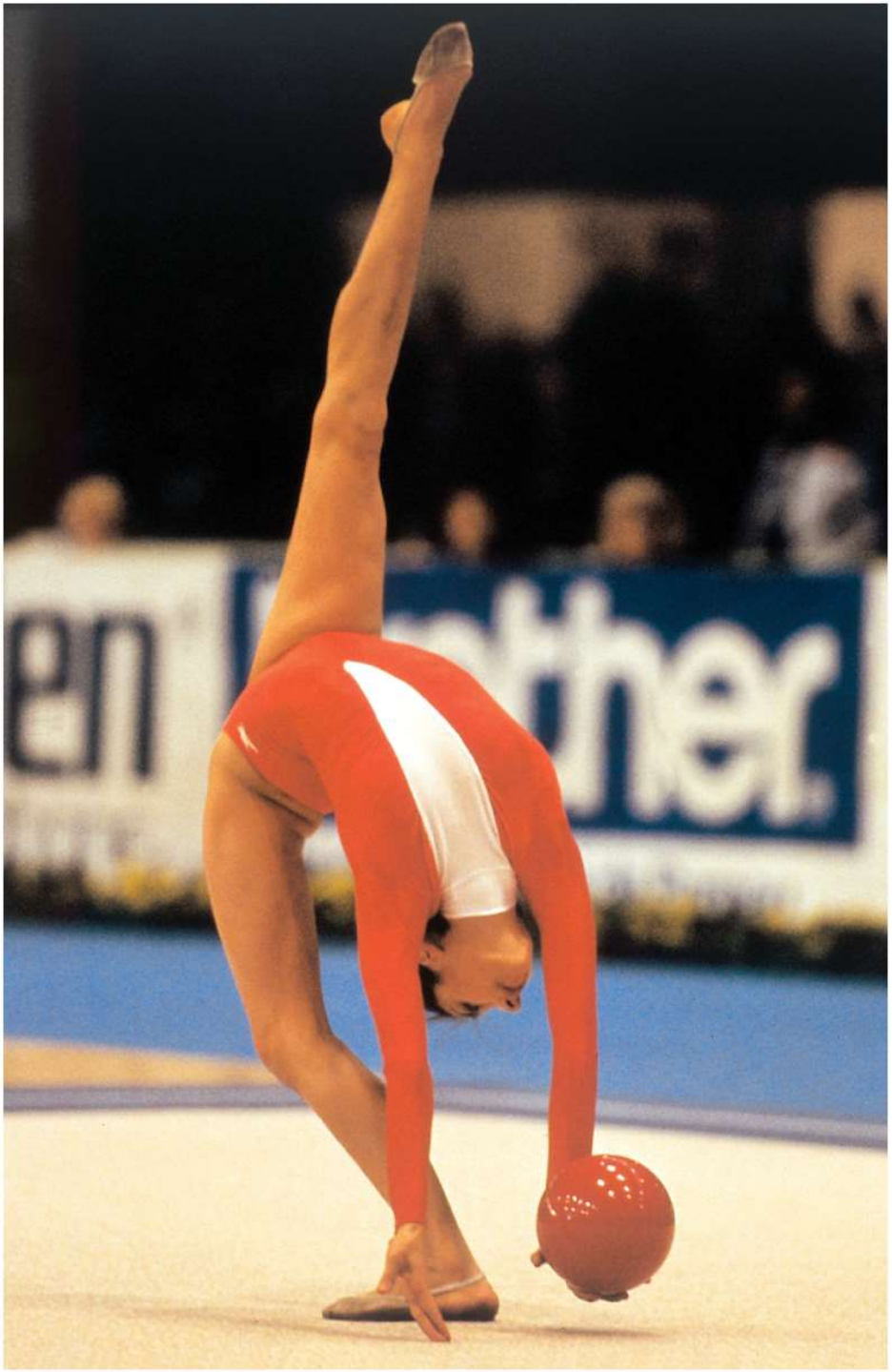


Chapter 9

Joints

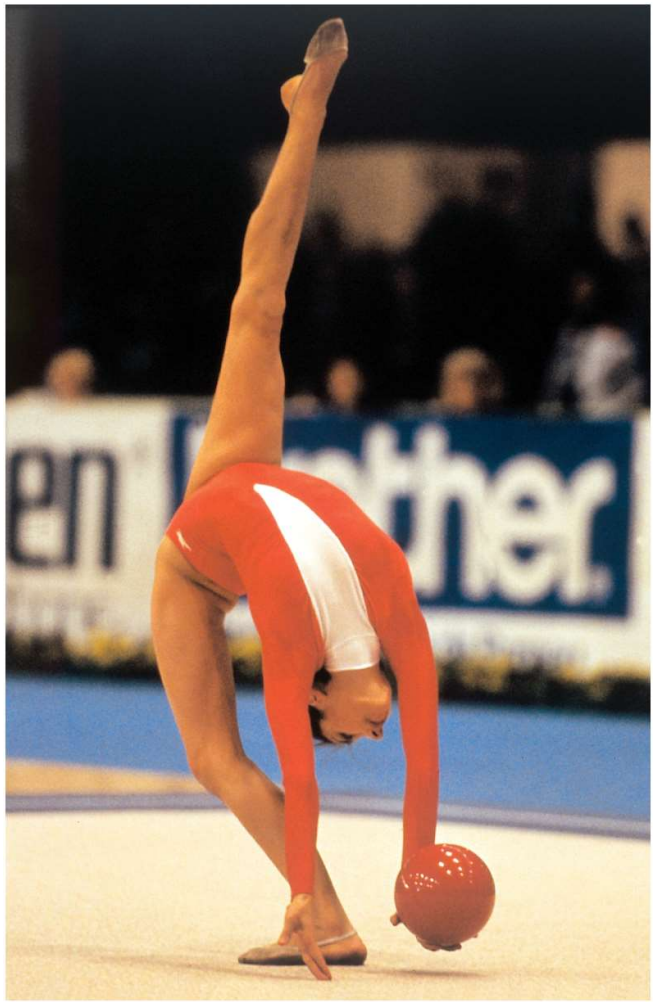
Joints Classified by Function or Structure

The Function and Structure of Synovial Joints

Types of Movements

Joints = Articulations

- Joints = point where two bones meet
- It is called a joint *<u>whether or not</u>* the bones are movable
- Functions of a joint
  - Give skeleton mobility
  - Hold skeleton together



- Two Classification Systems used to describe articulations – based on
  - Function = degree of movement
  - Structure = type of material between bones or if there is a capsule around the joint

Functional Classification of Joints

- Amount of movement = functional classification
- Three functional classifications: (know this!)
  - **Synarthroses**—immovable joints
  - **Amphiarthroses**—slightly movable joints
  - **Diarthroses**—freely movable joints

> Note: We will review the different structural classification and apply the functional classification to these structural joints.

Structural Classification of Joints

- Based on material binding bones together "and/or" the presence or absence of a joint cavity

- Three structural classifications (know this!)
  - Fibrous joints
  - Cartilaginous joints
  - Synovial joints *(know this in detail)*

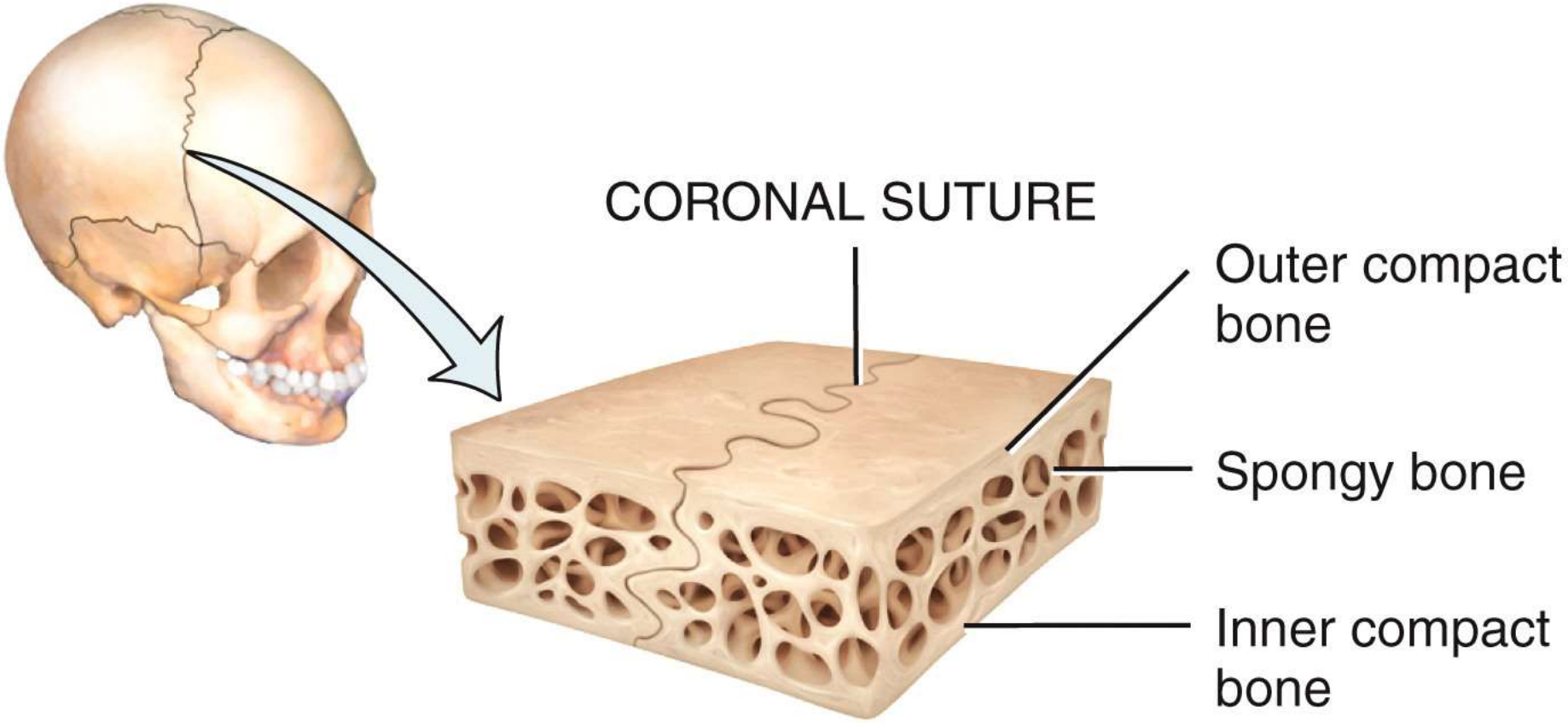
Fibrous Joints (Structural Classification)

- Bones joined by dense fibrous connective tissue
- No joint cavity
- Amphiarthrotic – slightly moveable // Depends on length of connective tissue fibers
- Potential to become synarthroses (immovable)
- Three types: Sutures / Syndesmoses / Gomphoses

Sutures - Fibrous Joints (e.g. #1)

- Rigid, interlocking joints
- Immovable joints for protection of brain
- Contain short connective tissue fibers
- Allow for growth during youth
- In middle age, sutures ossify and fuse // After they fuse become **Synarthroses Joints**

Fibrous Joints #1
Sutures



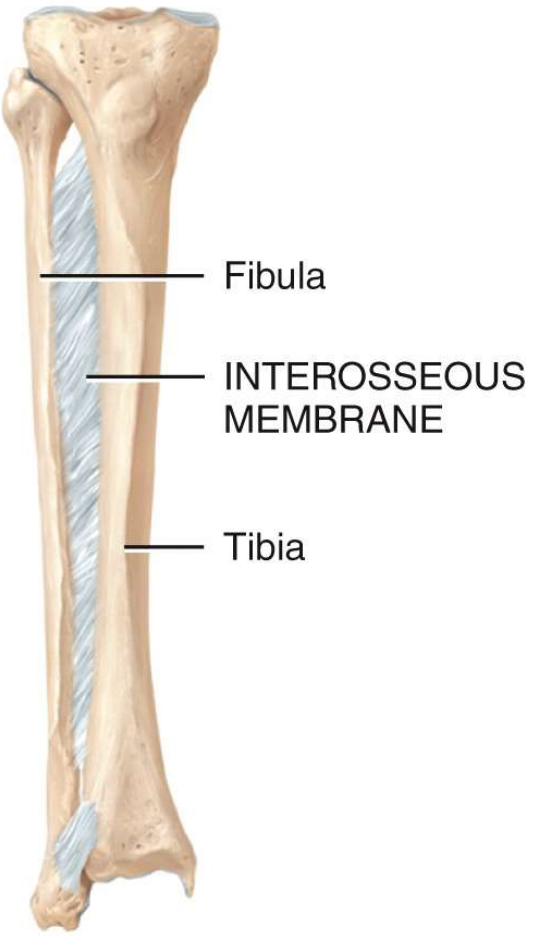
(a) Suture between skull bones

Syndesmoses - Fibrous Joints (e.g. #2)

- Bones connected by ligaments
- Fiber length varies // determines amount of movement varies
  - large amount of movement at interosseous membrane connecting radius and ulna
  - little to no movement at distal tibiofibular joint

Syndesmoses - Fibrous Joints (e.g. #3)

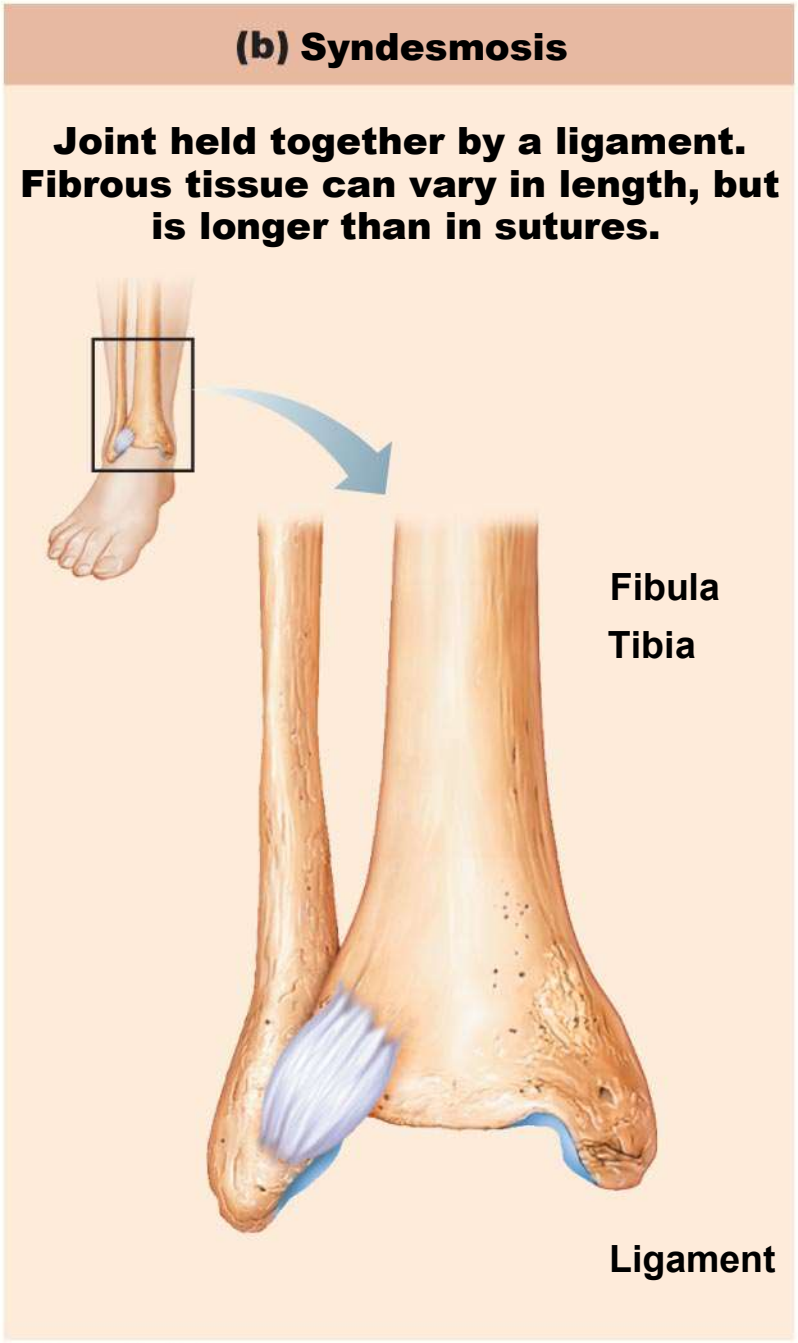
- Interosseus membranes
  - most movable syndesmosis joint
  - permits supination and pronation of the ulna and radius



(d) Interosseous membrane between diaphyses of tibia and fibula

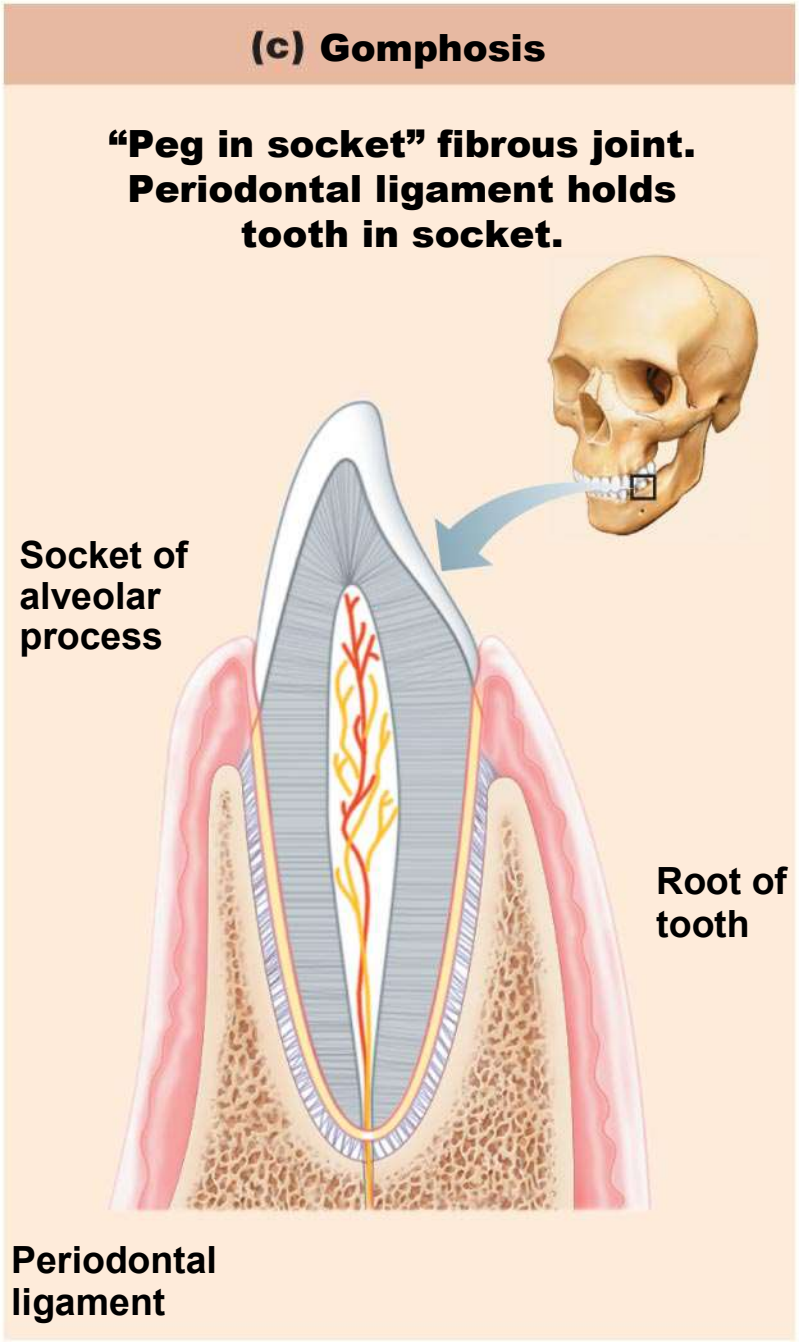
Syndesmoses Fibrous Joints (e.g. #3)

A less movable syndesmosis between tibia to fibula



Gomphoses - Fibrous Joints (e.g. #3)

- Peg-in-socket joints of teeth in alveolar sockets
- A tooth is technically not a bone
- Tooth is held in place within the alveolar socket of maxilla and mandible
- Fibrous connection = **periodontal ligament**



Cartilaginous Joints (Structural Classification)

- Bones united by cartilage (either hyaline cartilage or fibrous cartilage) // never elastic cartilage
- No joint cavity
- Not highly movable
- Two types:
  - Synchondroses (hyaline cartilage)
  - Symphyses (fibrous cartilage)

Cartilaginous Joints #1
Synchondroses

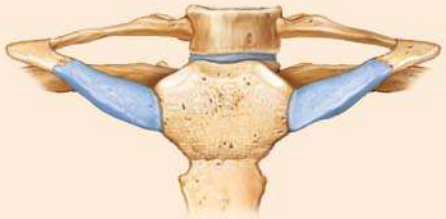
- Described as a bar or plate of hyaline cartilage
  - unites two osseous tissues with hyaline cartilage
  - Temporary epiphyseal plate joints
    - Will become a synarthrosis joiny after plate closure
  - Cartilage of 1st rib with manubrium

Cartilaginous Joints #1
Synchondroses

(a) Synchondroses

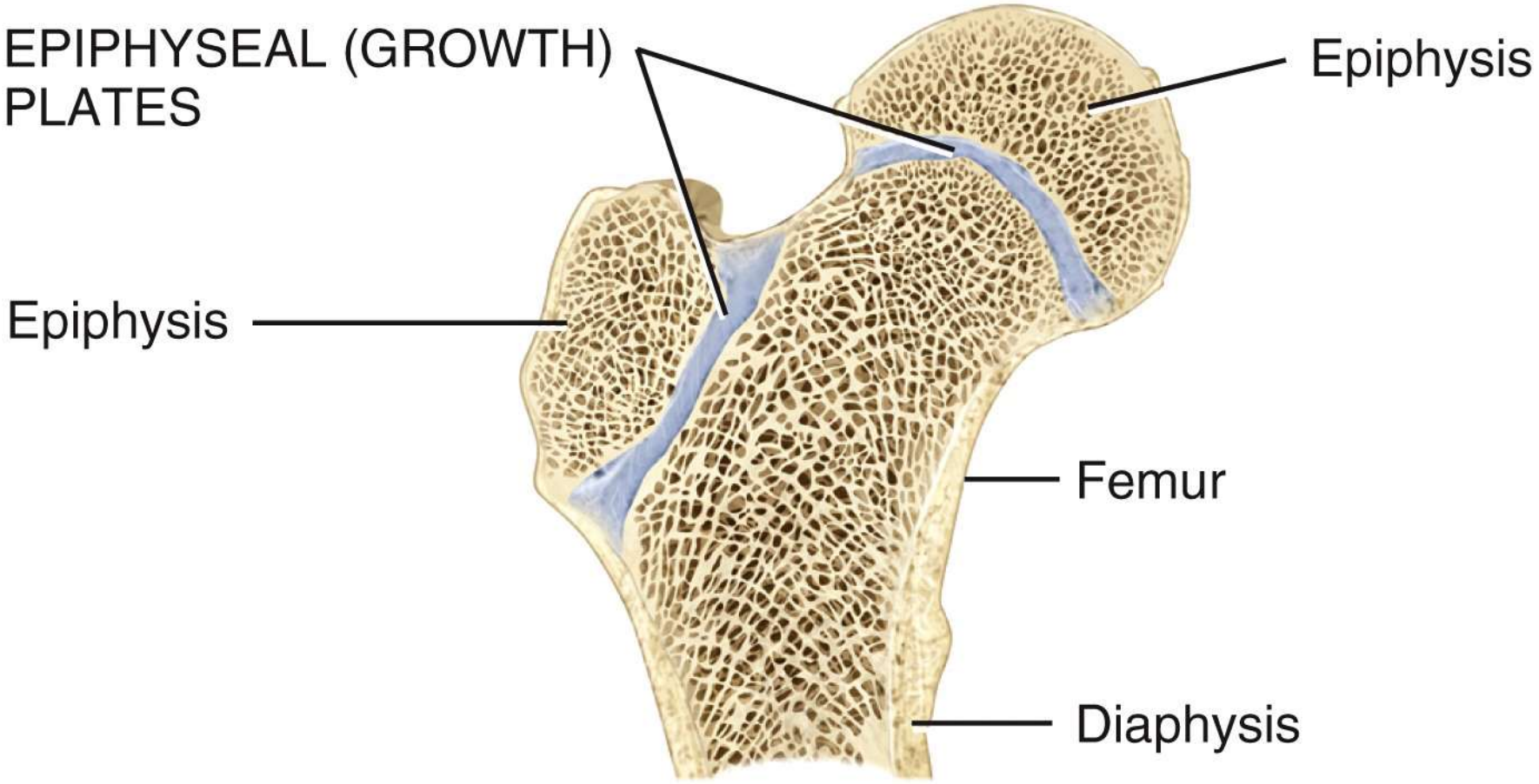
Bones united by hyaline cartilage

Epiphyseal plate (temporary hyaline cartilage joint)



Sternum (manubrium)

Joint between first rib and sternum (immovable)



(a) Synchondrosis

Synchondrotic joints eventually become synarthrotic //

Epiphyseal plate become the epiphysial line

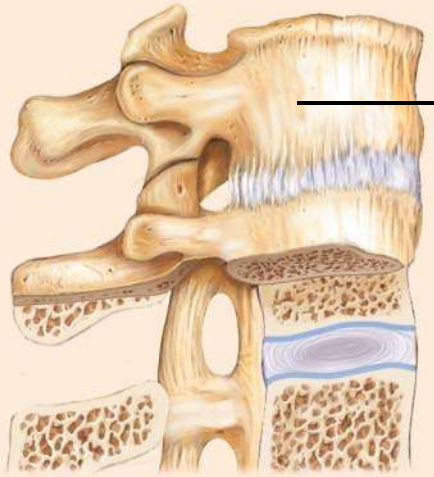
Cartilaginous Joints #2
Symphyses

- Fibrocartilage that unites bones
  - Strong, flexible, and amphiarthrotic
  - e.g. intervertebral disc or pubic symphisis

Cartilaginous Joints #2
Symphyses

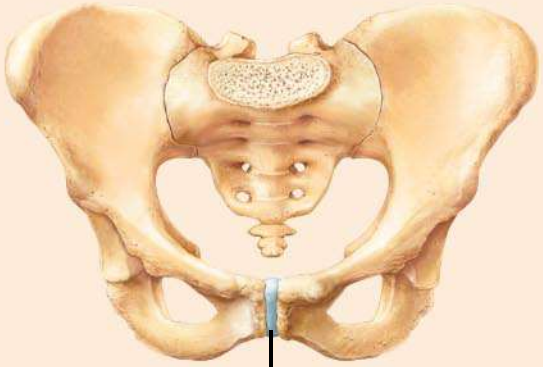
(b) Symphyses

Bones united by fibrocartilage



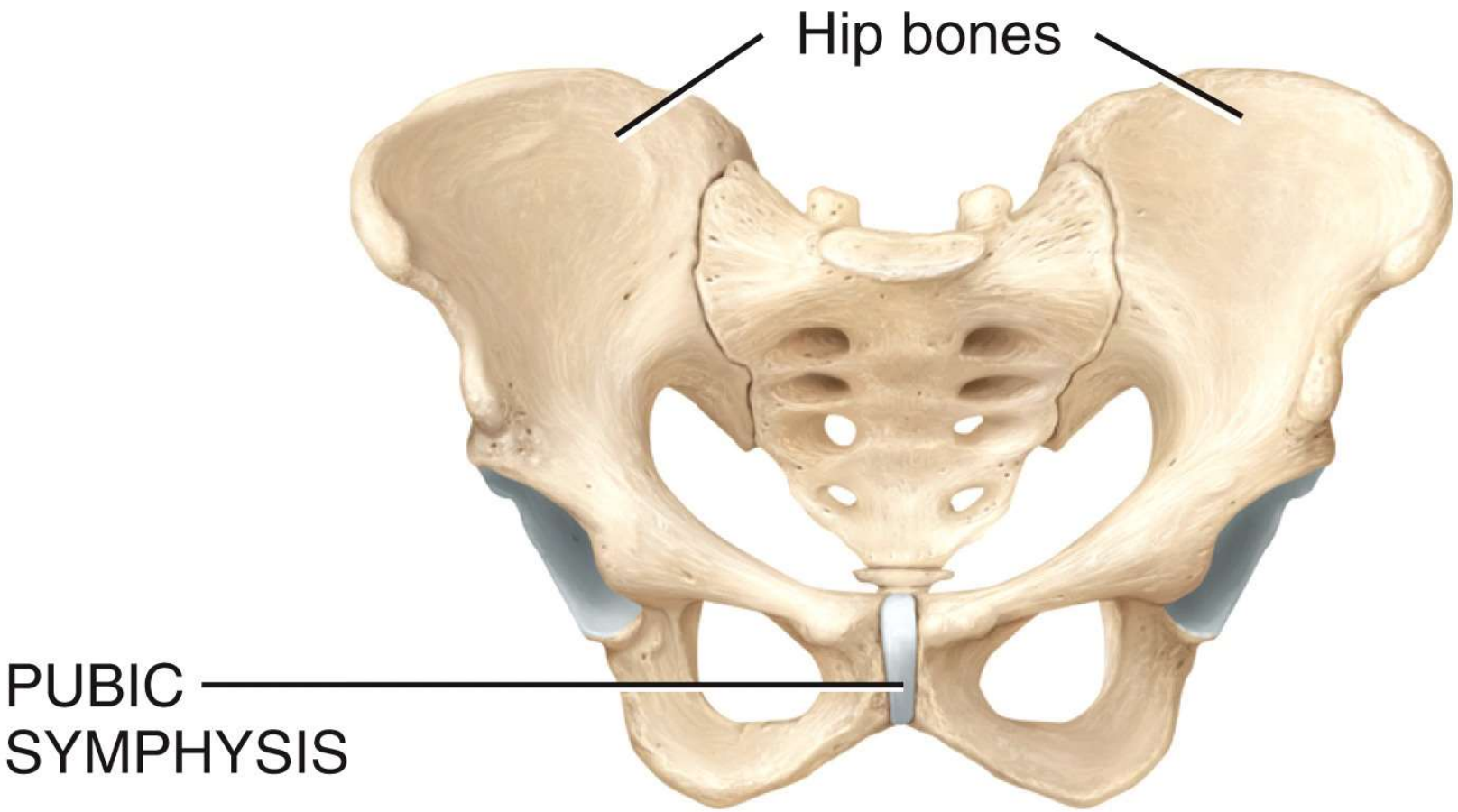
Body of vertebra

Fibrocartilaginous intervertebral disc (sandwiched between hyaline cartilage)



Pubic symphysis

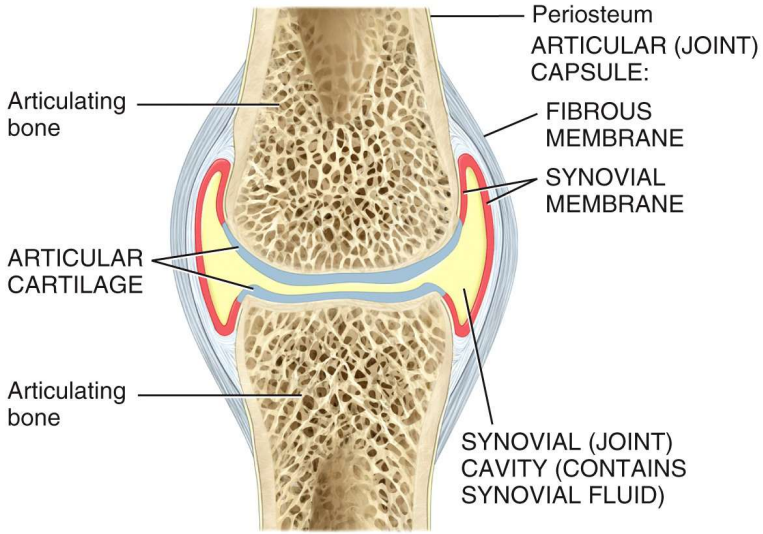
Cartilaginous Joints #2
Symphyses



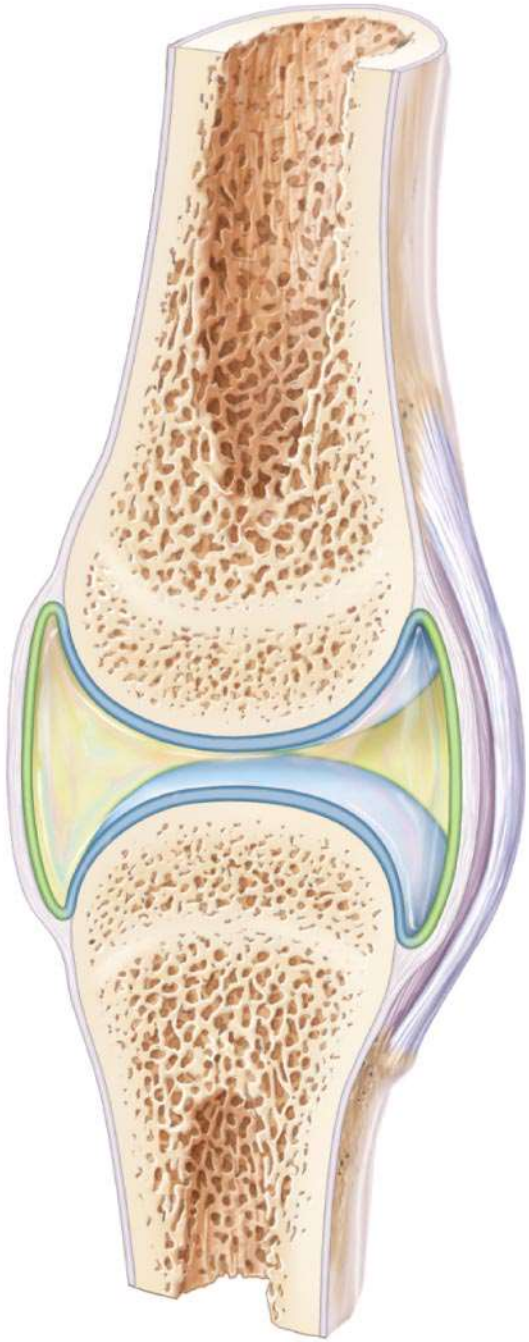
(b) Symphysis

Synovial Joints

- Bones separated by fluid-filled joint cavity
- All diarthrotic joints are freely moveable
- Include // all limb joints and most common joints of body



(a) Frontal section



Ligament

Joint cavity (contains **synovial fluid)**

Articular (hyaline) **cartilage**

Fibrous layer

Synovial membrane (secretes synovial fluid)

Articular capsule

Periosteum

Synovial Joints:
Six Distinguishing Features

1. **Articular cartilage = hyaline cartilage // Prevents crushing of bone ends**

2. **Joint (synovial) cavity // Small, fluid-filled potential space**

3. **Articular (joint) capsule // Two layers**

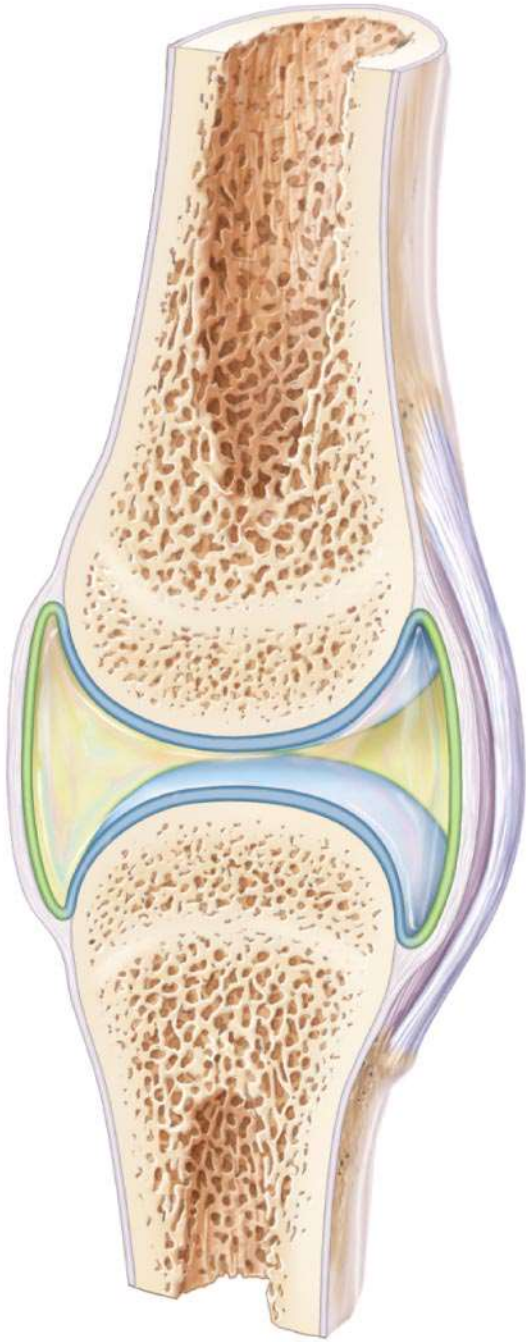
   External Fibrous layer // Dense irregular connective tissue

   Inner Synovial membrane // Loose connective tissue - Makes synovial fluid

4. Synovial fluid
   - Viscous, slippery filtrate of plasma and hyaluronic acid
   - Lubricates and nourishes articular cartilage
   - Contains phagocytic cells to remove microbes and debris

5. Different types of reinforcing ligaments
   - **Capsular** // Thickened part of fibrous layer
   - **Extracapsular //** Outside the capsule
   - **Intracapsular ///** Deep to capsule; covered by synovial membrane

6. Nerves and blood vessels
   - Nerve fibers detect pain, monitor joint position and stretch
   - Capillary beds supply filtrate for synovial fluid



Ligament

Joint cavity (contains **synovial fluid)**

Articular (hyaline) **cartilage**

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Synovial membrane (secretes synovial fluid)

Articular capsule

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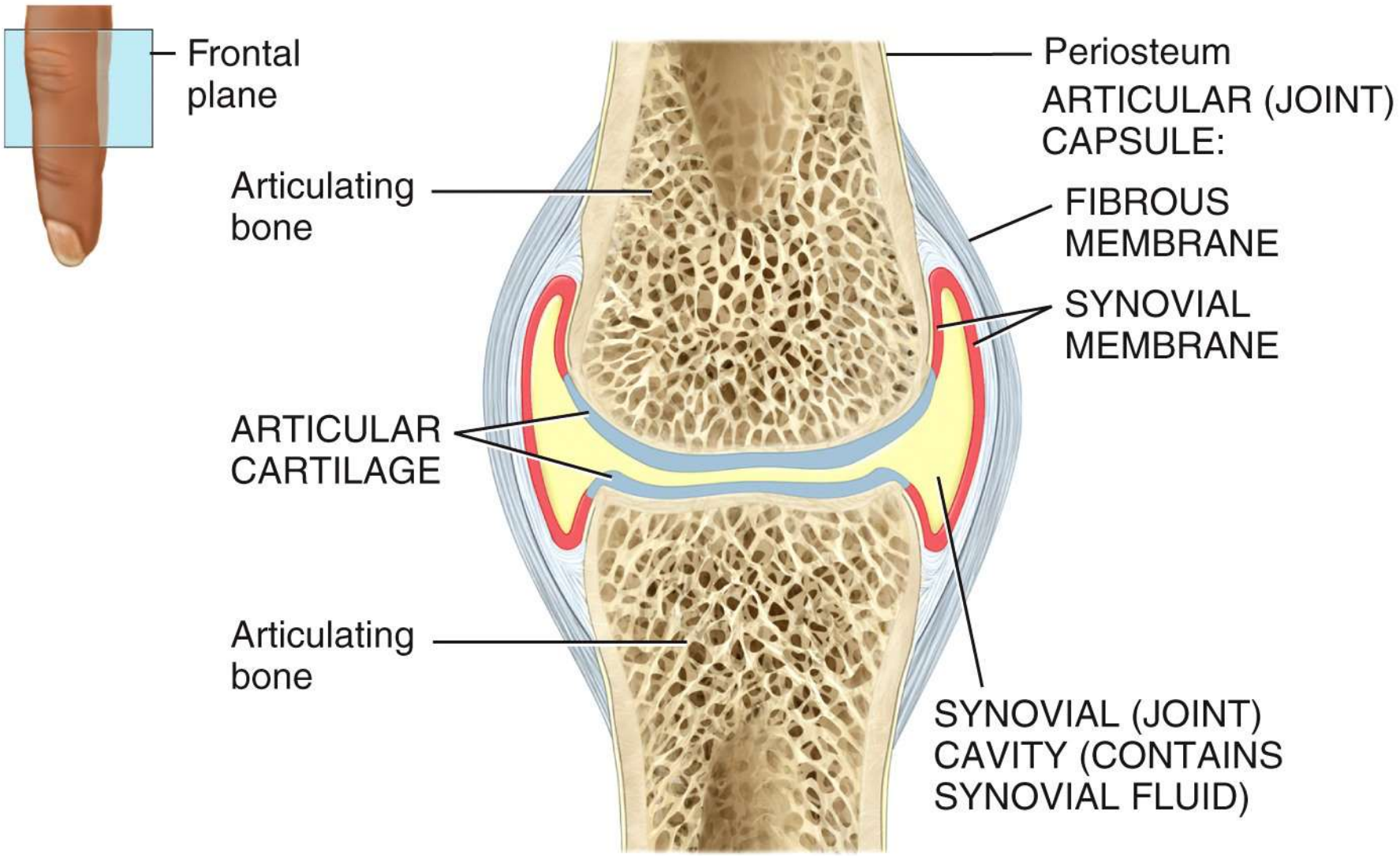


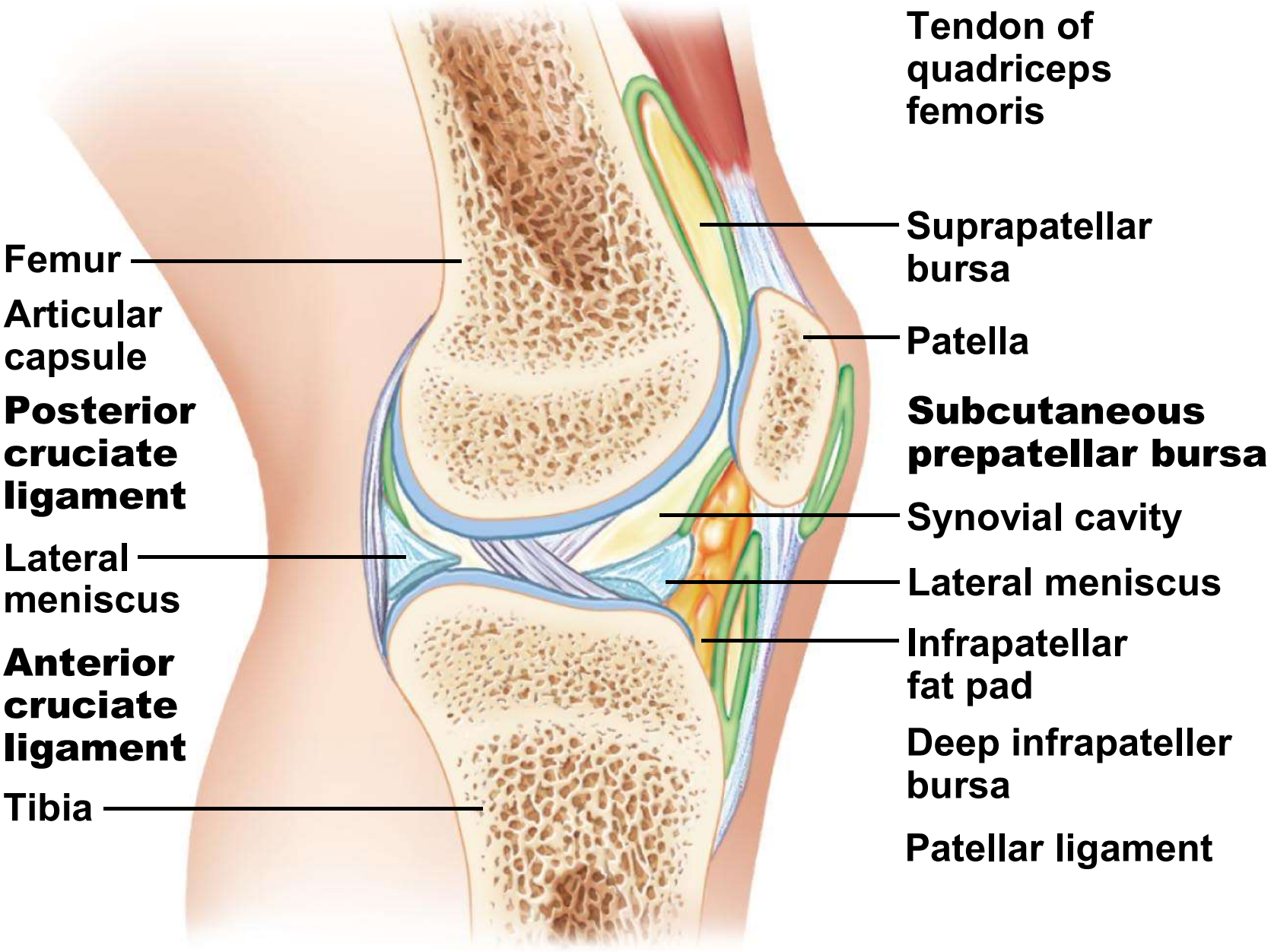
(a) Frontal section

Other Features of Some Synovial Joints

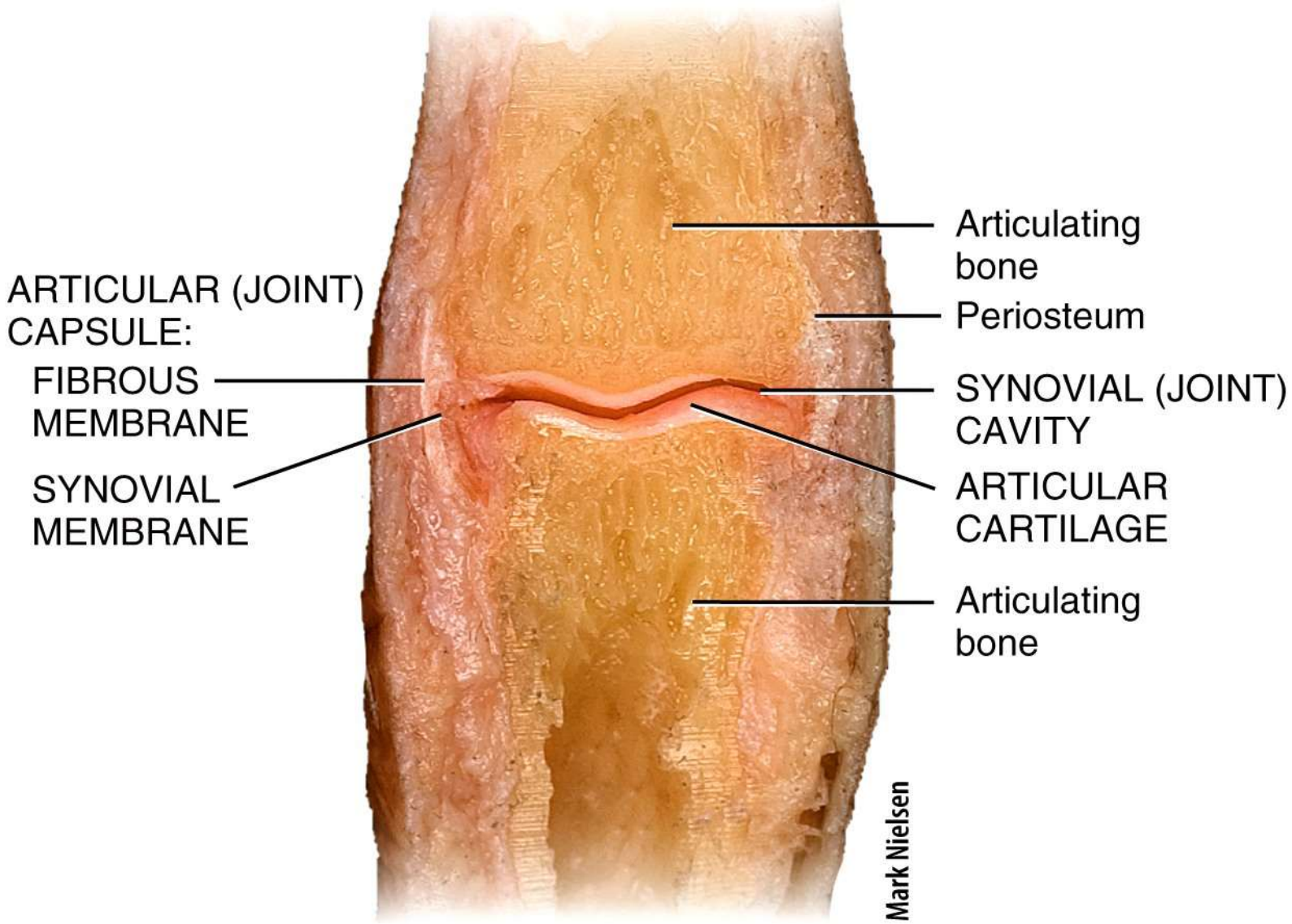
- Fatty pads // For cushioning between fibrous layer and synovial membrane or bone

- Articular discs (menisci) // Fibrocartilage separates articular surfaces

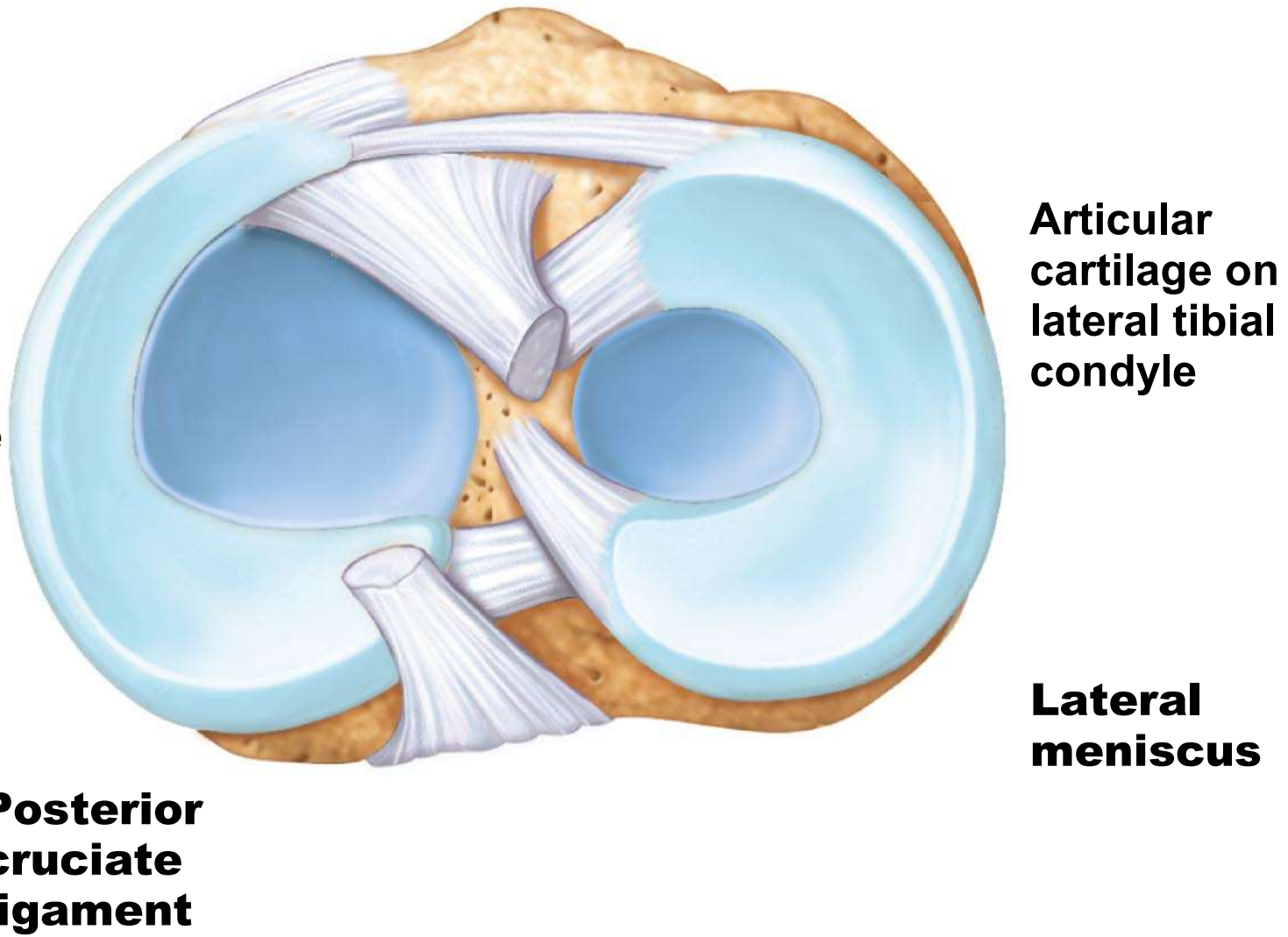
  - improve "fit" of bone ends
  - stabilize joint
  - reduce wear and tear



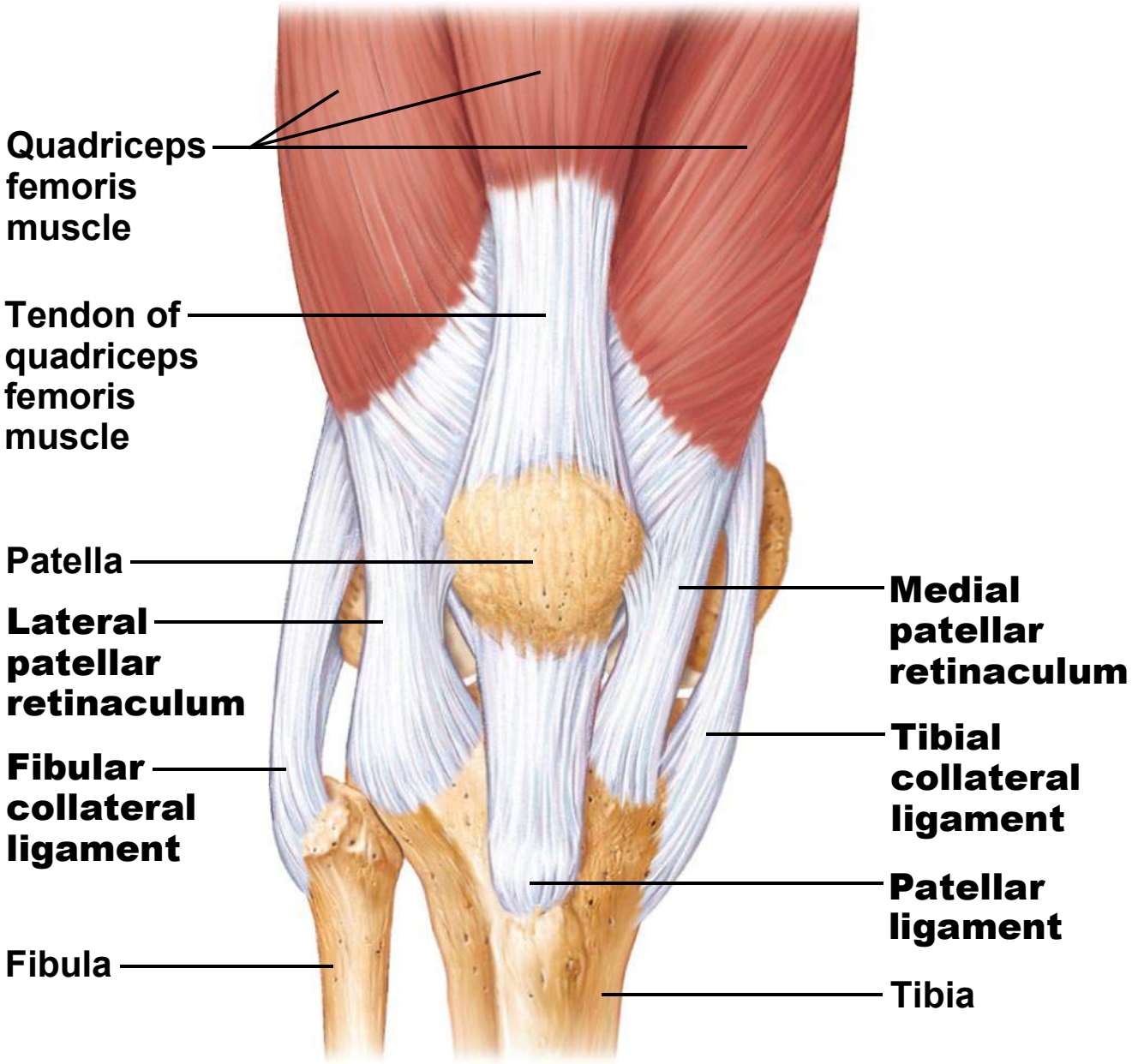
Sagittal section through the right knee joint



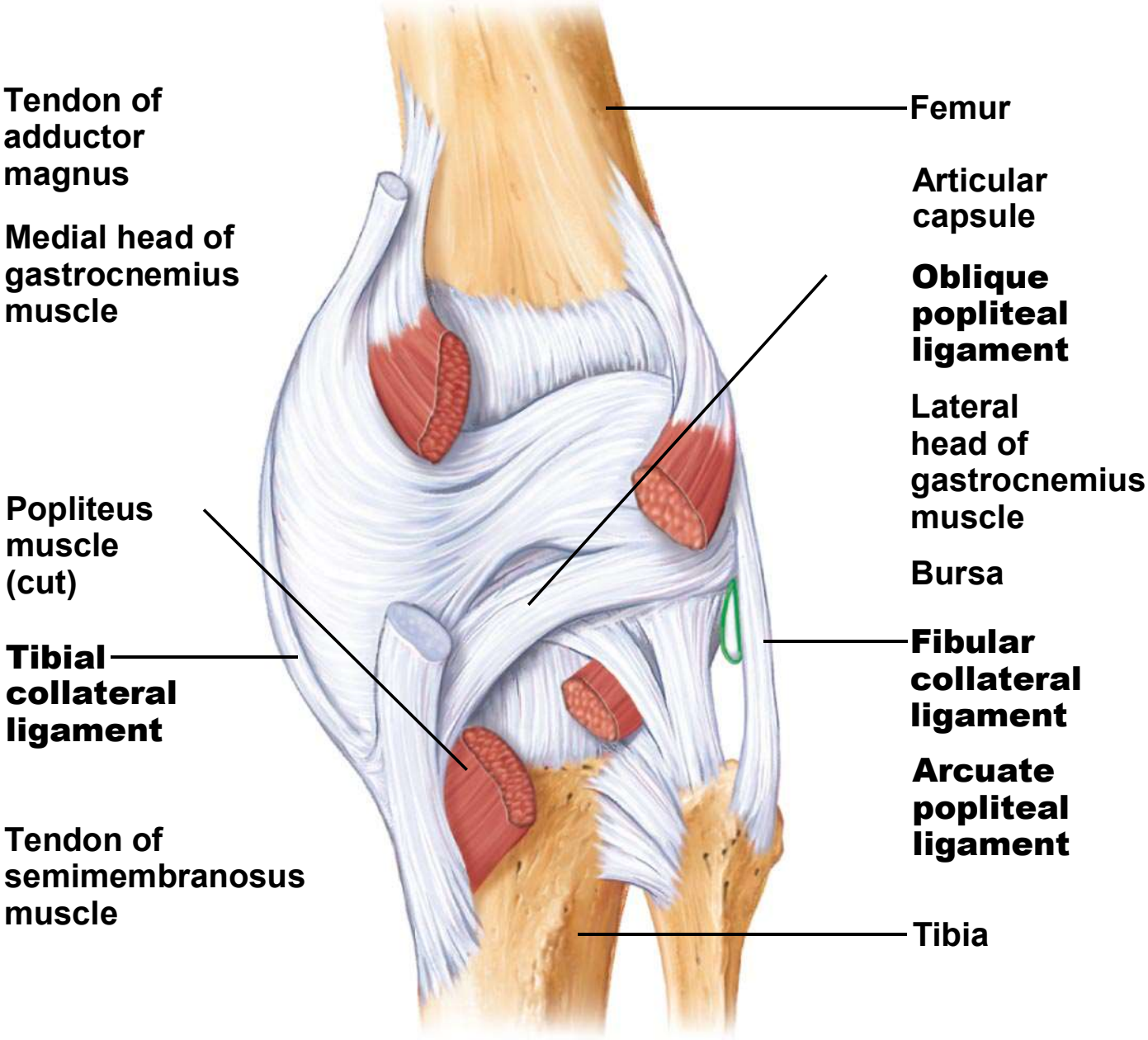
(b) Frontal section



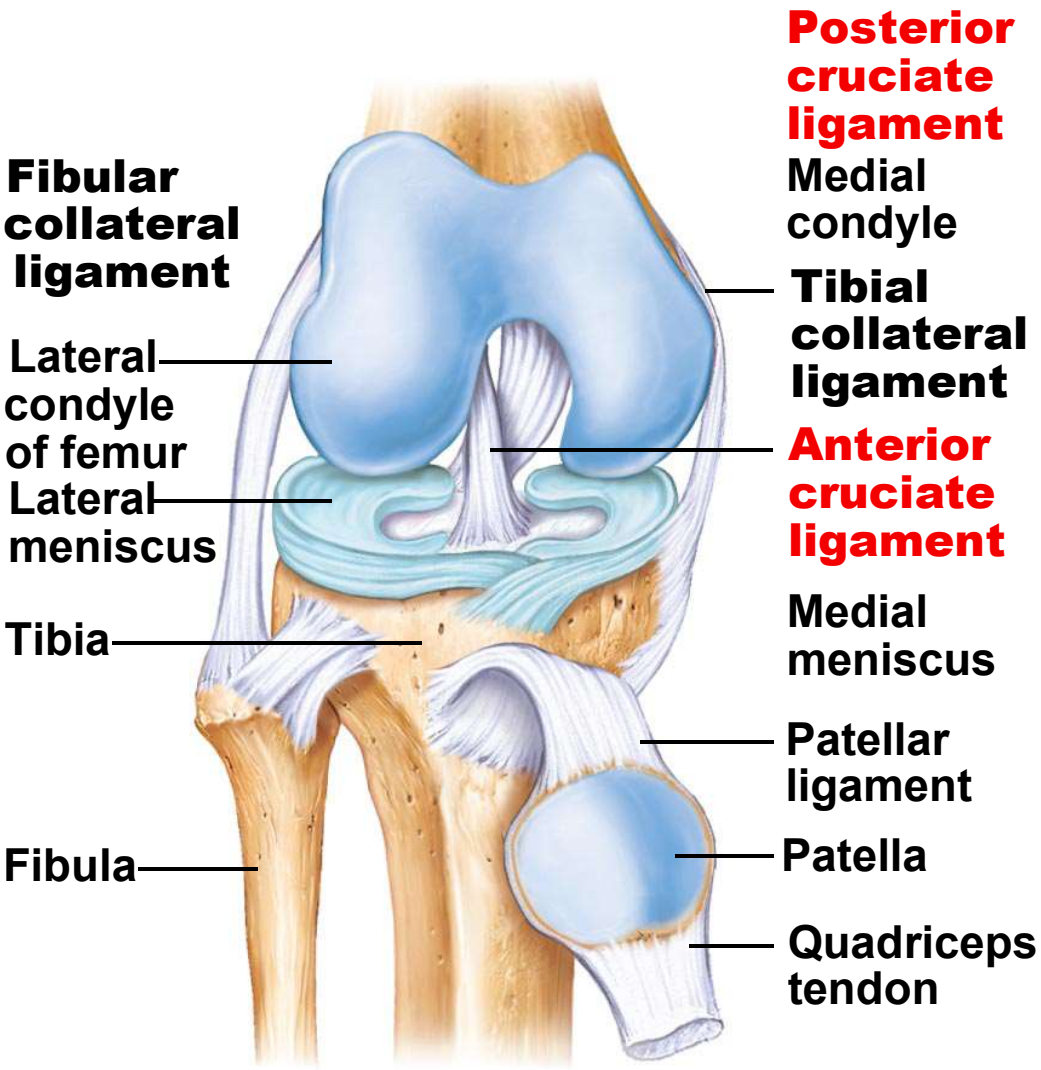
(b) Superior view of the right tibia in the knee joint, showing the menisci and cruciate ligaments



(c) Anterior view of right knee



(d) **Posterior view of the joint capsule, including ligaments**



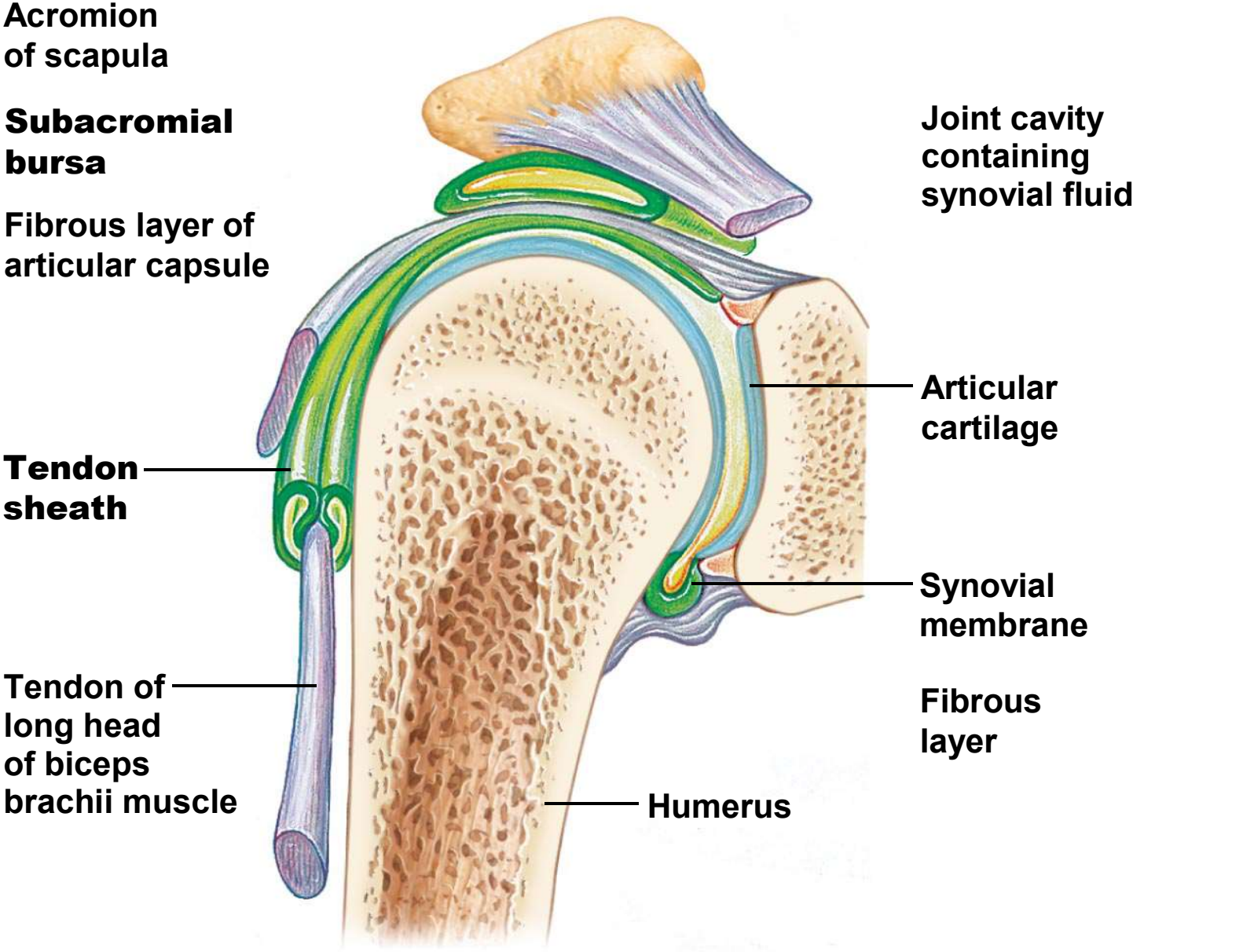
(e) Anterior view of flexed knee, showing the cruciate ligaments (articular capsule removed, and quadriceps tendon cut and reflected distally)

Structures Associated with Synovial Joints

- **Bursae =** Sacs lined with synovial membrane // Contain synovial fluid

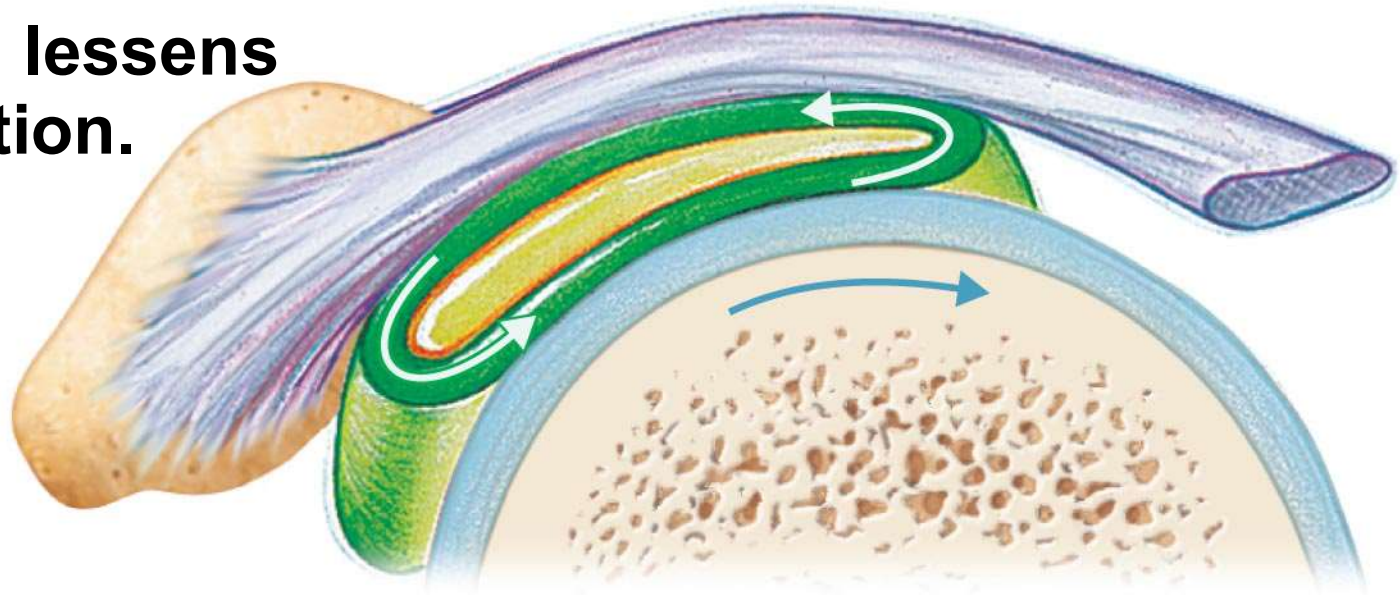
- **Tendon Sheaths =** Elongated bursa wrapped completely around tendon subjected to friction

Both of these structures reduce friction where ligaments, muscles, skin, tendons, or bones rub against each other



Frontal section through the right shoulder joint

Bursa rolls and lessens friction.



Humerus head rolls medially as arm abducts.

Humerus moving

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

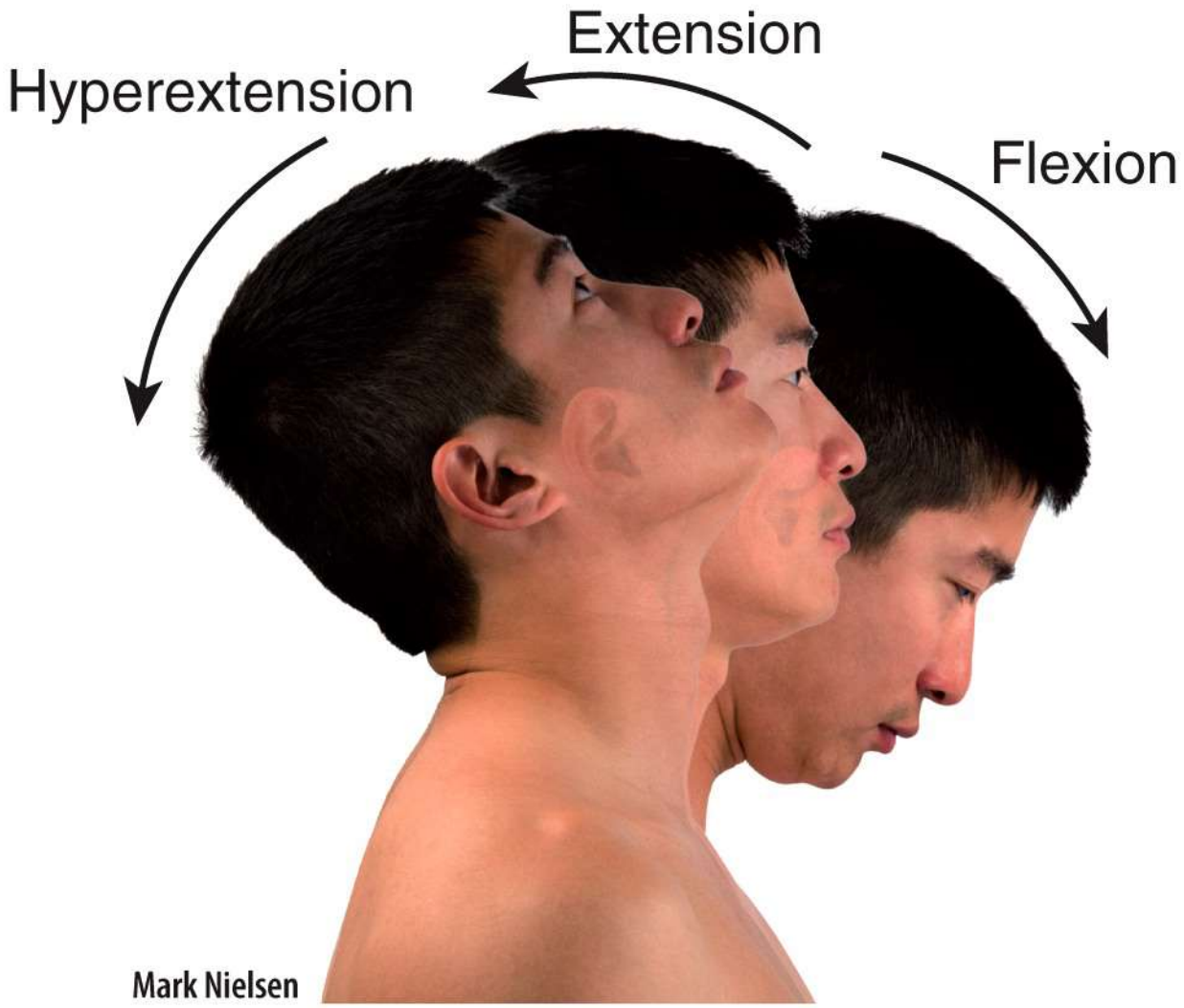
Three Stabilizing Factors at Synovial Joints

- 1) Shapes of articular surfaces (minor role)
- 2) Ligaments /// number and location (limited role)
- 3) Muscle tendons that cross joint (most important)
  - Muscle tone keeps tendons taut
  - Extremely important in reinforcing the shoulder and knee joints

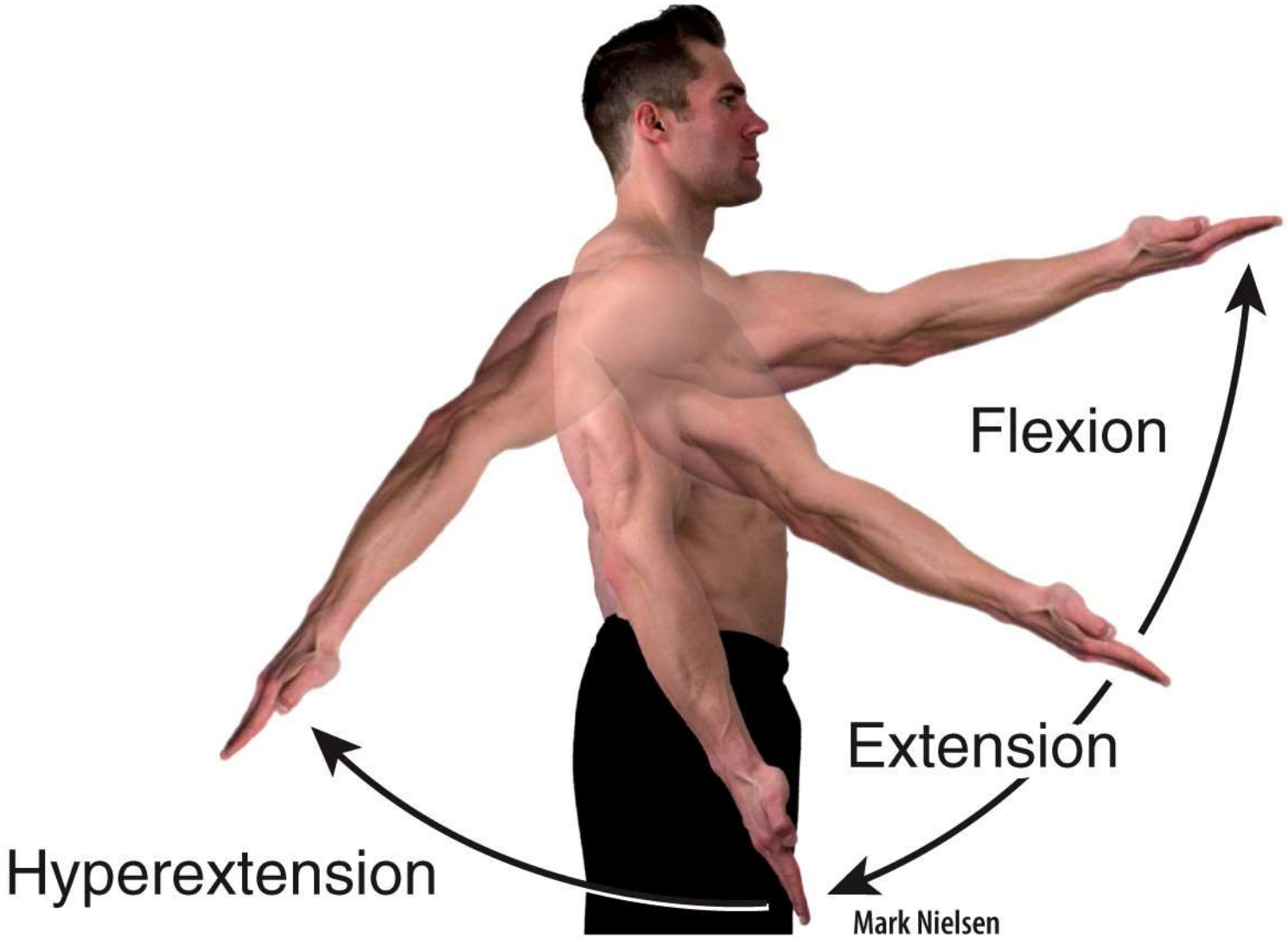
Stop Lecture Slides

Reference Resources Follow

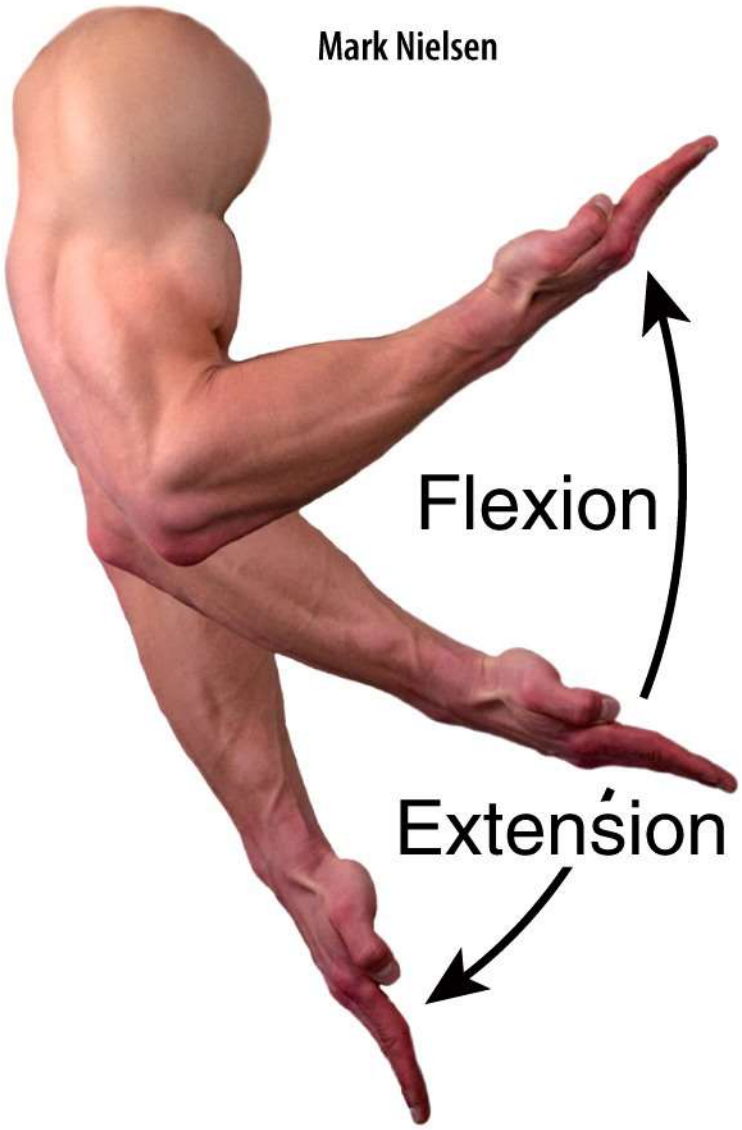
Range of Motion



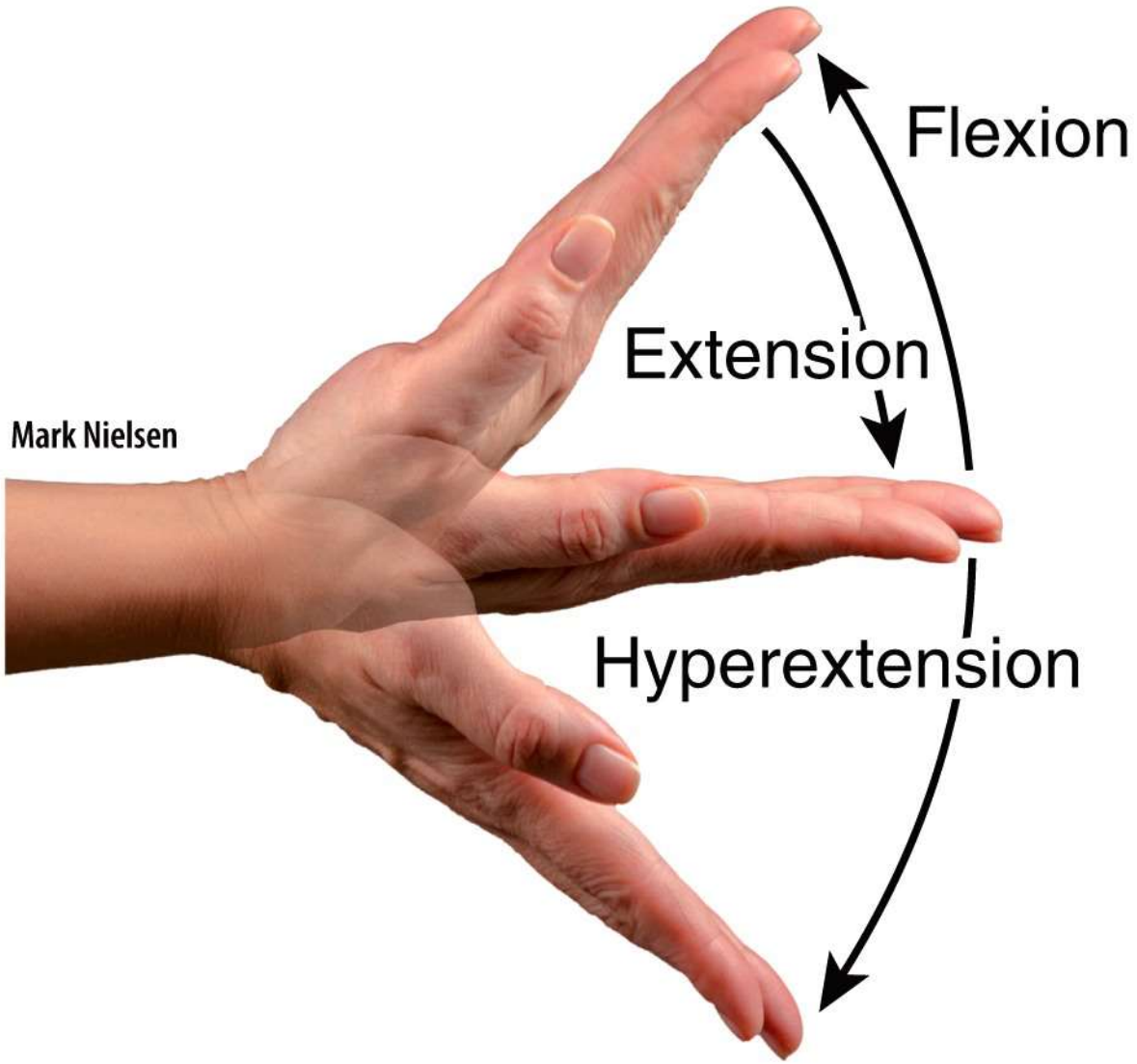
(a) Atlanto-occipital and cervical intervertebral joints



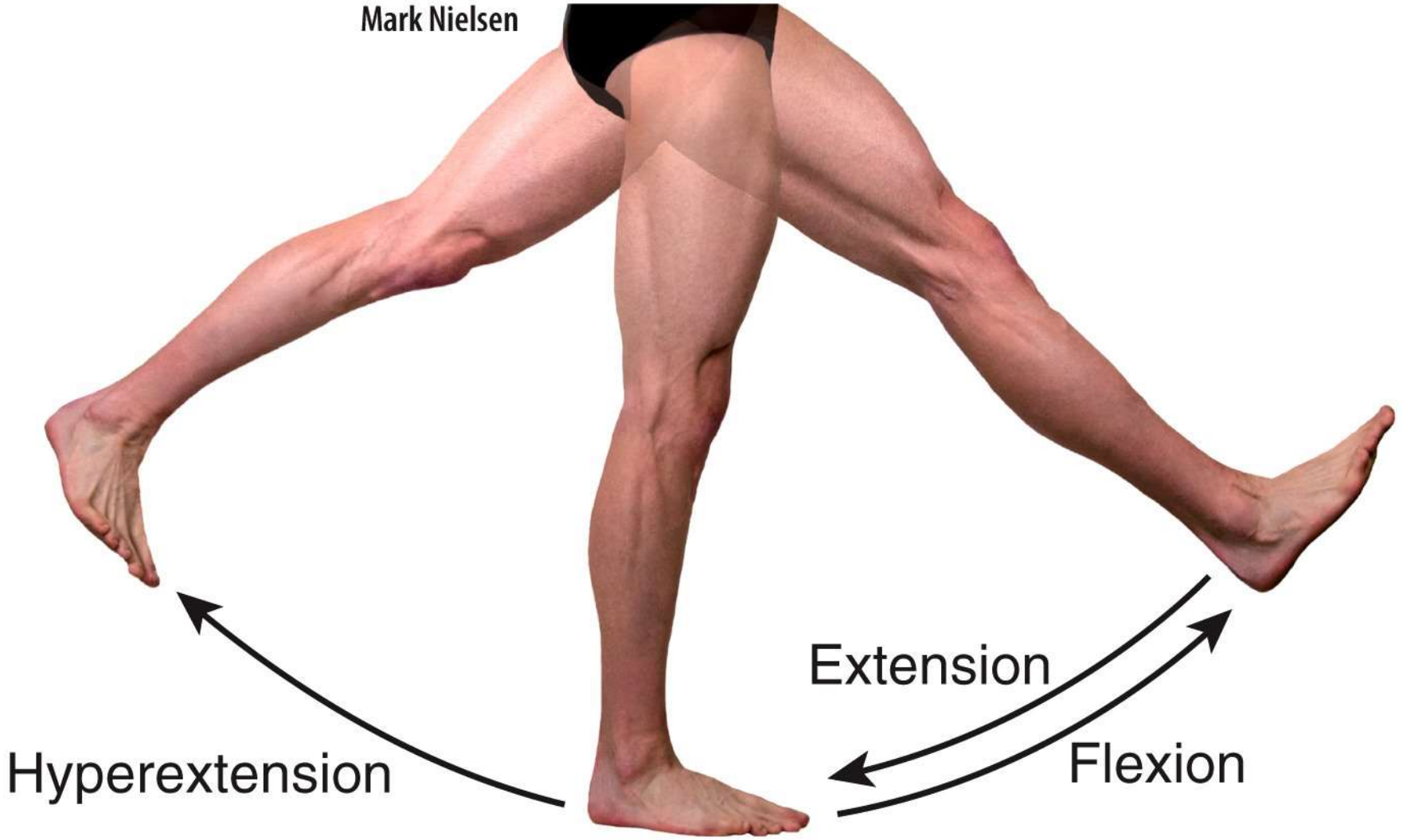
(b) Shoulder joint



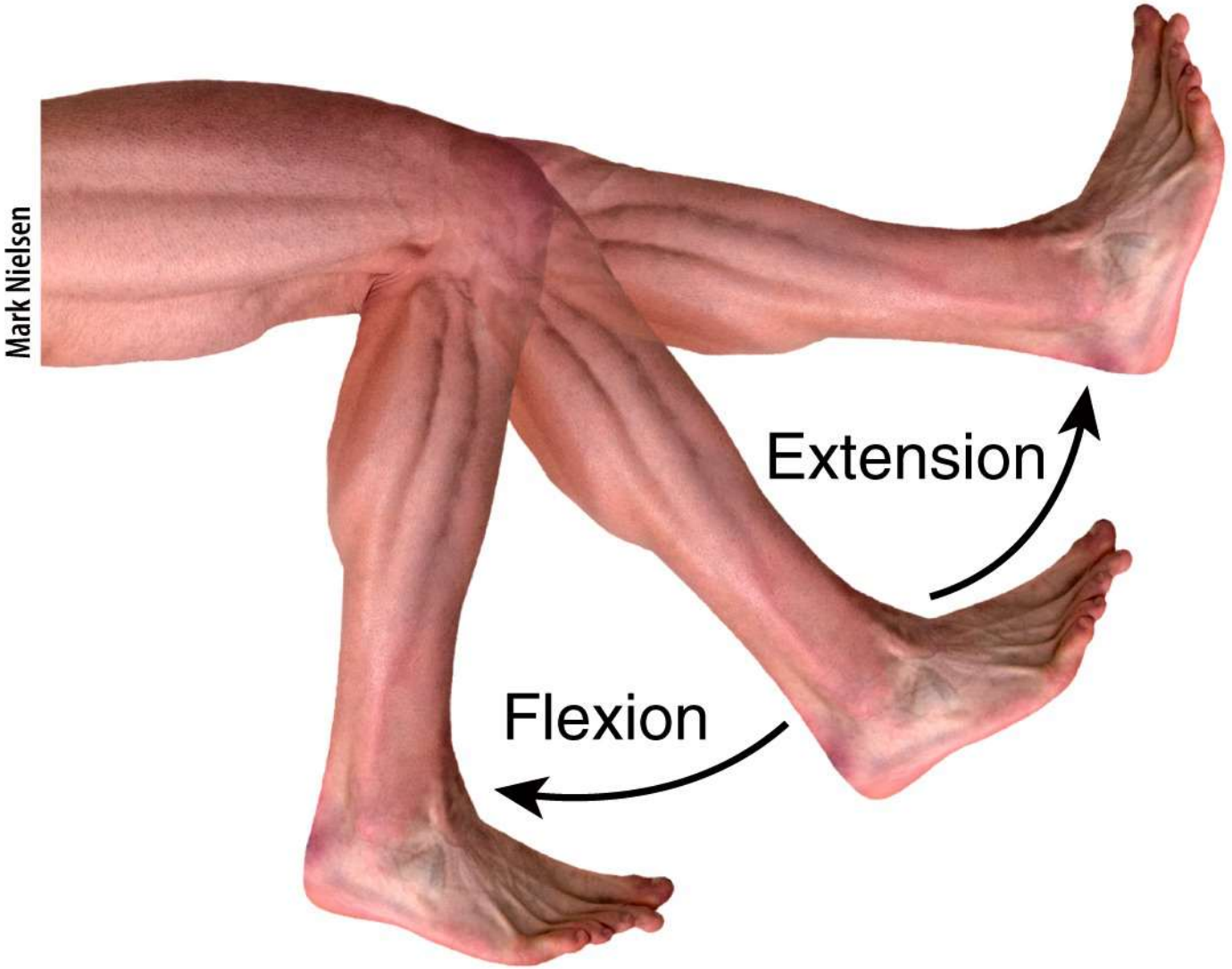
(c) Elbow joint



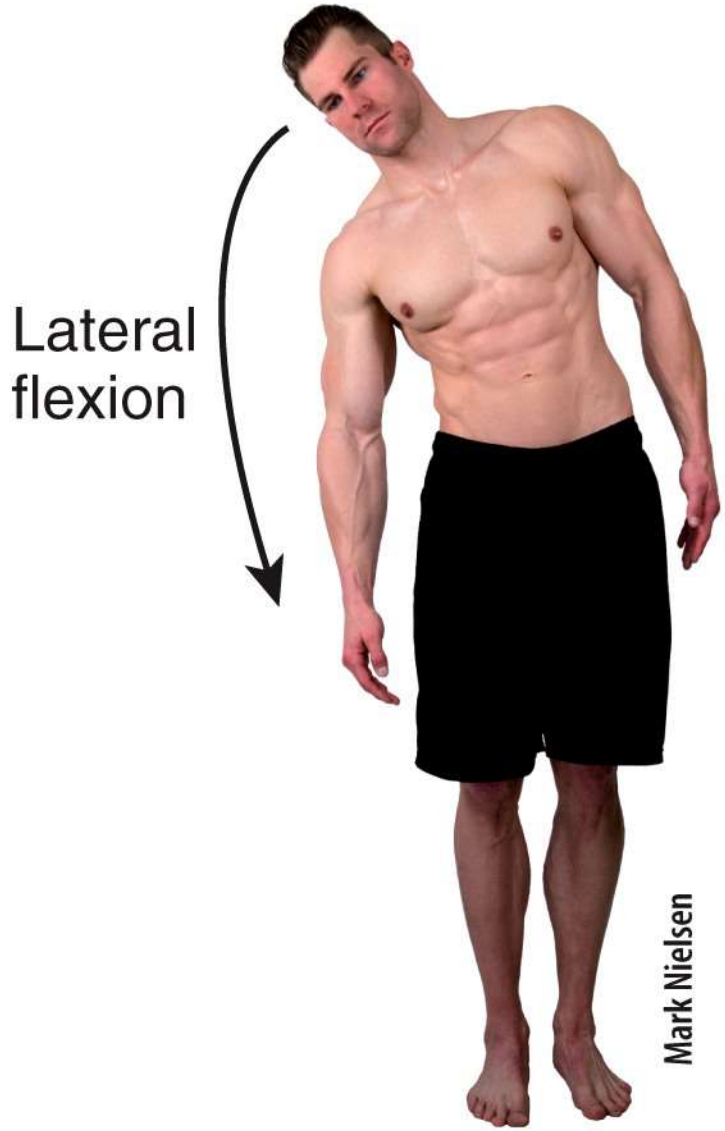
(d) Wrist joint



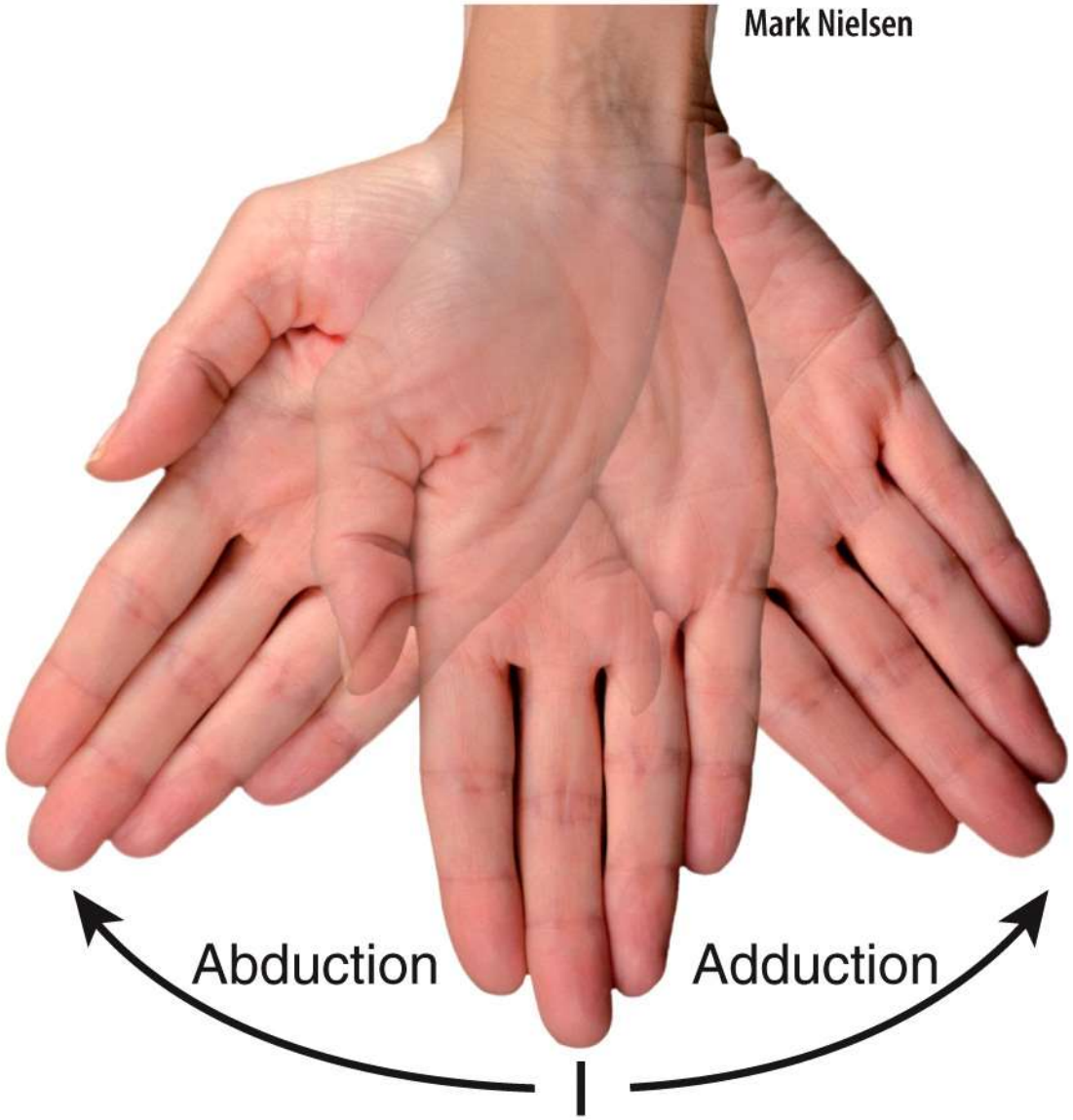
(e) Hip joint



(f) Knee joint

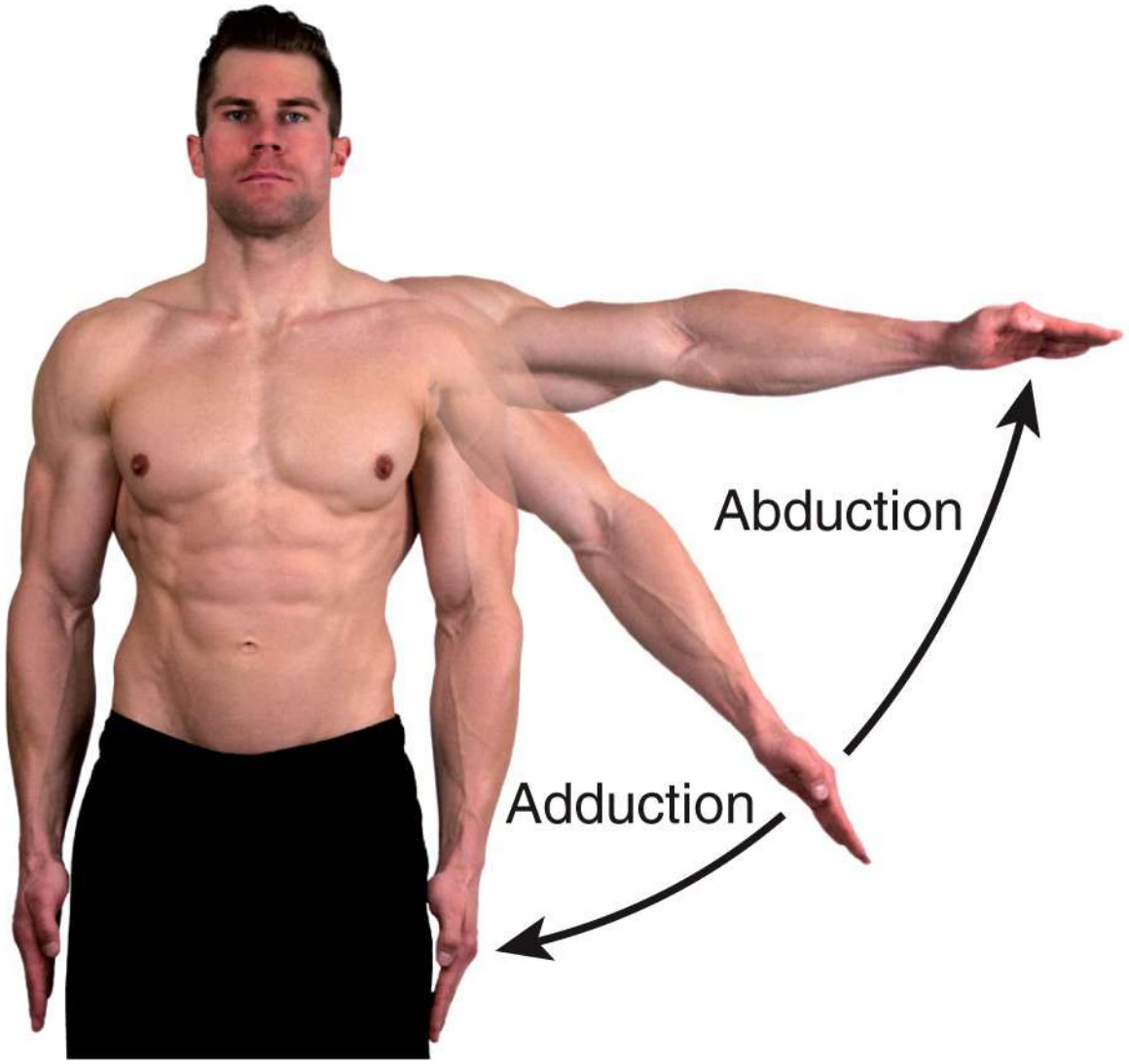


(g) Intervertebral joints

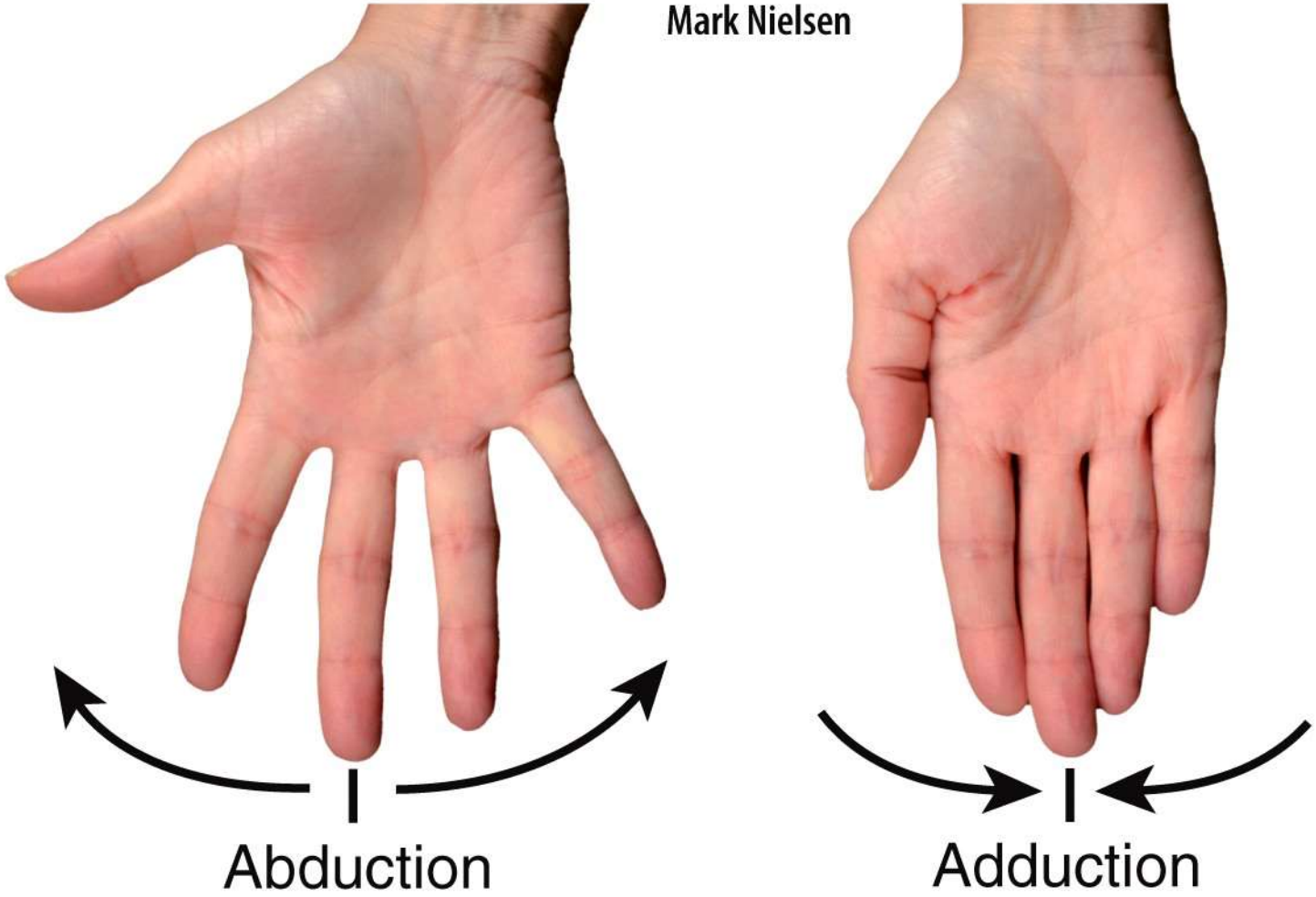


(b) Wrist joint

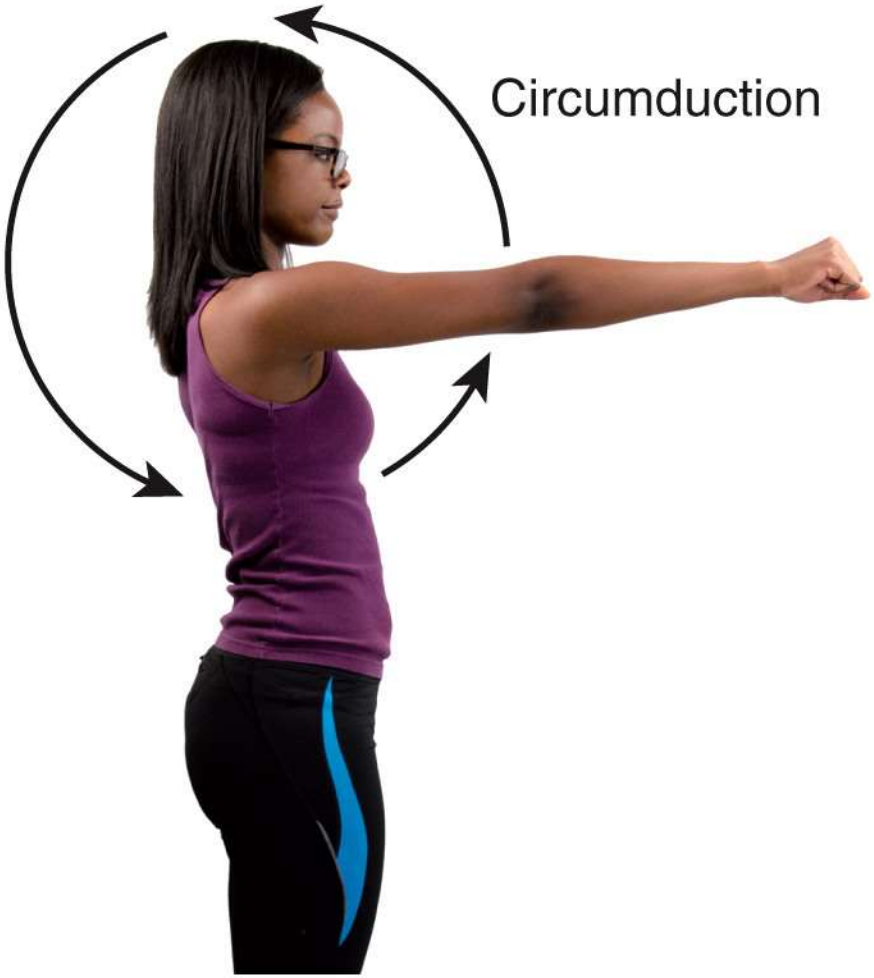
(c) Hip joint



(a) Shoulder joint

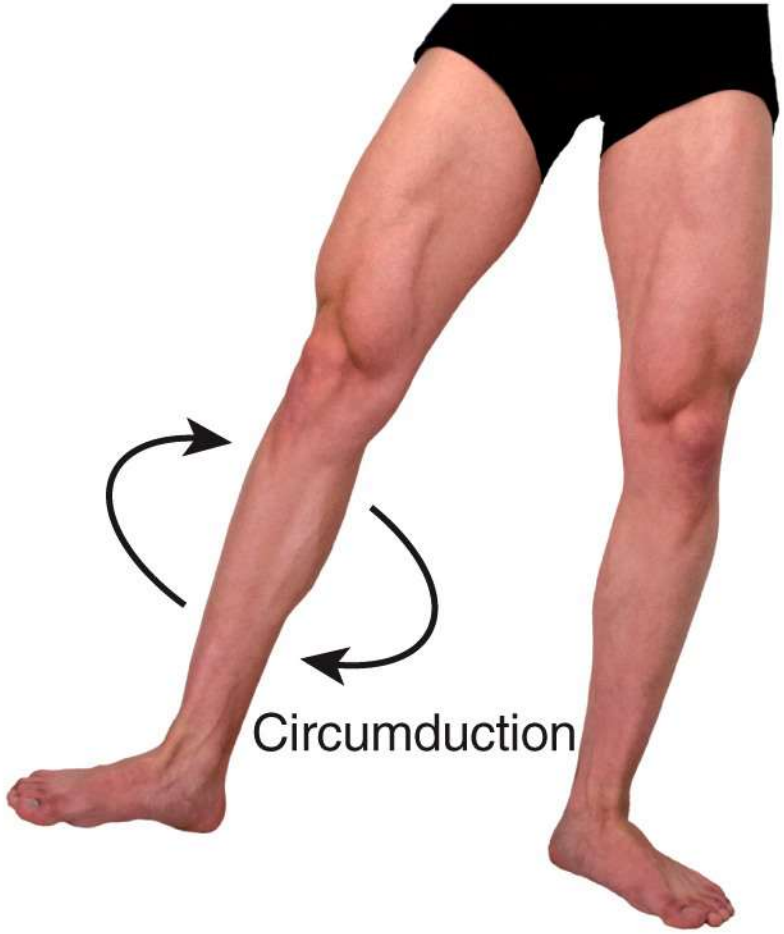


(d) Metacarpophalangeal joints of the fingers (not the thumb)

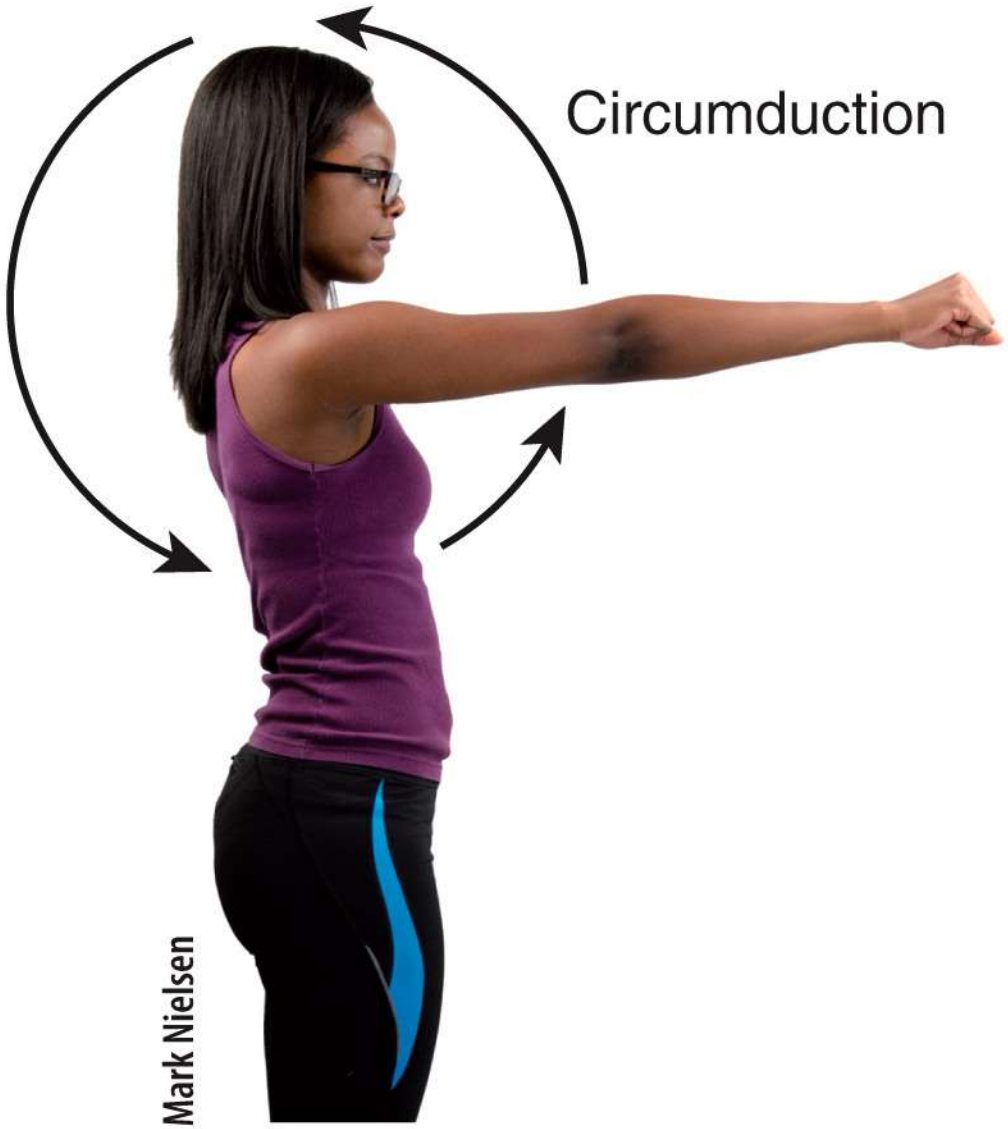


Mark Nielsen

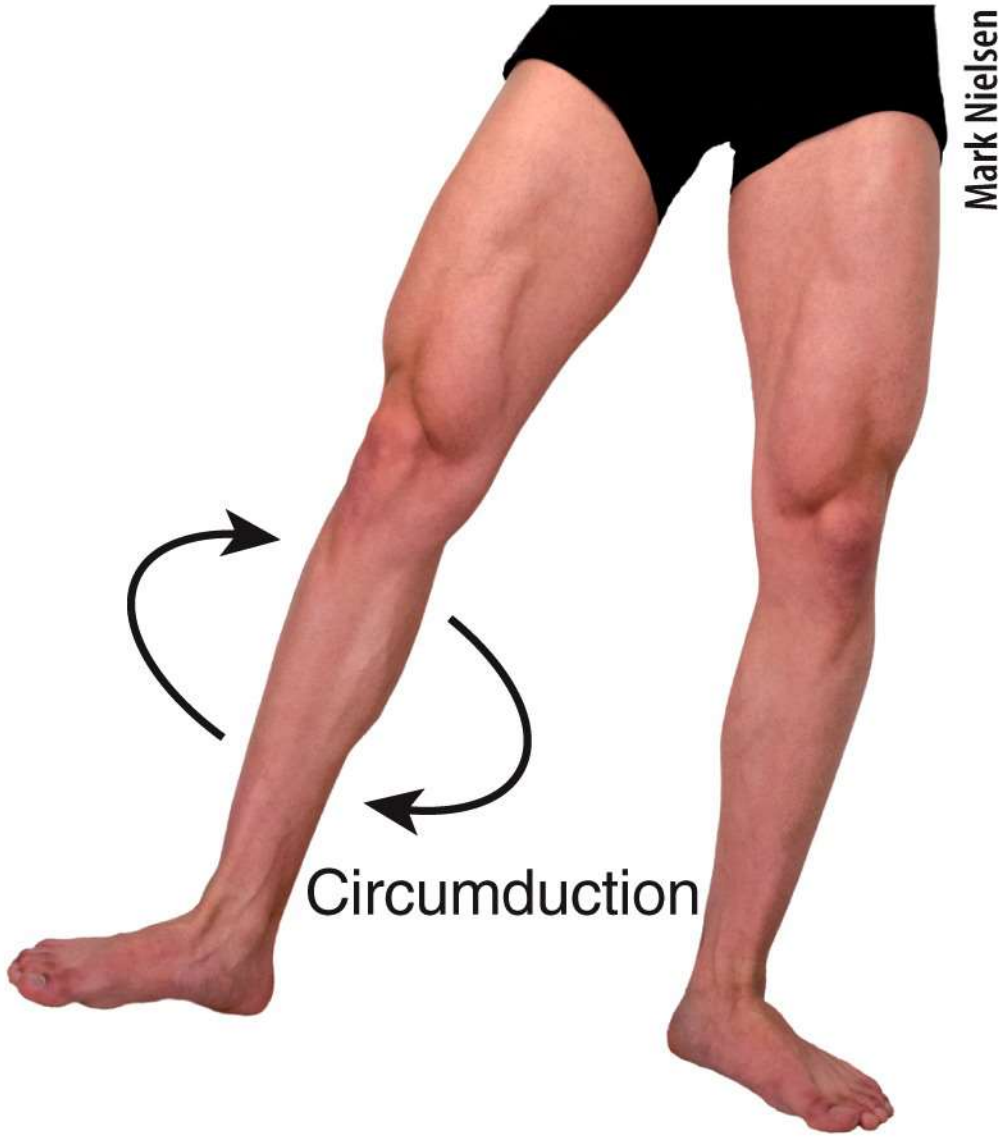
(a) Shoulder joint



(b) Hip joint



(a) Shoulder joint

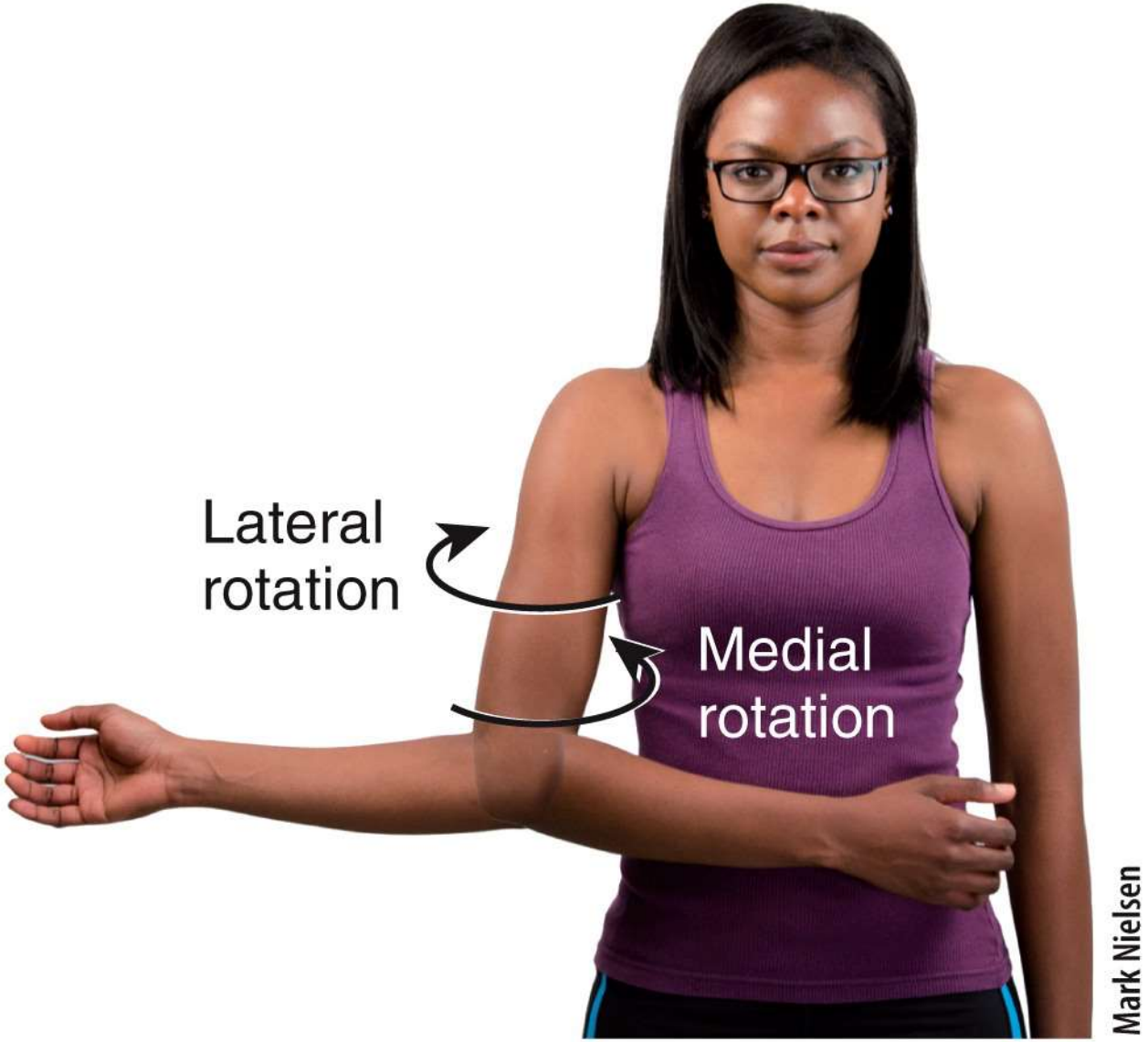


(b) Hip joint

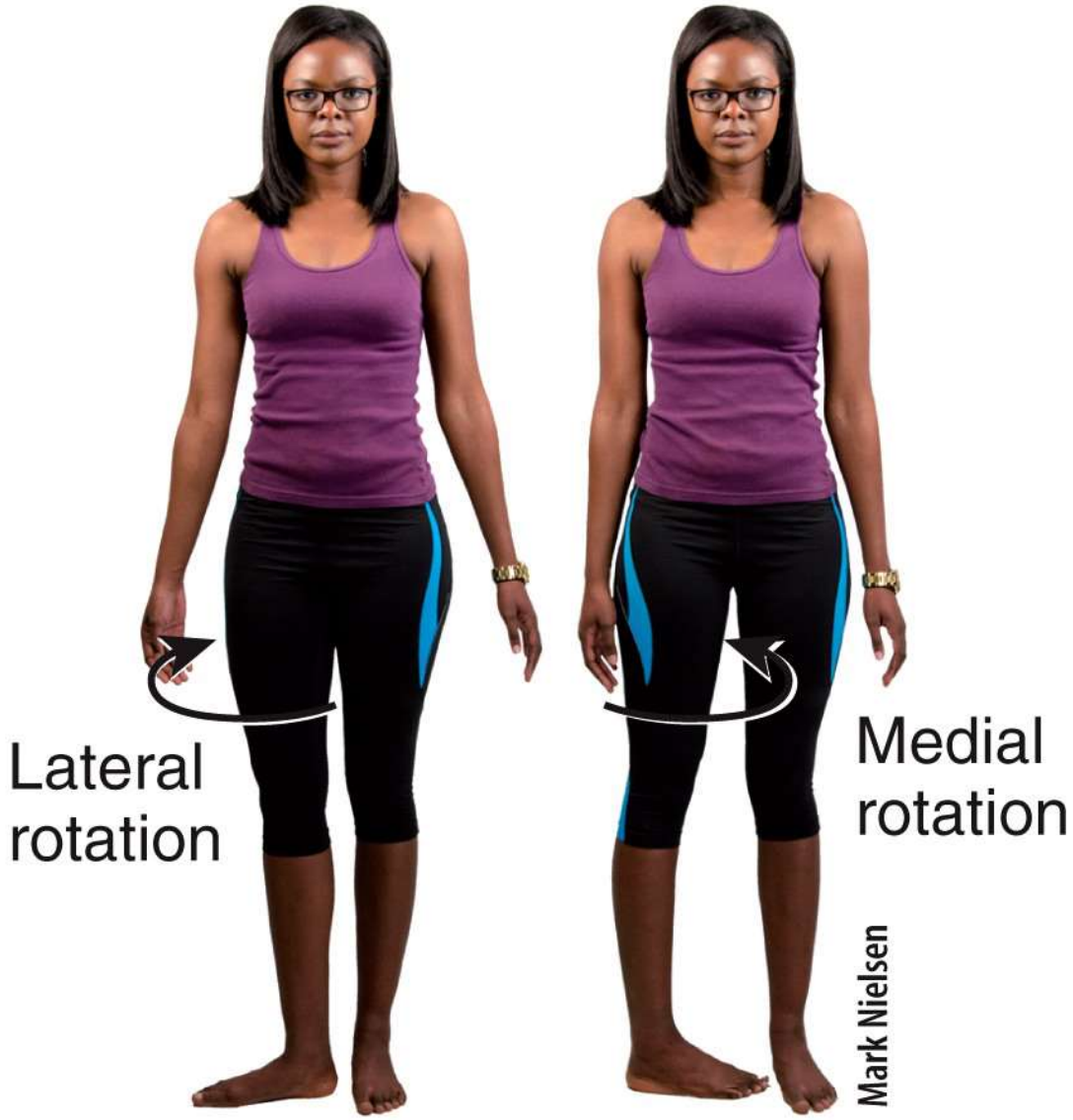
Rotation

Mark Nielsen

(a) Atlanto-axial joints



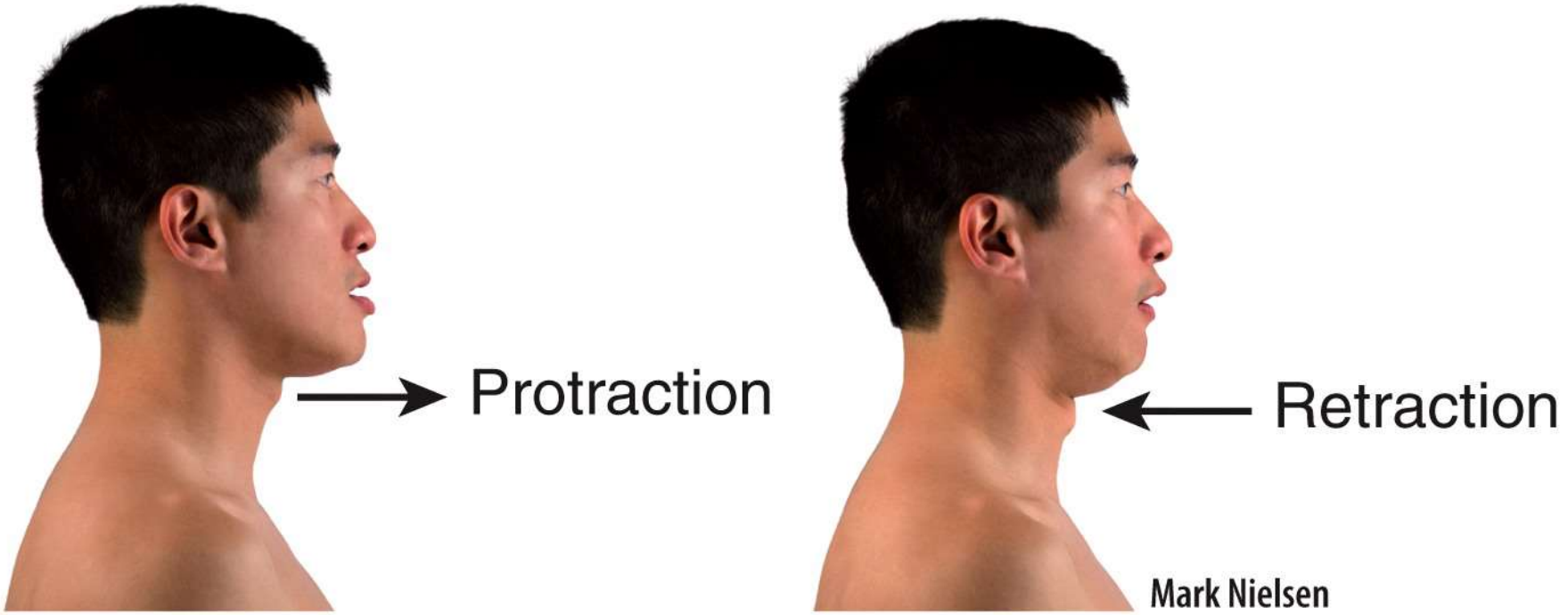
(b) Shoulder joint



(c) Hip joint

Mark Nielsen

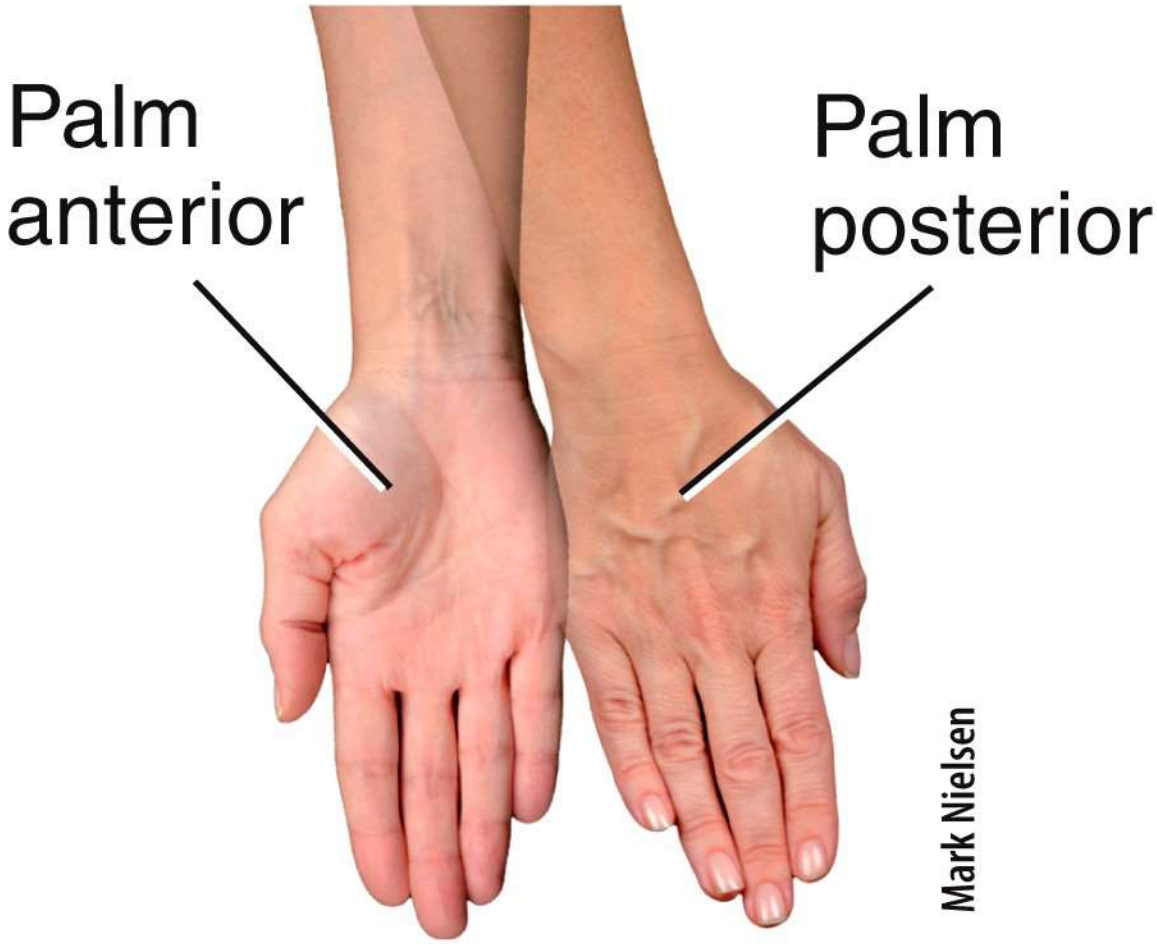
(a) Temporomandibular joints (b)



(c) Temporomandibular joints (d)

(e) Intertarsal joints (f)

(g) Ankle joint



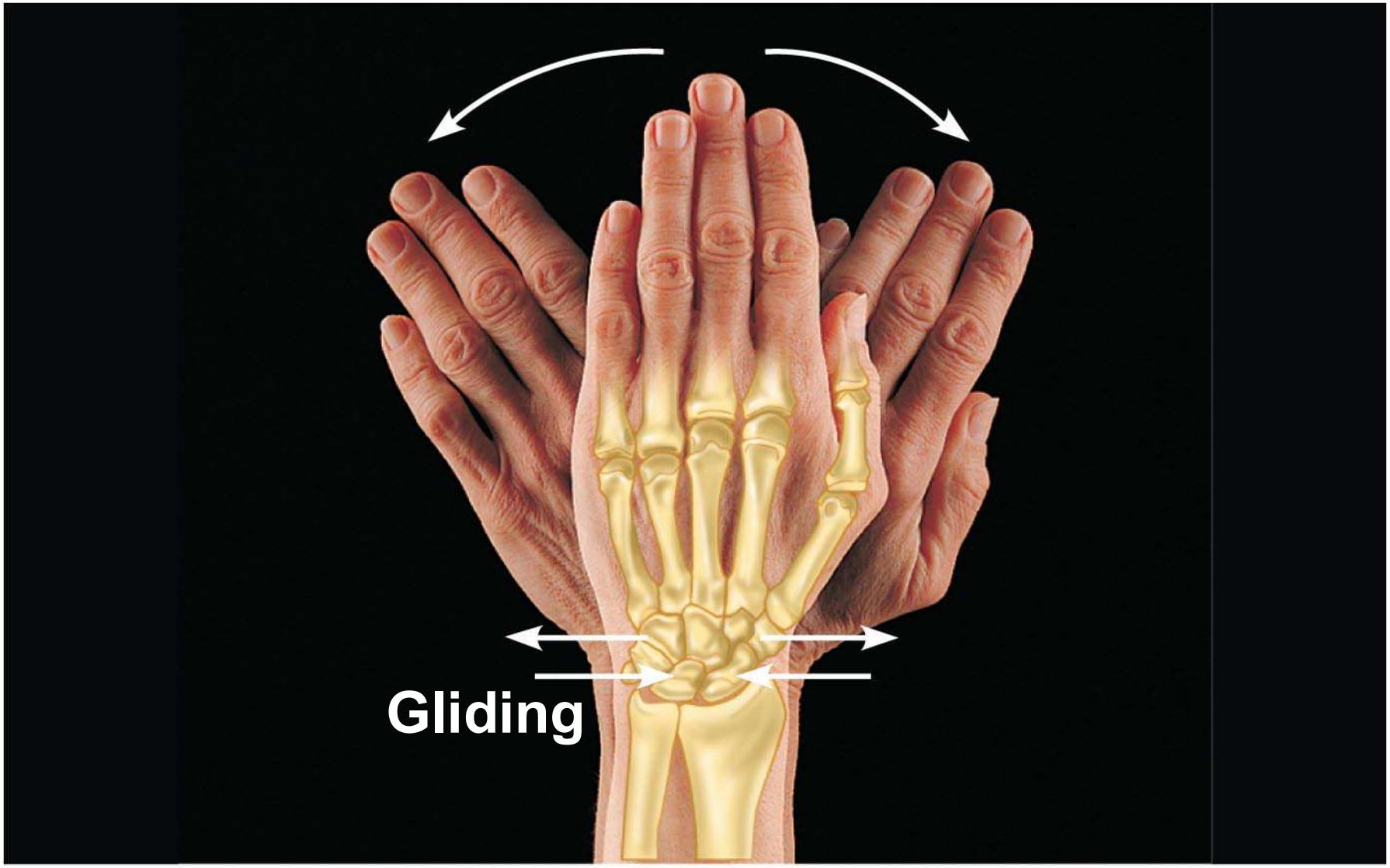
(h) Radioulnar joints

Opposition

(i) Carpometacarpal joint

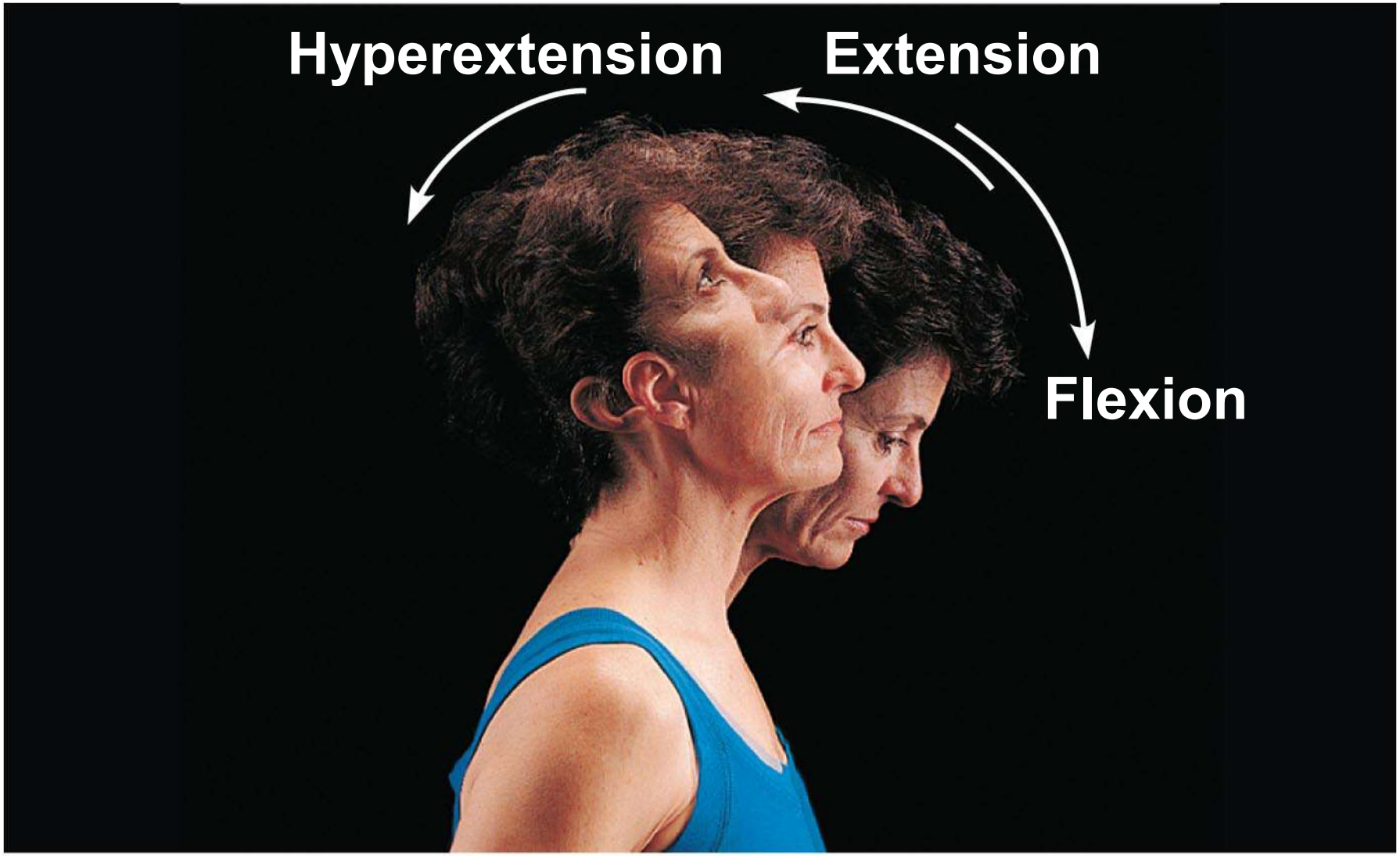
Type of Movements

Movements allowed by synovial joints.



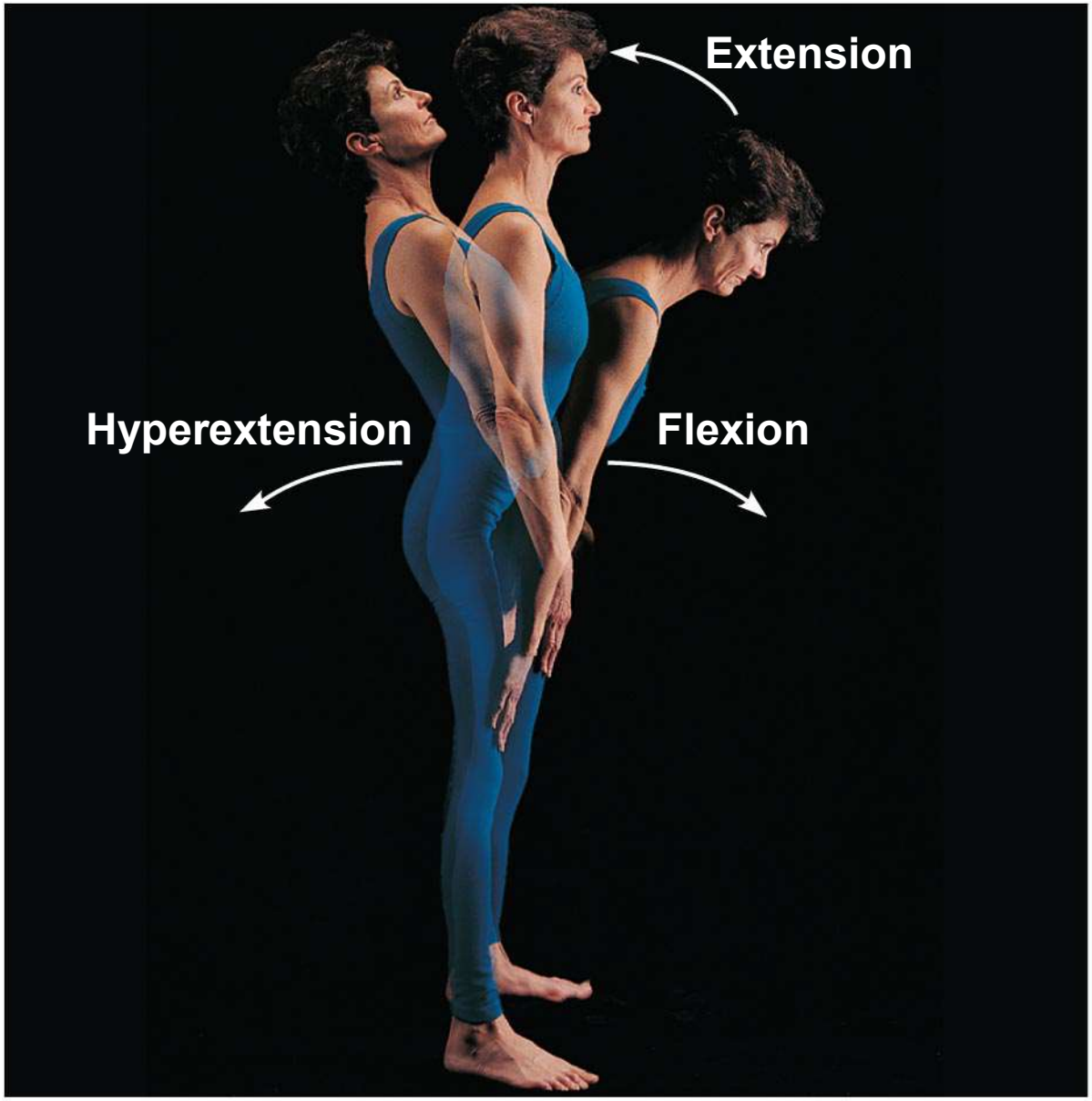
(a) Gliding movements at the wrist

Movements allowed by synovial joints.



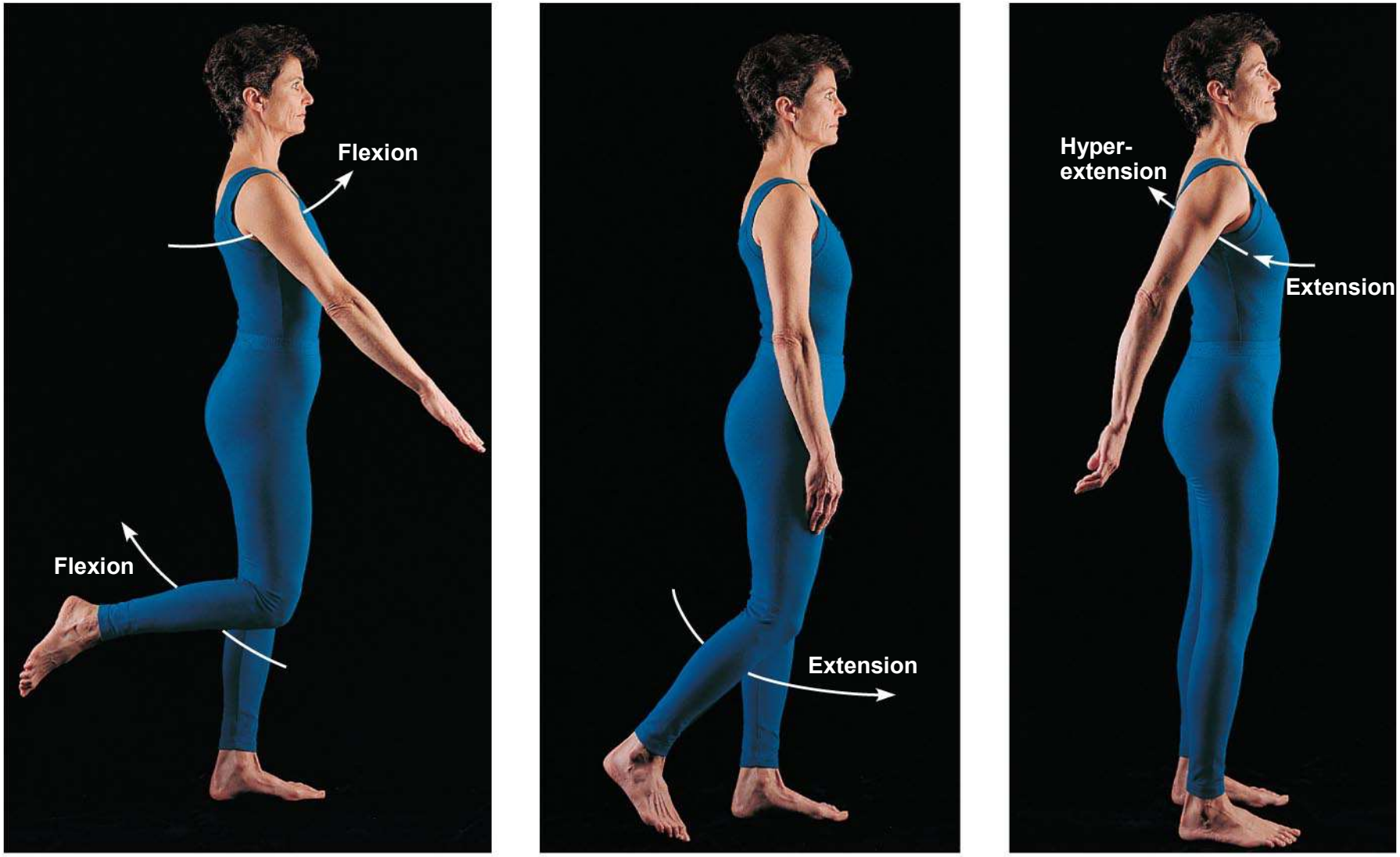
(b) Angular movements: flexion, extension, and hyperextension of the neck

Movements allowed by synovial joints.



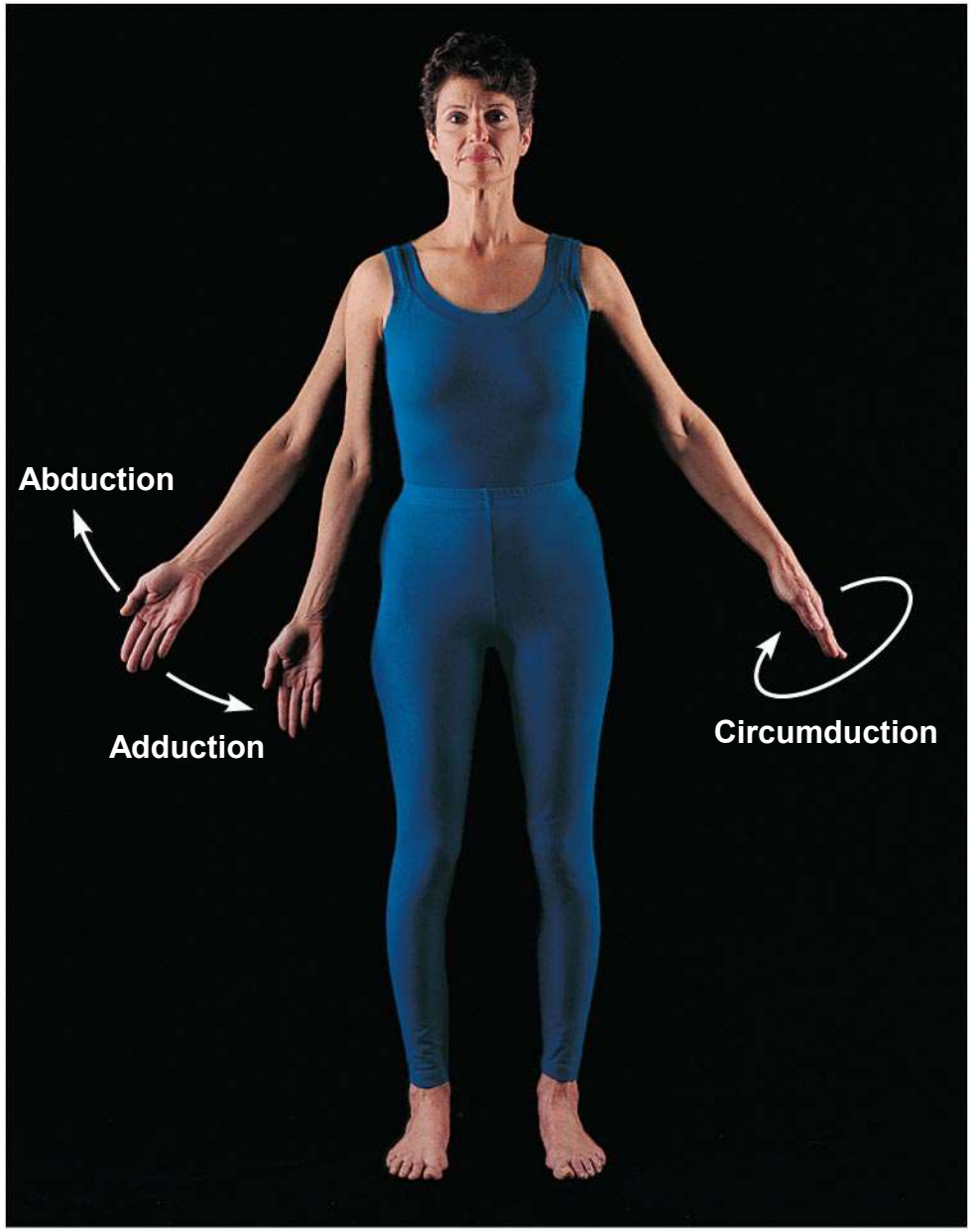
(c) Angular movements: flexion, extension, and hyperextension of the vertebral column

Movements allowed by synovial joints.



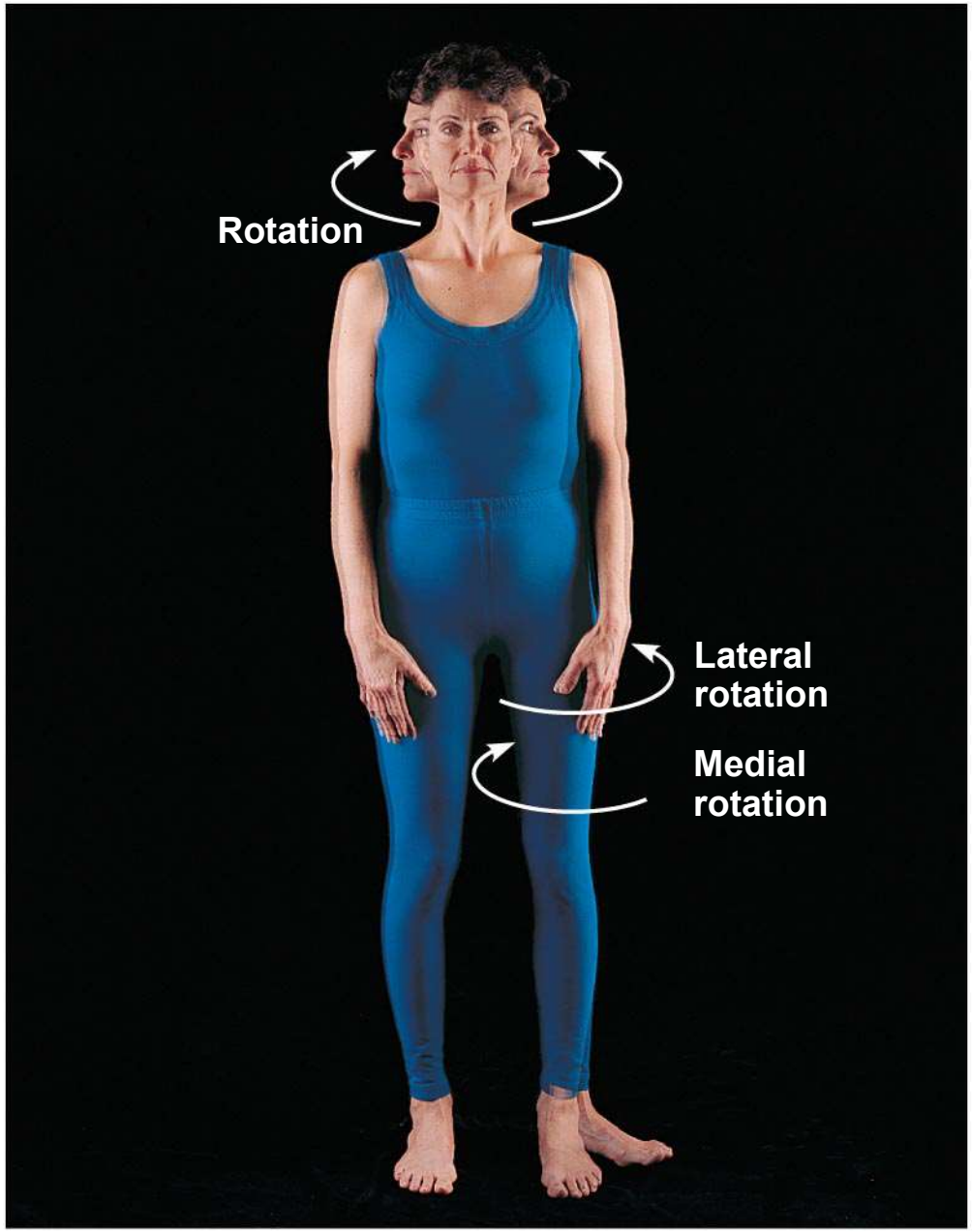
(d) Angular movements: flexion, extension, and hyperextension at the shoulder and knee

Movements allowed by synovial joints.



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

Movements allowed by synovial joints.

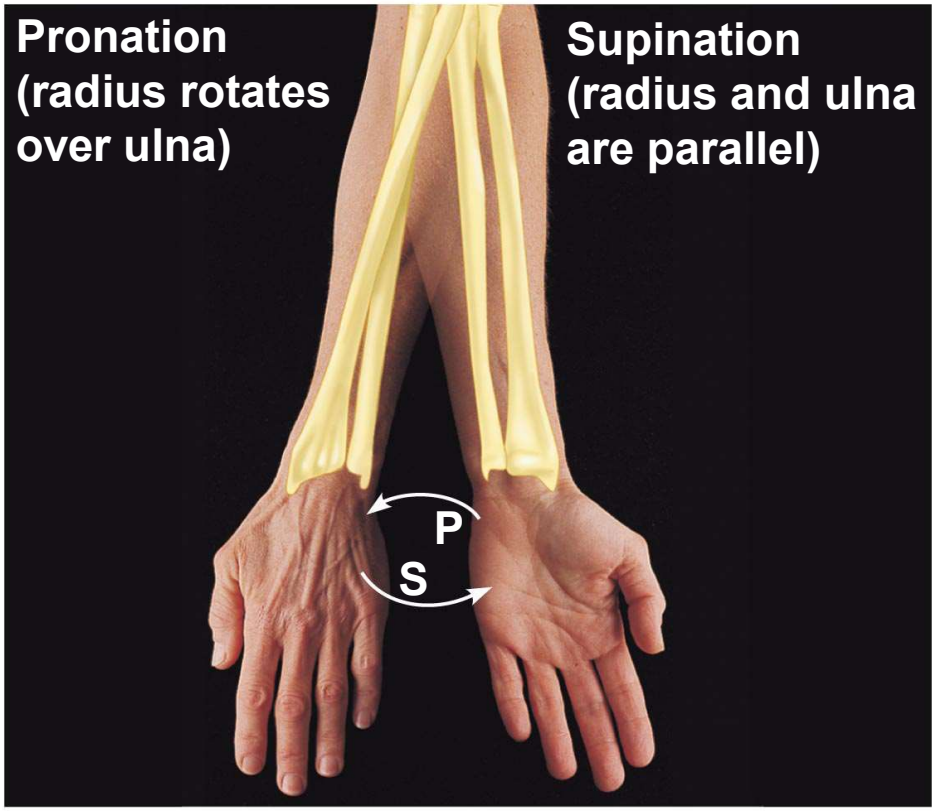


(f) Rotation of the head, neck, and lower limb

Special Movements at Synovial Joints

- **Supination** and **pronation** of radius and ulna
- **Dorsiflexion** and **plantar flexion** of foot
- **Inversion** and **eversion** of foot
- **Protraction** and **retraction**
- **Elevation** and **depression** of mandible
- **Opposition** of thumb of mandible

Special body movements.

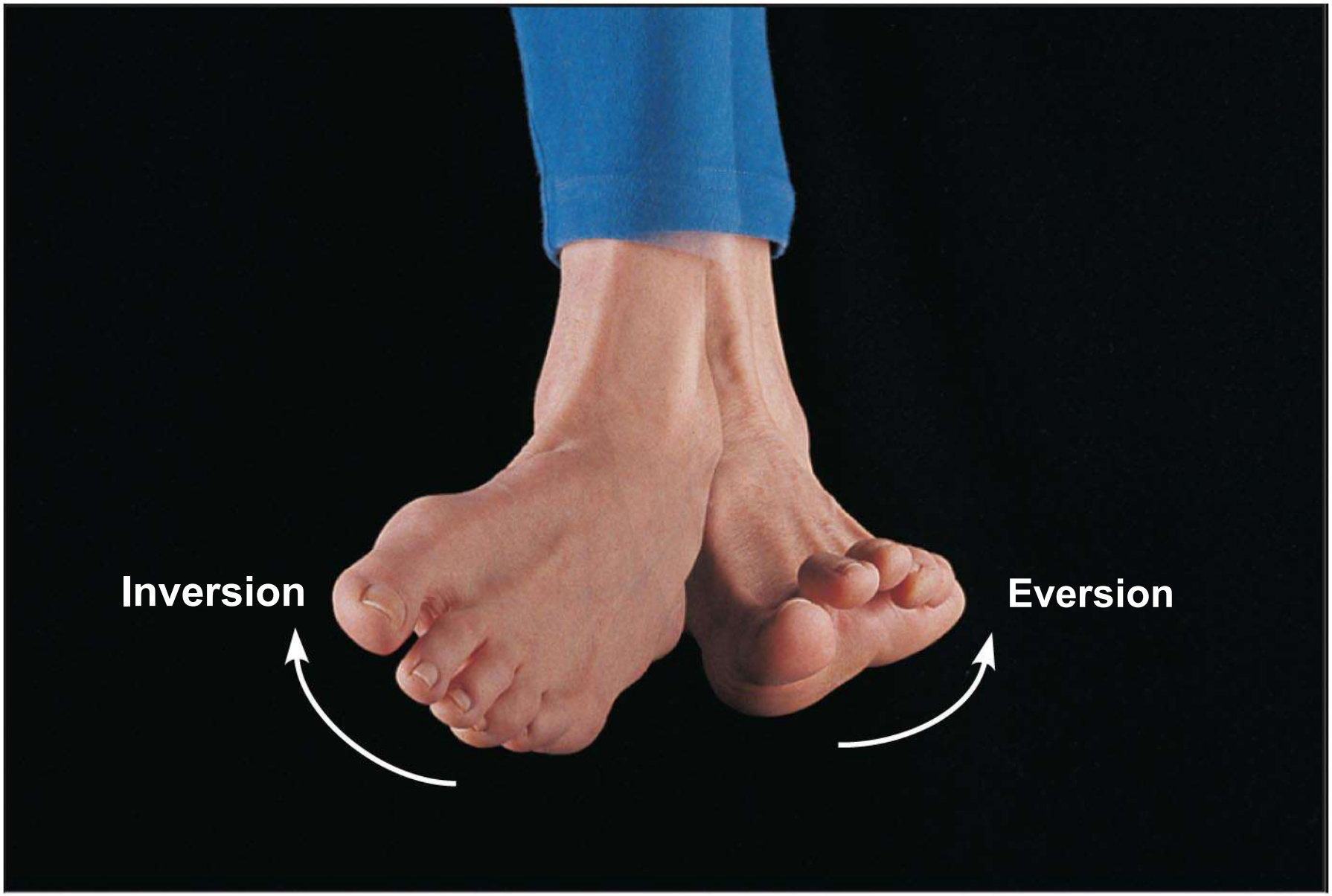


(a) Pronation (P) and supination (S)

Special body movements.

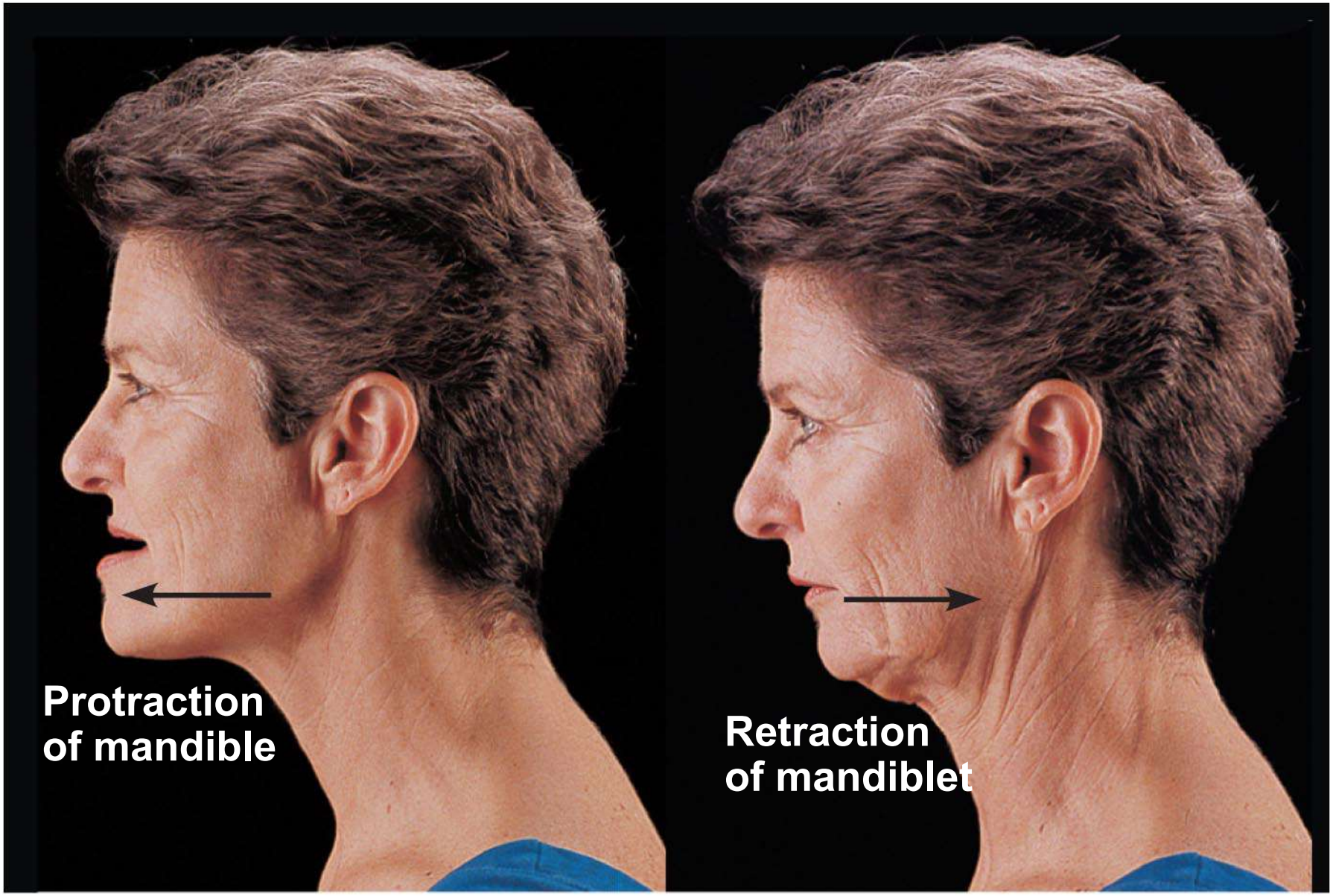
(b) Dorsiflexion and plantar flexion

Special body movements.



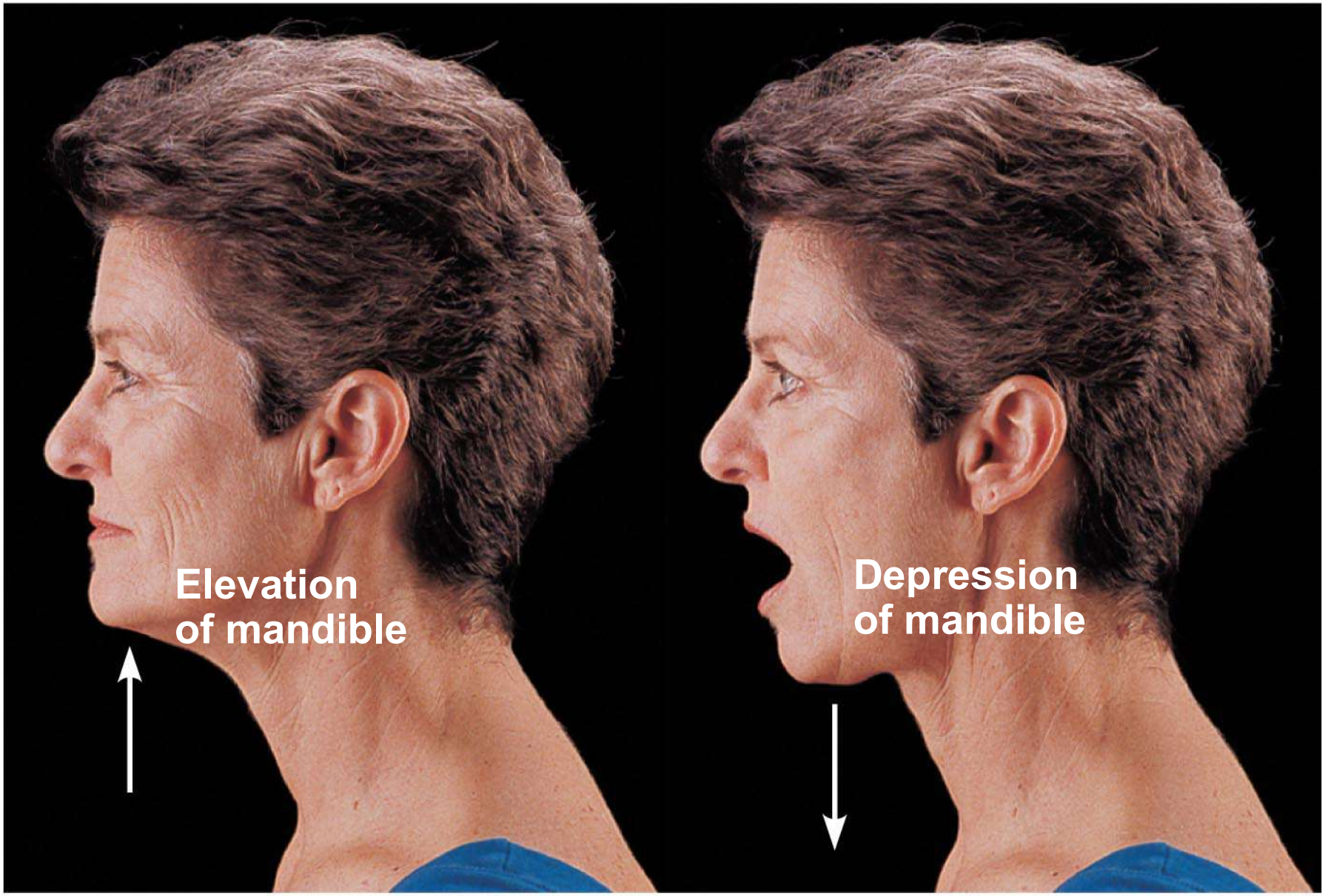
(c) Inversion and eversion

Special body movements.



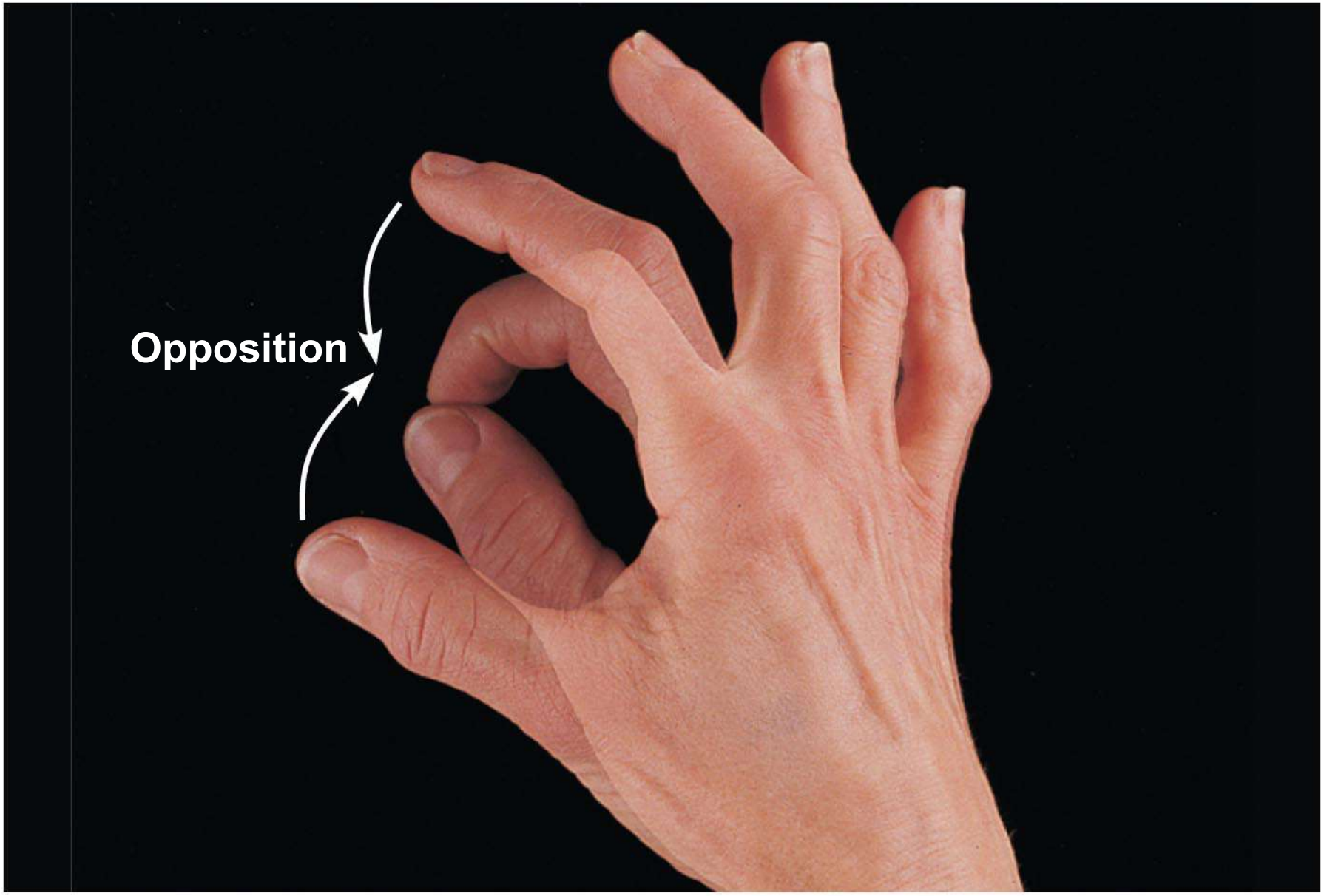
(d) Protraction and retraction

Special body movements.



(e) Elevation and depression

Special body movements.



(f) Opposition

C9

Images of Joints