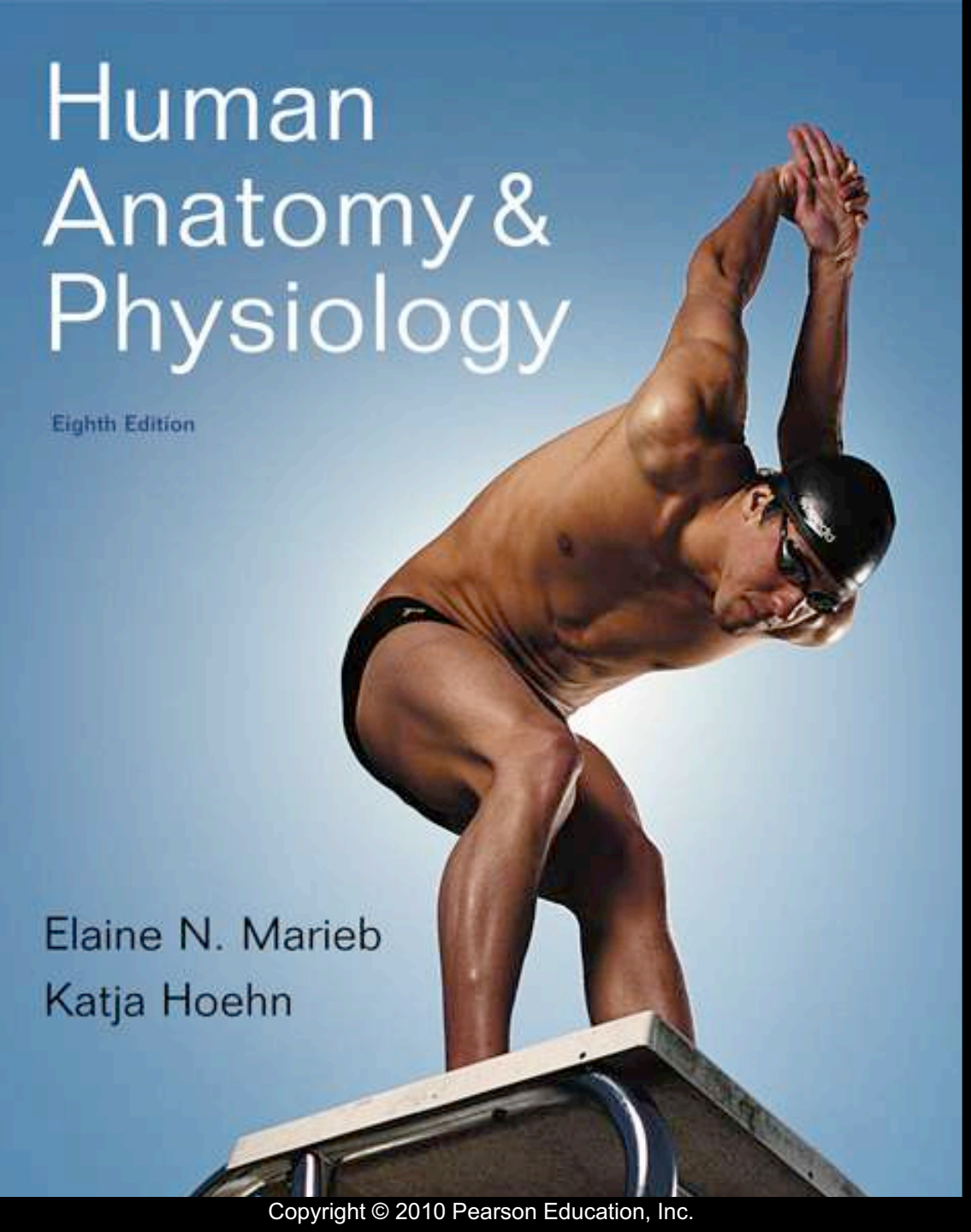


PowerPoint® Lecture Slides
prepared by
Janice Meeking,
Mount Royal College

CHAPTER 8

Joints: Part A

Cover Slides 1-28. Students Review the Information on Slides 29-56 and ask questions as

Joints (Articulations)

- Articulation—site where two or more bones meet
- Functions of joints:
  - Give skeleton mobility
  - Hold skeleton together

Functional Classification of Joints

- Based on amount of movement allowed by the joint
- Three functional classifications:
  - Synarthroses—immovable
  - Amphiarthroses—slightly movable
  - Diarthroses—freely movable

Structural Classification of Joints

- Based on material binding bones together and whether or not a joint cavity is present
- Three structural classifications:
  - Fibrous
  - Cartilaginous
  - Synovial

Fibrous Joints

- Bones joined by dense fibrous connective tissue
- No joint cavity
- Most are synarthrotic (immovable)
- Three types:
  - Sutures
  - Syndesmoses
  - Gomphoses

Fibrous Joints: Sutures

- Rigid, interlocking joints containing short connective tissue fibers
- Allow for growth during youth
- In middle age, sutures ossify and are called synostoses
- Skull

(a) Suture

Joint held together with very short, interconnecting fibers, and bone edges interlock. Found only in the skull.

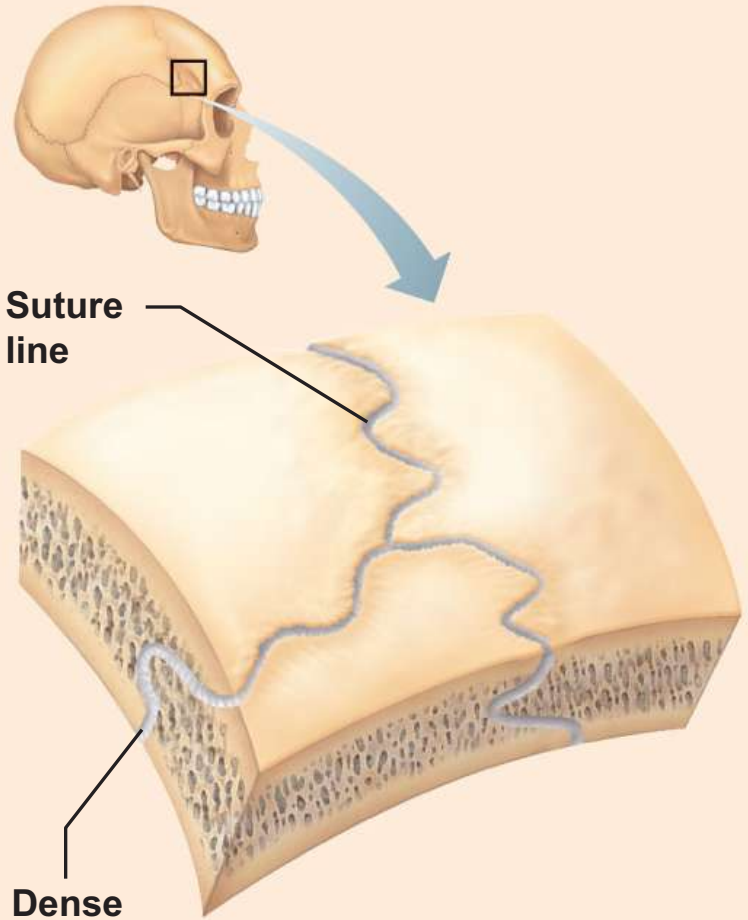


Figure 8.1a

Fibrous Joints: Syndesmoses

- Bones connected by ligaments (bands of fibrous tissue)
- Movement varies from immovable to slightly movable
- Examples:
  - Synarthrotic distal tibiofibular joint (tibia & fibula)
  - Diarthrotic interosseous connection between radius and ulna

(b) Syndesmosis

Joint held together by a ligament. Fibrous tissue can vary in length, but is longer than in sutures.

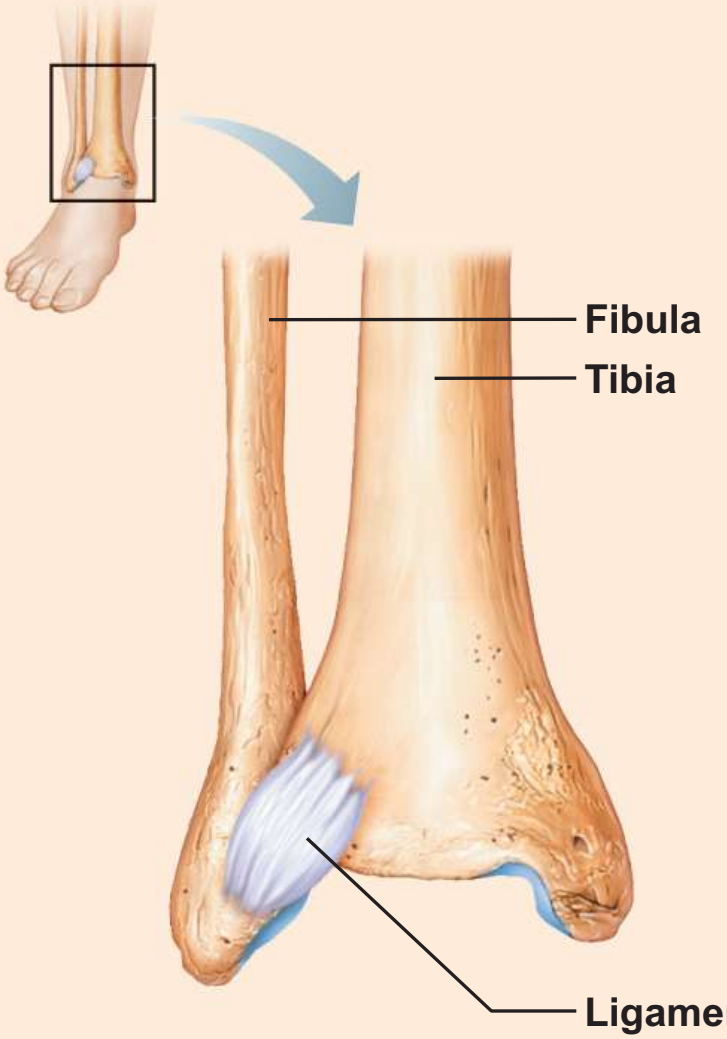


Figure 8.1b

Fibrous Joints: Gomphoses

- Peg-in-socket joints of teeth in alveolar sockets
- Fibrous connection is the periodontal ligament

(c) Gomphosis

"Peg in socket" fibrous joint. Periodontal ligament holds tooth in socket.

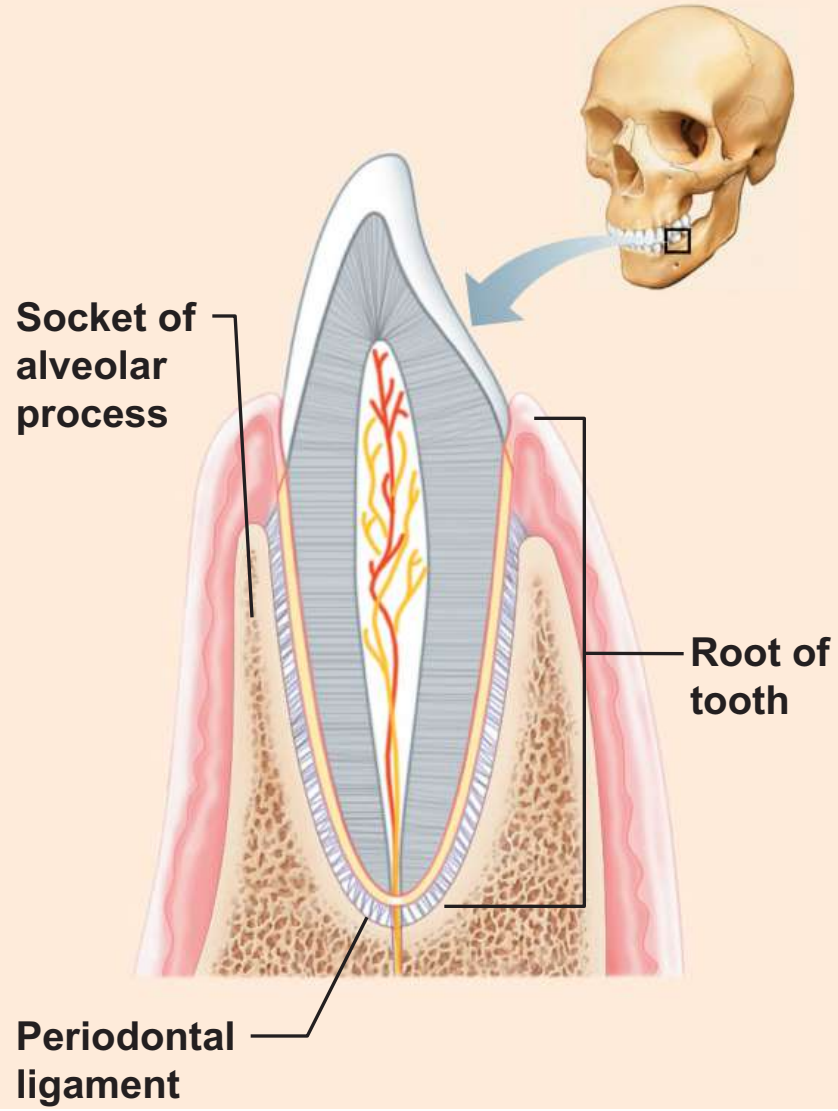


Figure 8.1c

Cartilaginous Joints

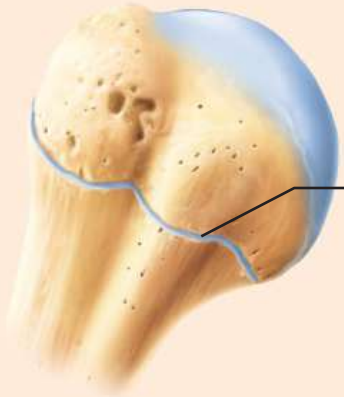
- Bones united by cartilage
- No joint cavity
- Two types:
  - Synchondroses
  - Symphyses

Cartilaginous Joints: Synchondroses

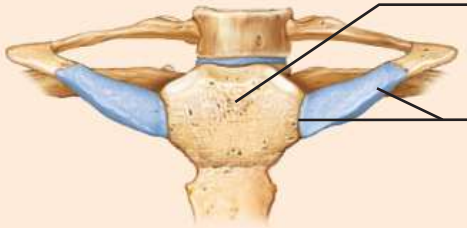
- A bar or plate of hyaline cartilage unites the bones
- All are synarthrotic
- Epiphyseal plate; manubrium & 1st rib

(a) Synchondroses

Bones united by hyaline cartilage



Epiphyseal plate (temporary hyaline cartilage joint)



Sternum (manubrium)

Joint between first rib and sternum (immovable)

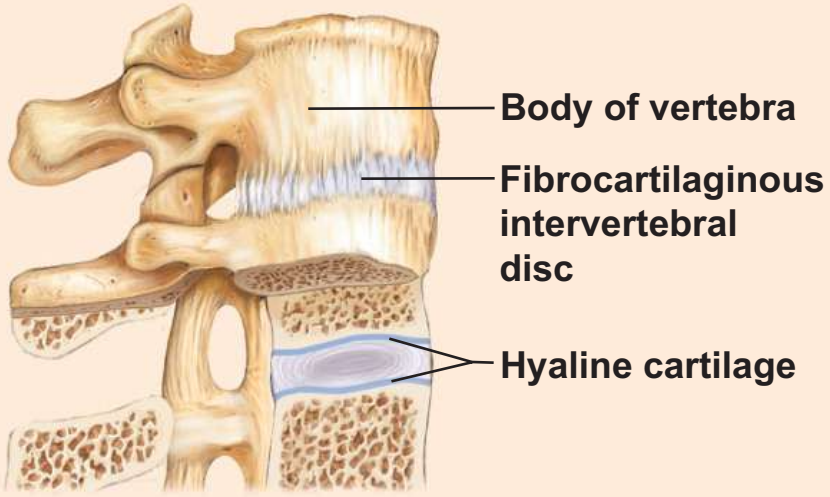
Figure 8.2a

Cartilaginous Joints: Symphyses

- Hyaline cartilage covers the articulating surfaces and is fused to an intervening pad of fibrocartilage
- Strong, flexible amphiarthroses
- Intervertebral disc; pubic symphysis

(b) Symphyses

Bones united by fibrocartilage



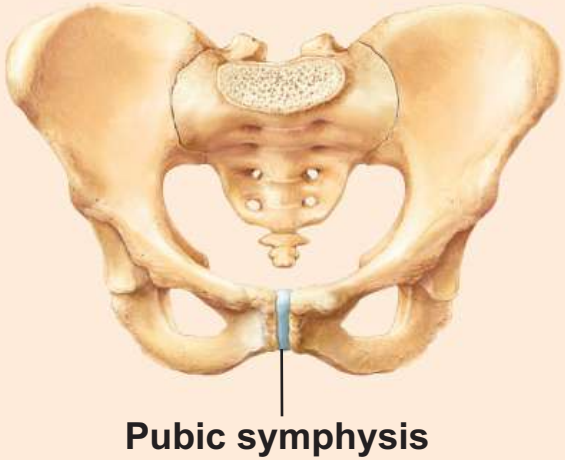


Figure 8.2b

Synovial Joints

- All are diarthrotic
- Include all limb joints; most joints of the body

Distinguishing features:

1. Articular cartilage: hyaline cartilage
2. Joint (synovial) cavity: small potential space
3. Articular (joint) capsule:
    - Outer fibrous capsule of dense irregular connective tissue
    - Inner synovial membrane of loose connective tissue

Synovial Joints Distinguishing features (continued)

4. Synovial fluid:
   - Viscous slippery filtrate of plasma + hyaluronic acid
   - Lubricates and nourishes articular cartilage

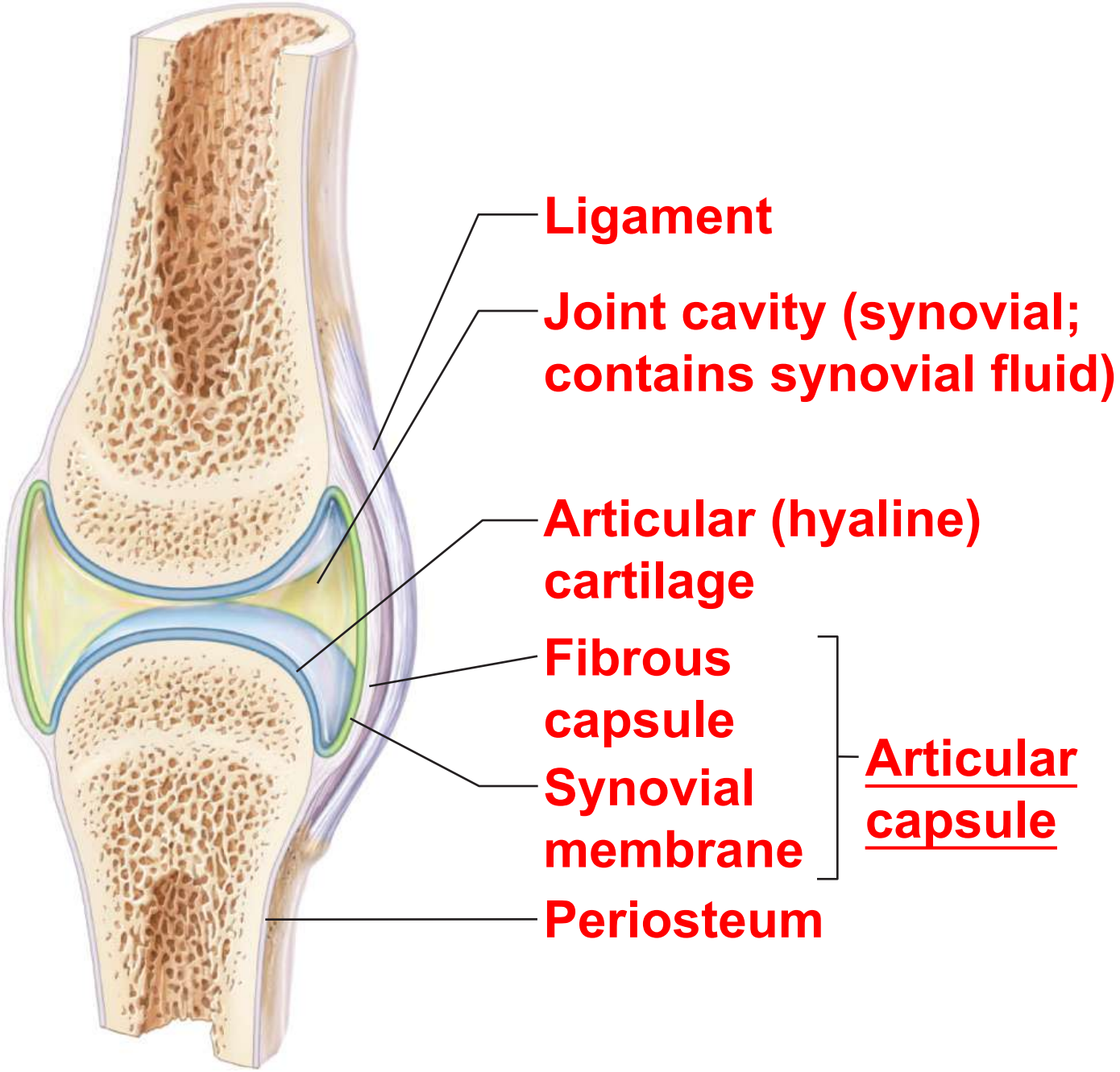


Figure 8.3

Synovial Joints Distinguishing features (continued)

5. Three possible types of reinforcing ligaments:
   - Capsular (intrinsic)—part of the fibrous capsule
   - Extracapsular—outside the capsule
   - Intracapsular—deep to capsule; covered by synovial membrane

Synovial Joints Distinguishing features (continued)Synovial Joints

6.Rich nerve and blood vessel supply:

- Nerve fibers detect pain, monitor joint position and stretch
- Capillary beds produce filtrate for synovial fluid

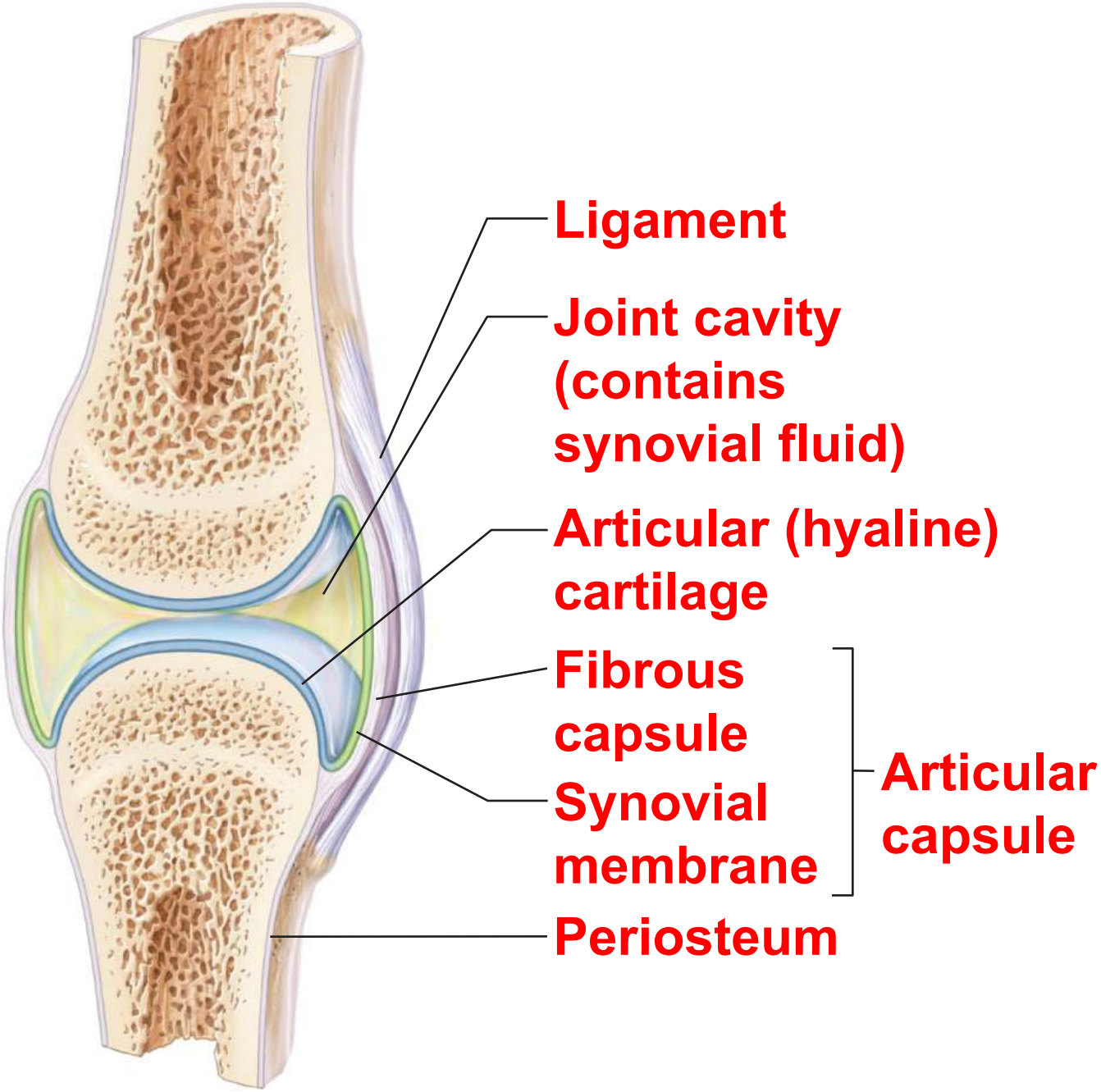
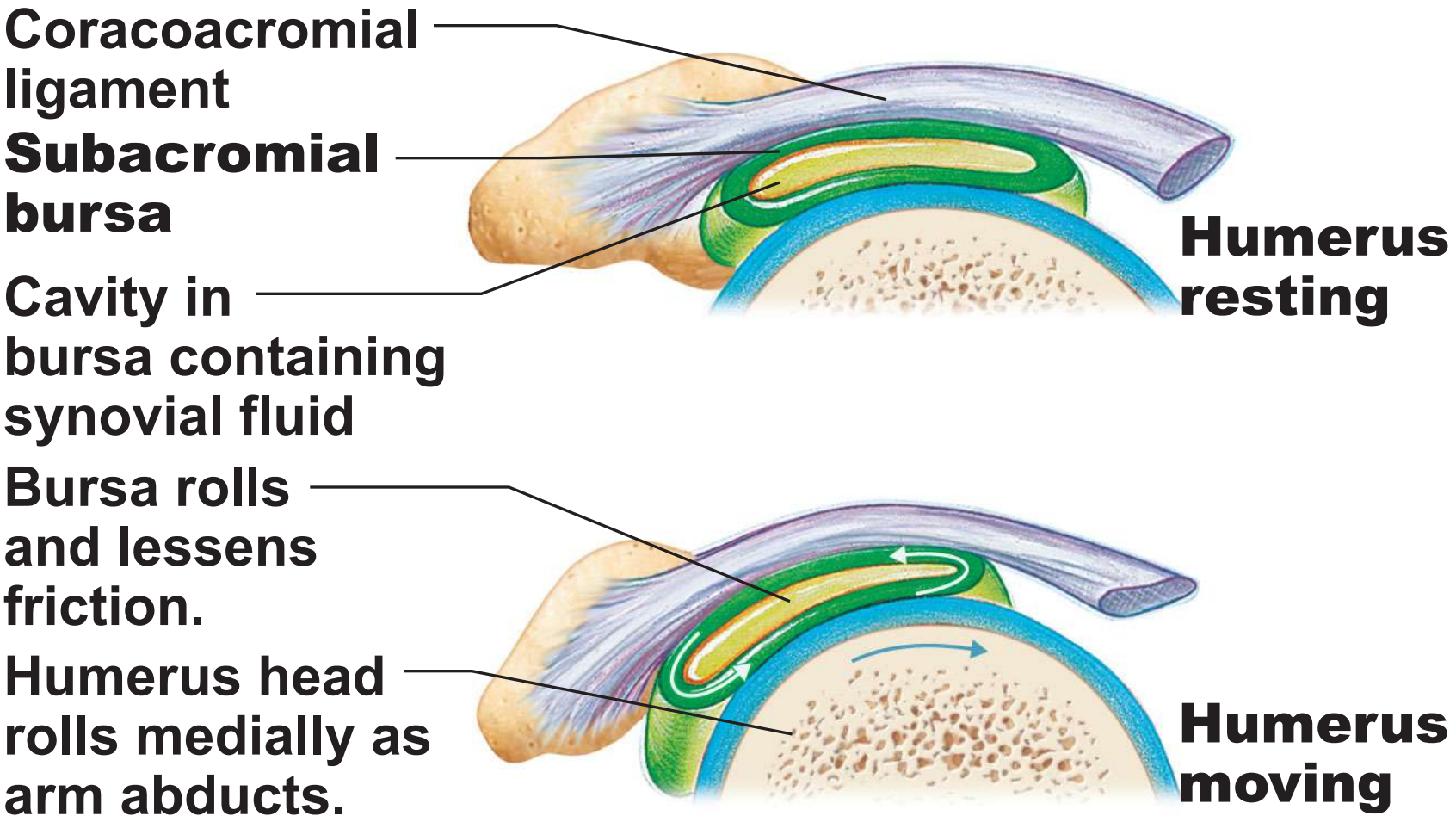


Figure 8.3

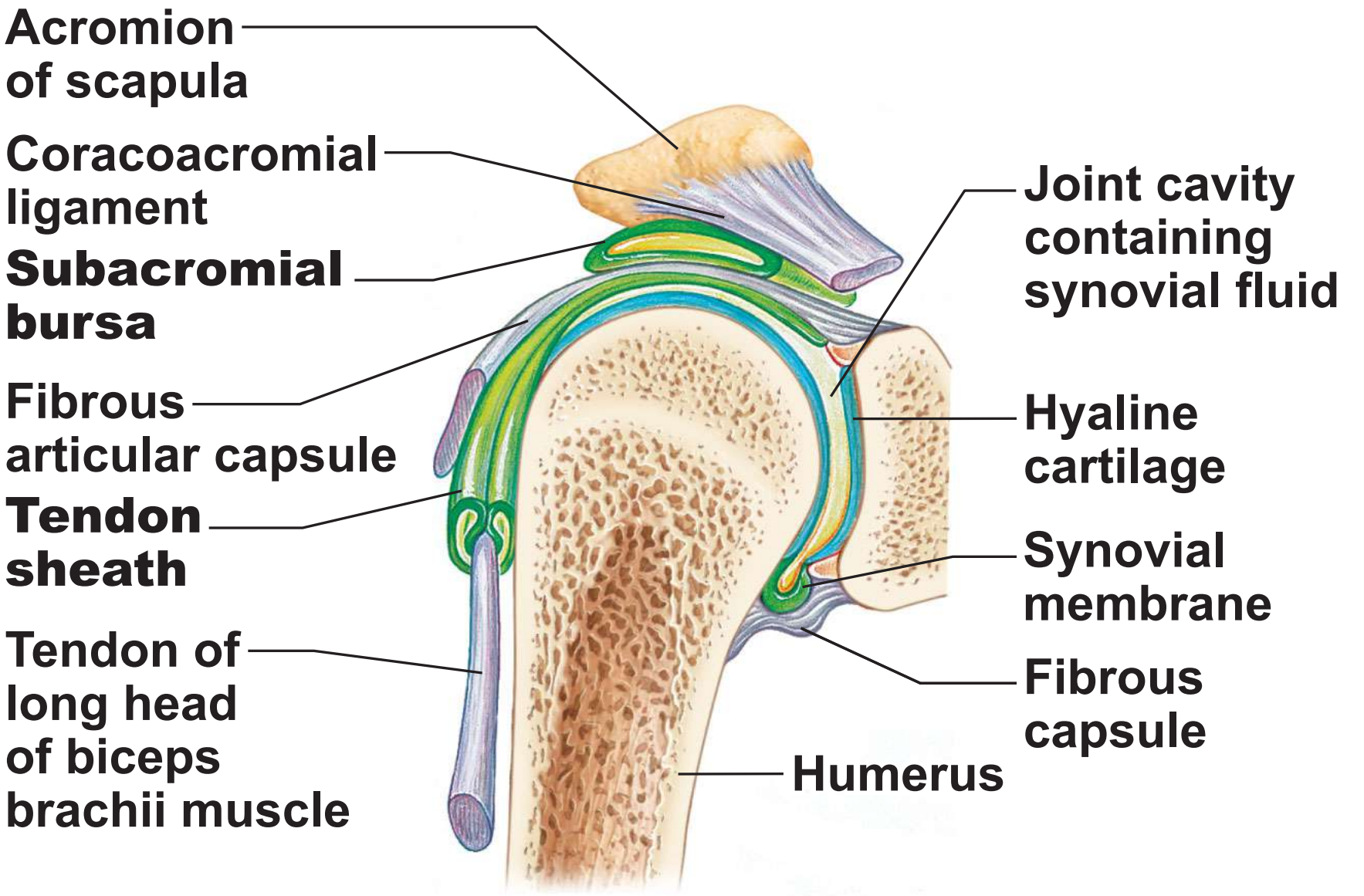
Synovial Joints: Friction-Reducing Structures

- Bursae:
  - Flattened, fibrous sacs lined with synovial membranes
  - Contain synovial fluid
  - Commonly act as “ball bearings” where ligaments, muscles, skin, tendons, or bones rub together
- Tendon sheath:
  - Elongated bursa that wraps completely around a tendon



(b) Enlargement of (a), showing how a bursa eliminates friction where a ligament (or other structure) would rub against a bone

Figure 8.4b



(a) Frontal section through the right shoulder joint

Figure 8.4a

Stabilizing Factors at Synovial Joints

- Shapes of articular surfaces (minor role)
- Ligament number and location (limited role)
- Muscle tone, which keeps tendons that cross the joint taut
  - Extremely important in reinforcing shoulder and knee joints and arches of the foot

Synovial Joints: Movement

- Muscle attachments across a joint:
  - Origin—attachment to the immovable bone
  - Insertion—attachment to the movable bone
- Muscle contraction causes the insertion to move toward the origin
- Movements occur 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

Summary of Characteristics of Body Joints

Consult Table 8.2 for:

- Joint names
- Articulating bones
- Structural classification
- Functional classification
- Movements allowed

TABLE 8.2 Structural and Functional Characteristics of Body Joints

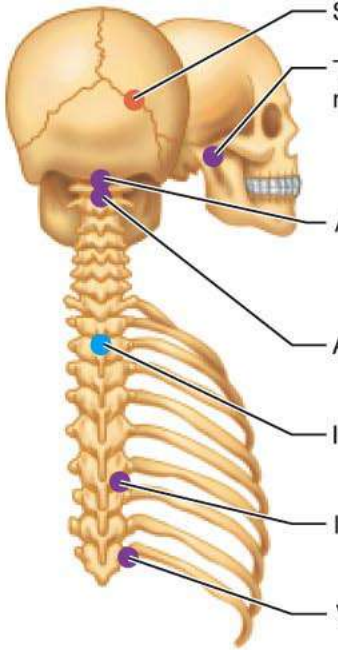
ILLUSTRATION	JOINT	ARTICULATING BONES	STRUCTURAL TYPE*	FUNCTIONAL TYPE; MOVEMENTS ALLOWED
	Skull	Cranial and facial bones	Fibrous; suture	Synarthrotic; no movement
	Temporo-mandibular	Temporal bone of skull and mandible	Synovial; modified hinge† (contains articular disc)	Diarthrotic; gliding and uniaxial 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

TABLE 8.2 Structural and Functional Characteristics of Body Joints

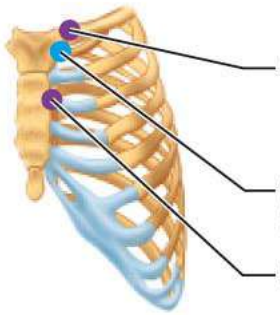
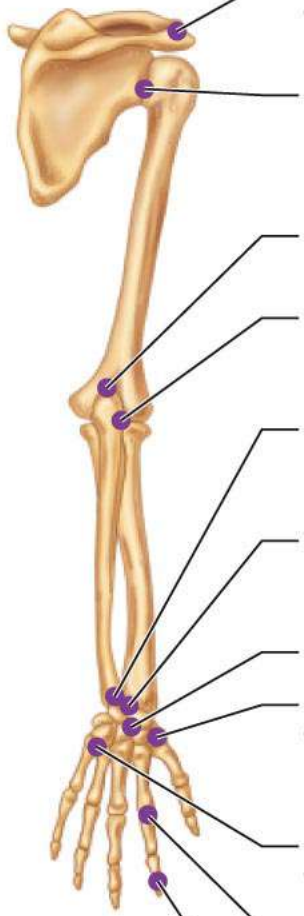
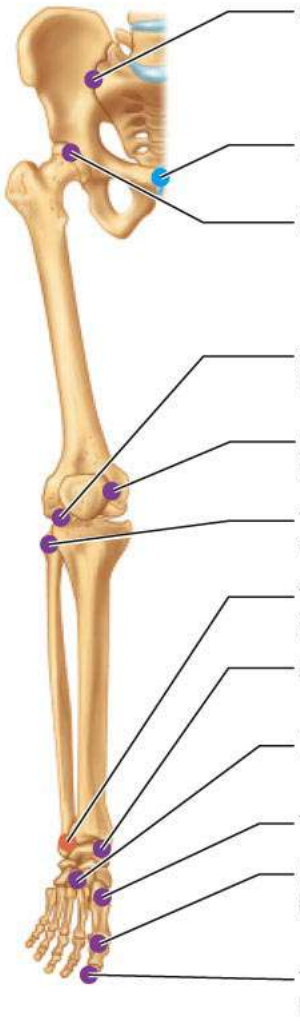
ILLUSTRATION	JOINT	ARTICULATING BONES	STRUCTURAL TYPE*	FUNCTIONAL TYPE; MOVEMENTS ALLOWED
	Sternoclavicular	Sternum and clavicle	Synovial; shallow saddle (contains articular disc)	Diarthrotic; multiaxial (allows clavicle to move in all axes)
	Sternocostal (first)	Sternum and rib 1	Cartilaginous; synchondrosis	Synarthrotic; no movement
	Sternocostal	Sternum and ribs 2–7	Synovial; double plane	Diarthrotic; gliding

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

TABLE 8.2 Structural and Functional Characteristics of Body Joints



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 in flexed position
Knee (femoropatellar)	Femur and patella	Synovial; plane	Diarthrotic; gliding of patella
Tibiofibular (proximal)	Tibia and fibula (proximally)	Synovial; plane	Diarthrotic; gliding of fibula
Tibiofibular (distal)	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
Metatarso-phalangeal	Metatarsal and proximal phalanx	Synovial; condyloid	Diarthrotic; biaxial; flexion, extension, abduction, adduction, circumduction of great toe
Toe (interpha-langeal)	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.

Movements at Synovial Joints

1. Gliding
2. Angular movements:
   - Flexion, extension, hyperextension
   - Abduction, adduction
   - Circumduction
3. Rotation - Medial and lateral rotation
4. Special movements
   - Supination, pronation
   - Dorsiflexion, plantar flexion of the foot
   - Inversion, eversion
   - Protraction, retraction
   - Elevation, depression

Gliding Movements

- One flat bone surface glides or slips over another similar surface
- Examples:
  - Intercarpal joints
  - Intertarsal joints
  - Between articular processes of vertebrae

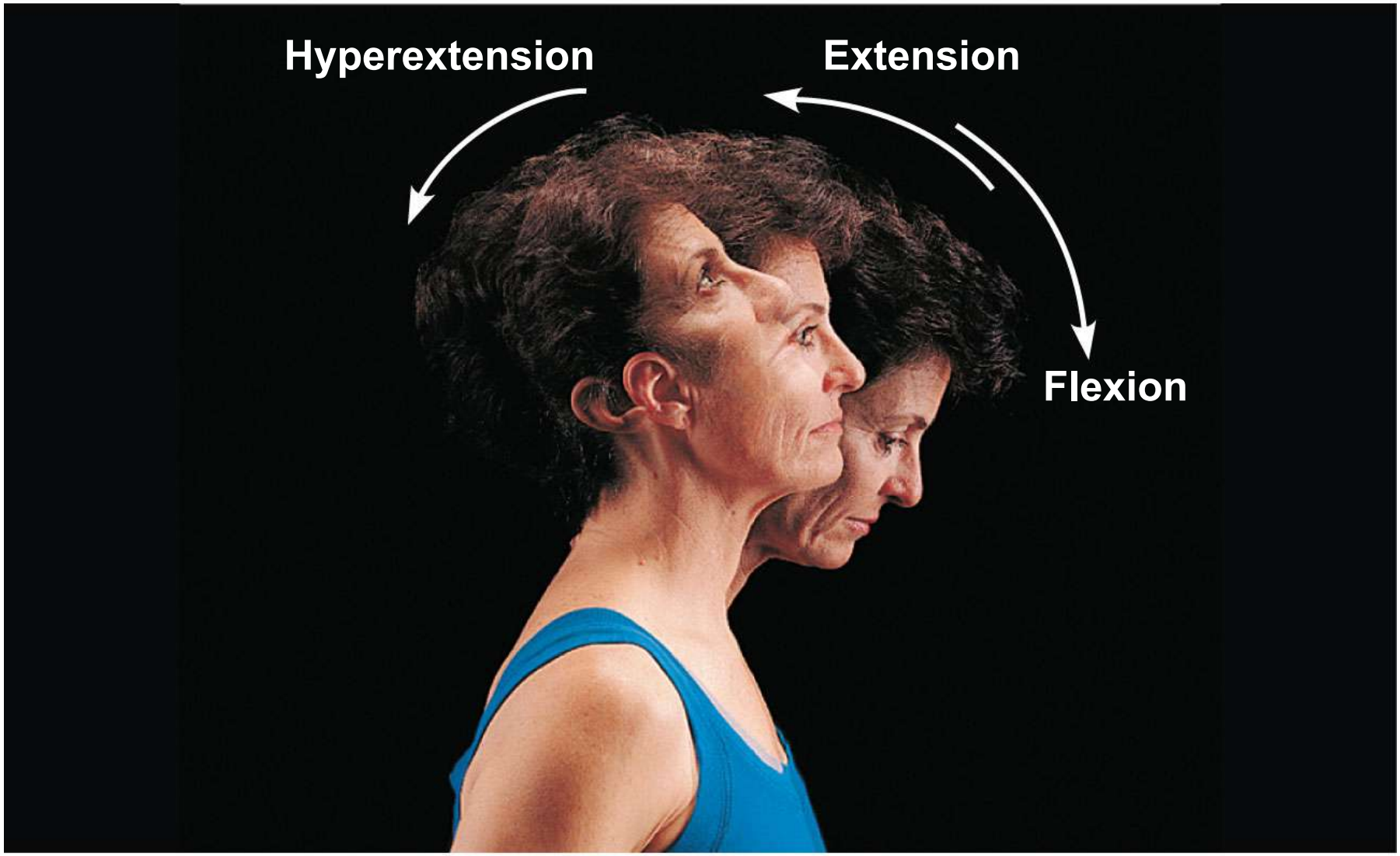
(a) Gliding movements at the wrist

Figure 8.5a

Angular Movements

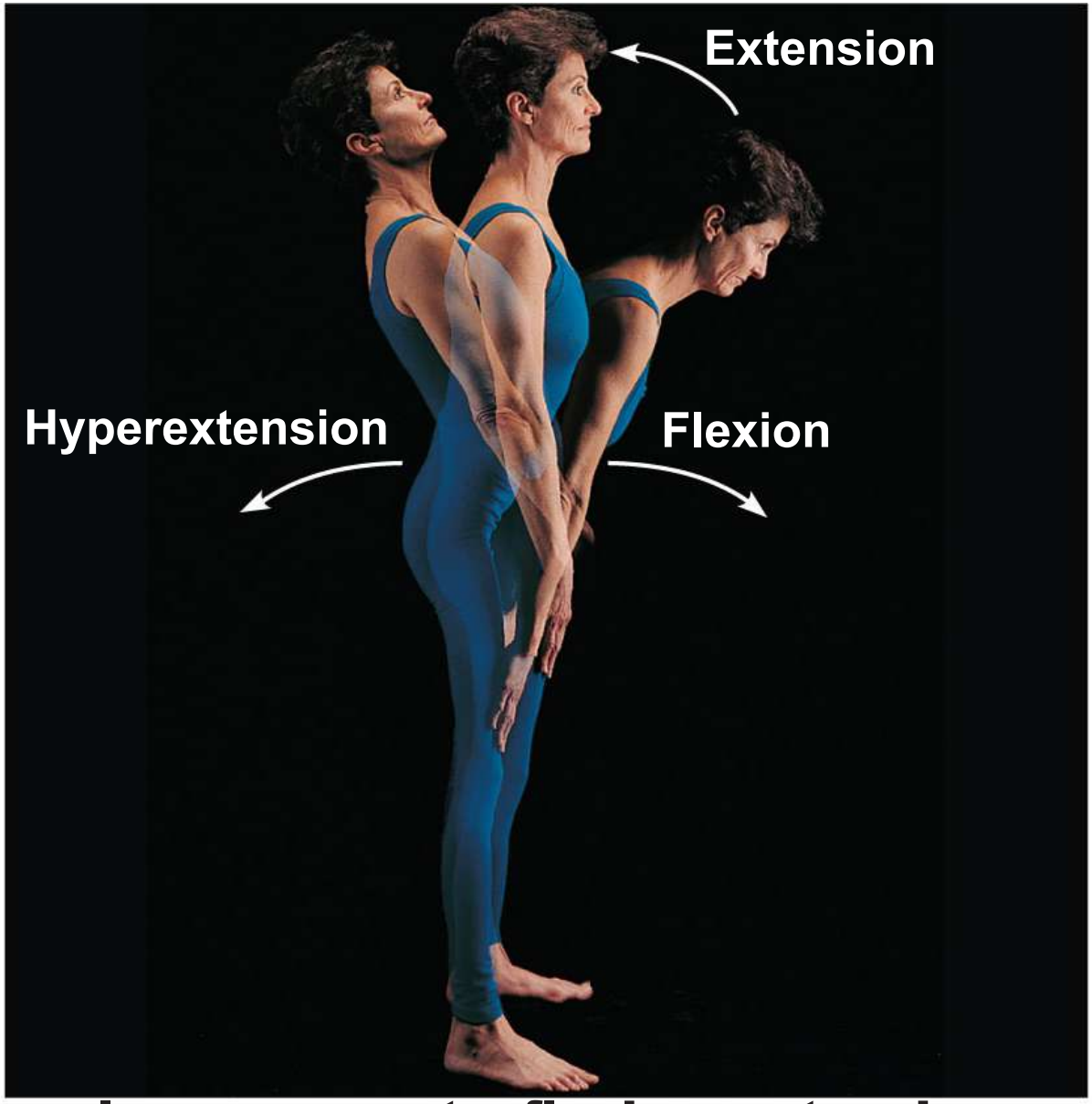
Movements that occur along the sagittal plane:

- Flexion—decreases the angle of the joint
- Extension— increases the angle of the joint
- Hyperextension—excessive extension beyond normal range of motion



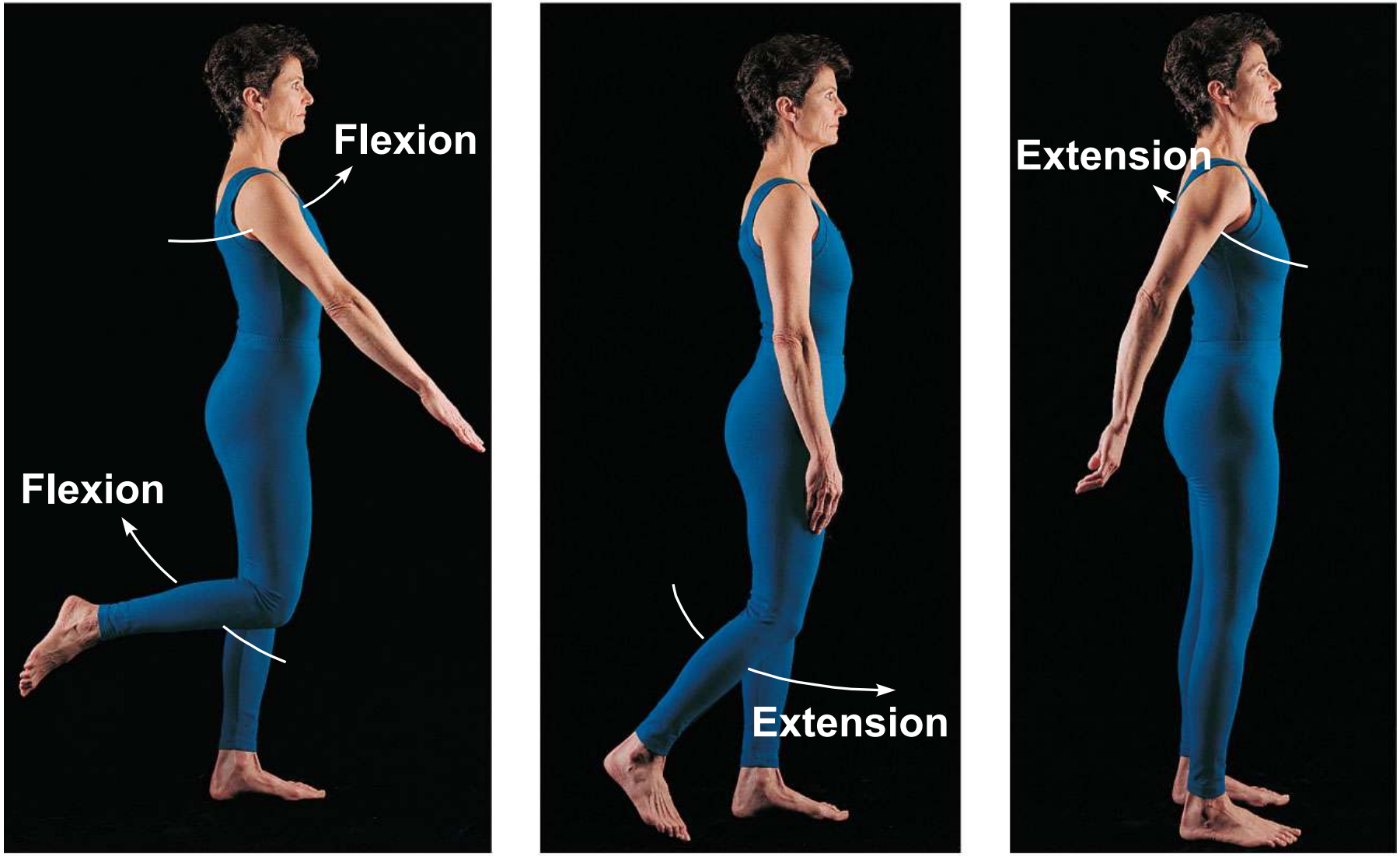
(b) Angular movements: flexion, extension, and hyperextension of the neck

Figure 8.5b



(c) Angular movements: flexion, extension, and hyperextension of the vertebral column

Figure 8.5c



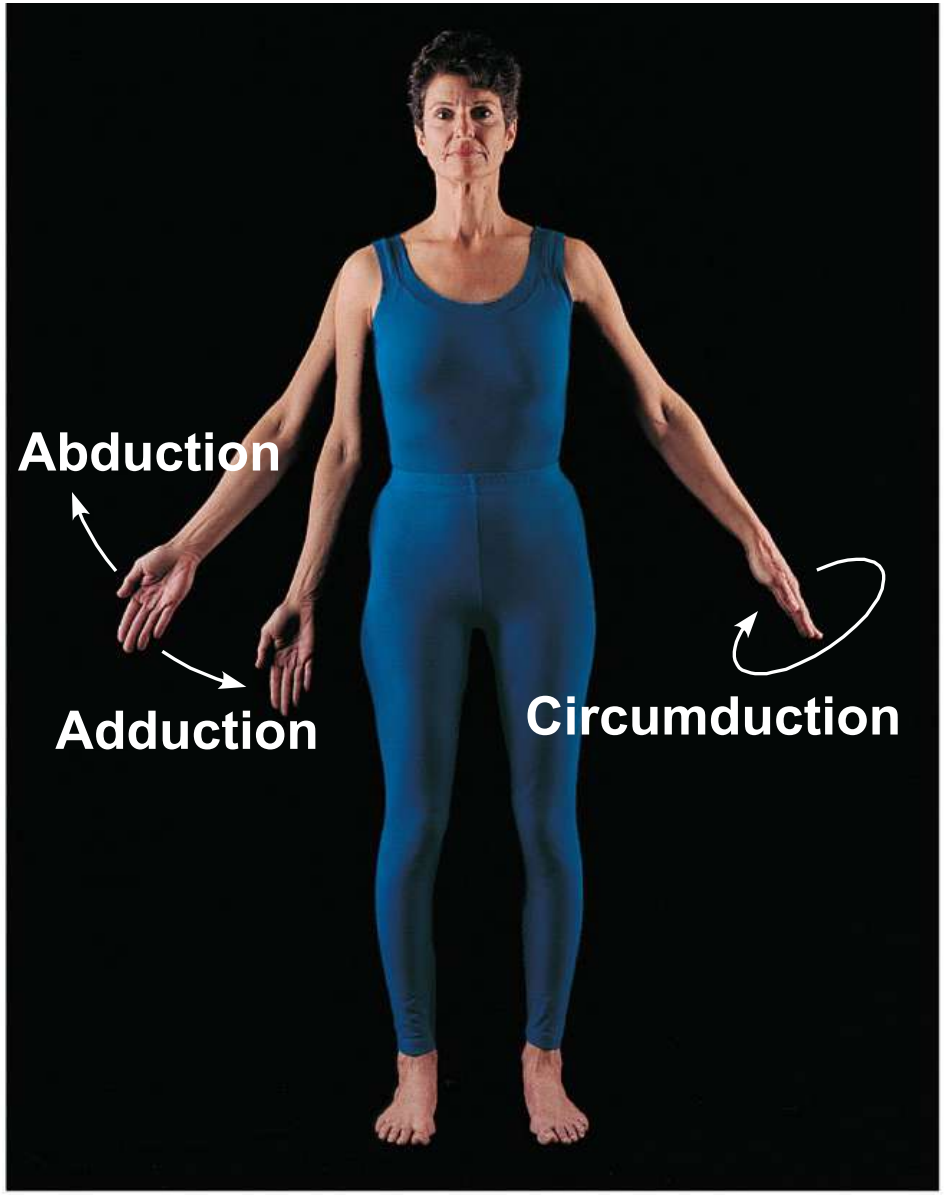
(d) Angular movements: flexion and extension at the shoulder and knee

Figure 8.5d

Angular Movements

Movements that occur along the frontal plane:

- Abduction—movement away from the midline
- Adduction—movement toward the midline
- Circumduction—flexion + abduction + extension + adduction of a limb so as to describe a cone in space

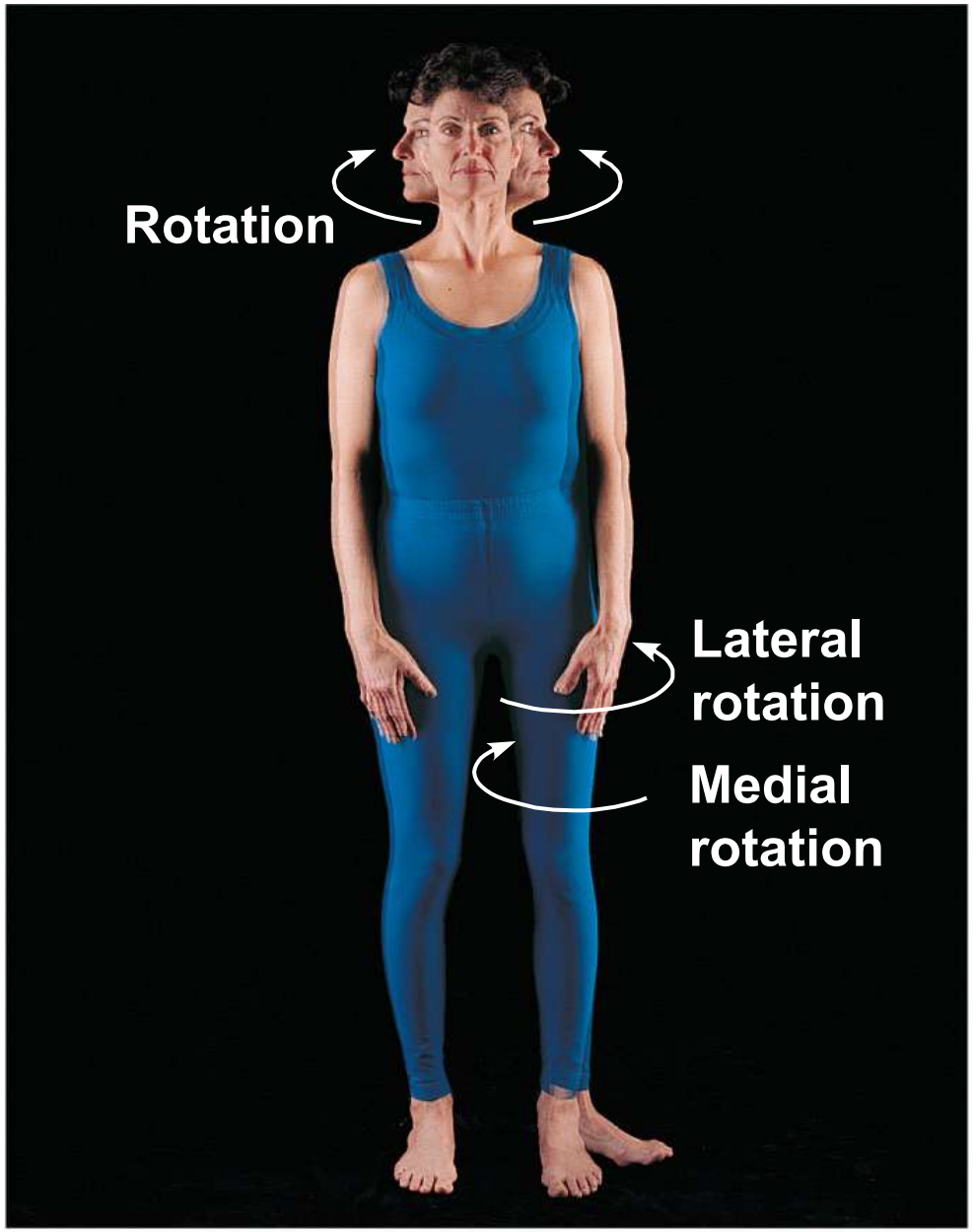


(e) Angular movements: abduction, adduction, and circumduction of the upper limb at the shoulder

Figure 8.5e

Rotation

- The turning of a bone around its own long axis
- Examples:
  - Between C_1 and C_2 vertebrae
  - Rotation of humerus and femur

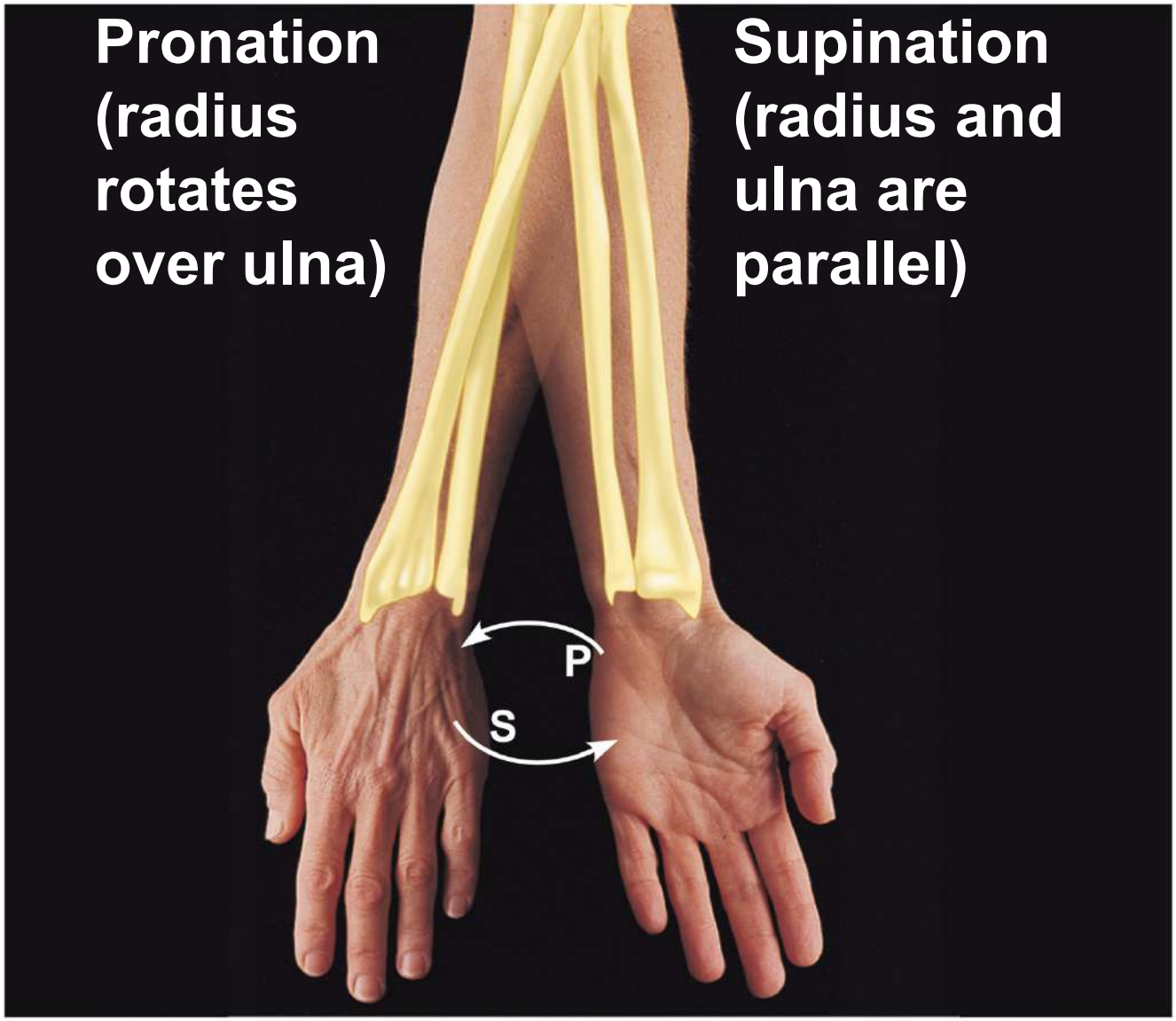


(f) Rotation of the head, neck, and lower limb

Figure 8.5f

Special Movements

- Movements of radius around ulna:
  - Supination (turning hand backward)
  - Pronation (turning hand forward)



(a) Pronation (P) and supination (S)

Figure 8.6a

Special Movements

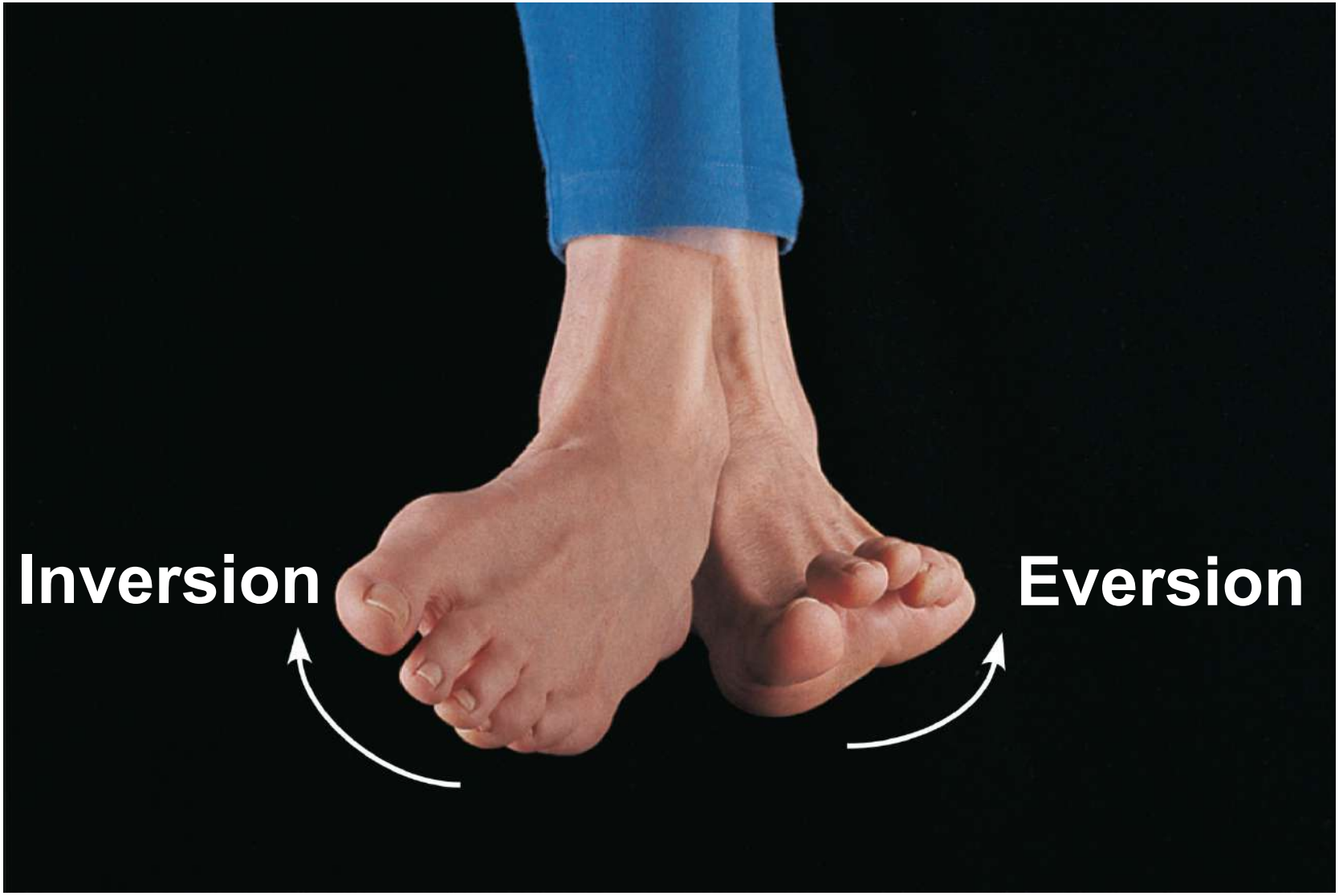
- Movements of the foot:
  - Dorsiflexion (upward movement)
  - Plantar flexion (downward movement)

(b) Dorsiflexion and plantar flexion

Figure 8.6b

Special Movements

- Movements of the foot:
  - Inversion (turn sole medially)
  - Eversion (turn sole laterally)

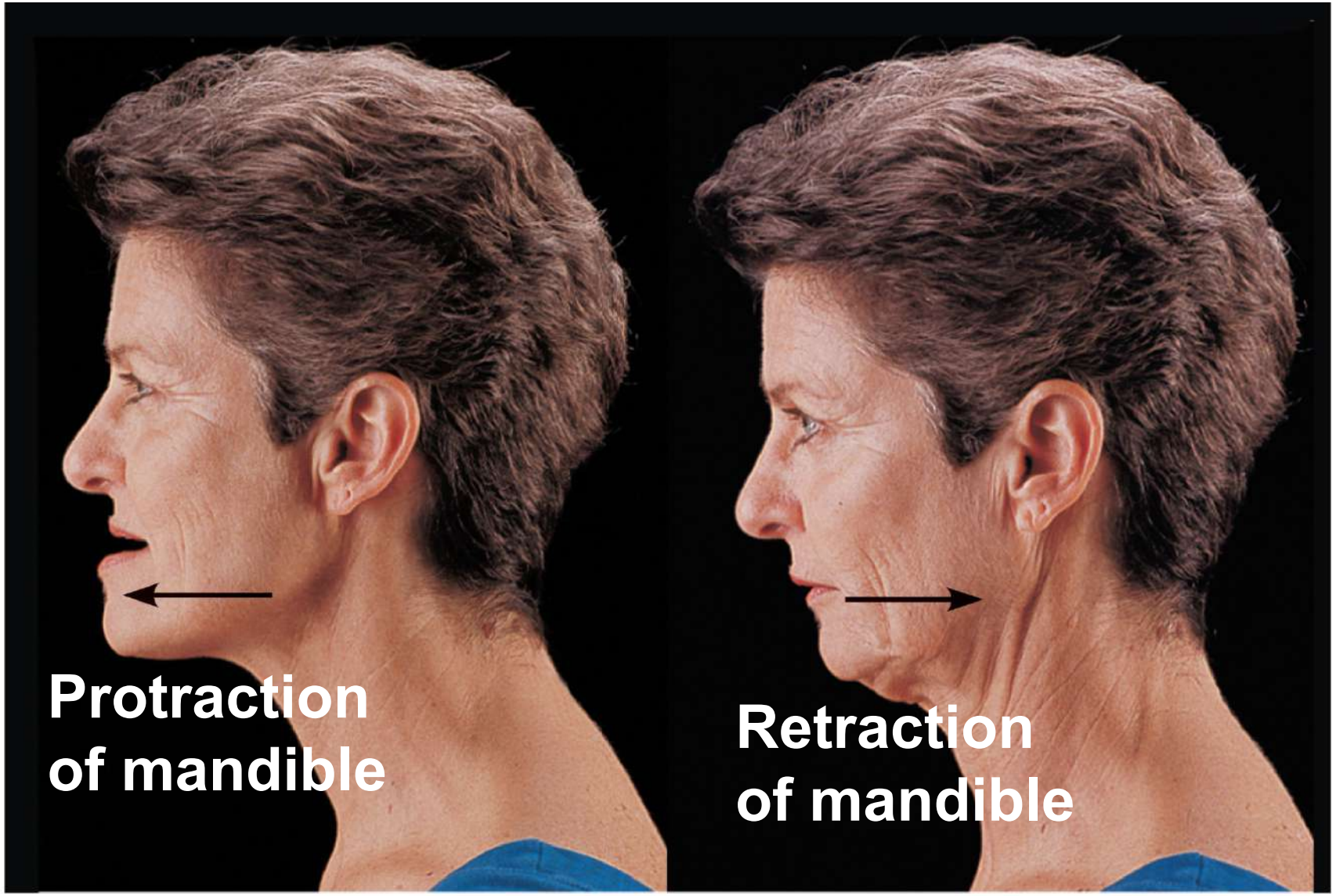


(c) Inversion and eversion

Figure 8.6c

Special Movements

- Movements in a transverse plane:
  - Protraction (anterior movement)
  - Retraction (posterior movement)

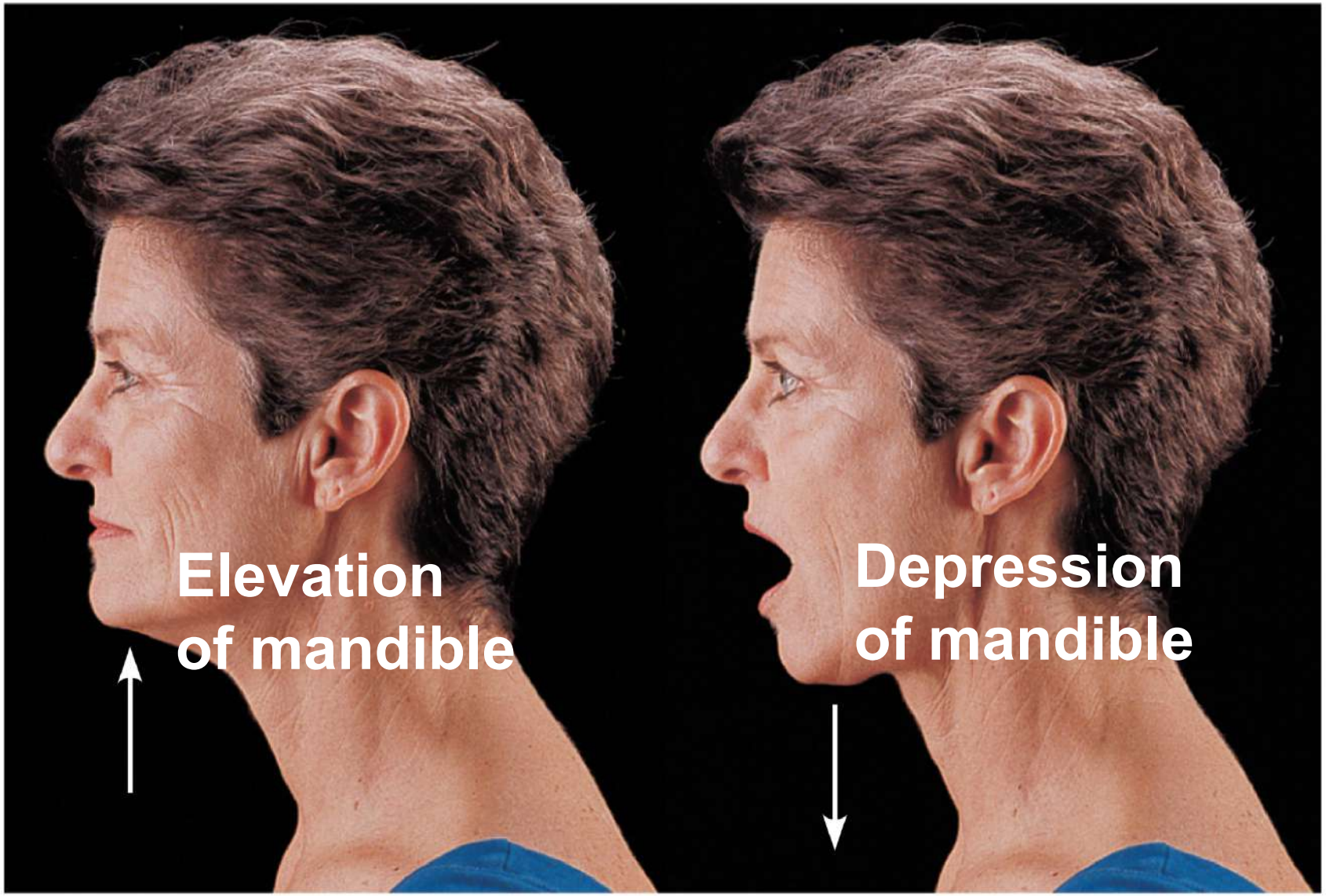


(d) Protraction and retraction

Figure 8.6d

Special Movements

- Elevation (lifting a body part superiorly)
- Depression (moving a body part inferiorly)

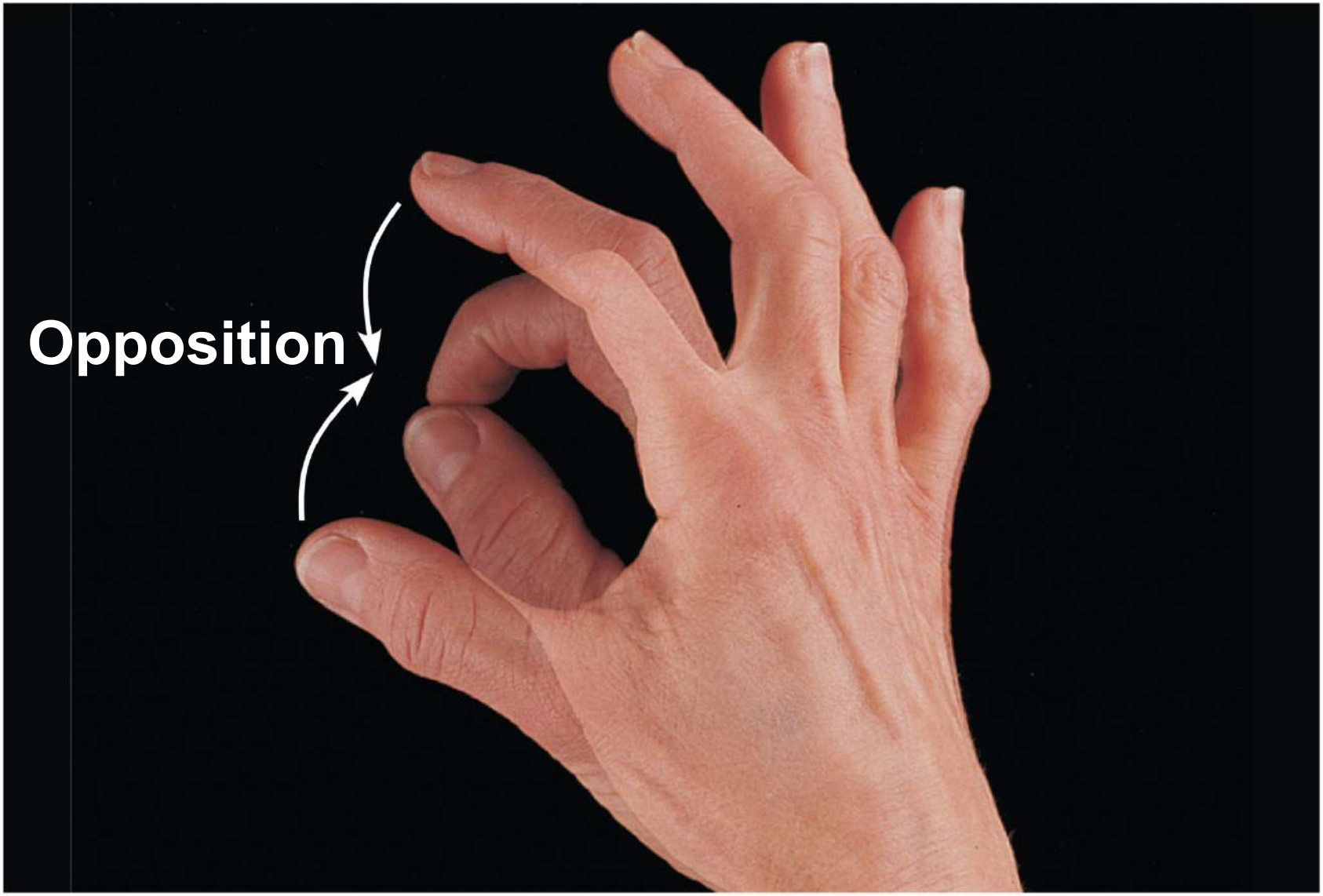


(e) Elevation and depression

Figure 8.6e

Special Movements

- Opposition of the thumb
  - Movement in the saddle joint so that the thumb touches the tips of the other fingers



(f) Opposition

Figure 8.6f