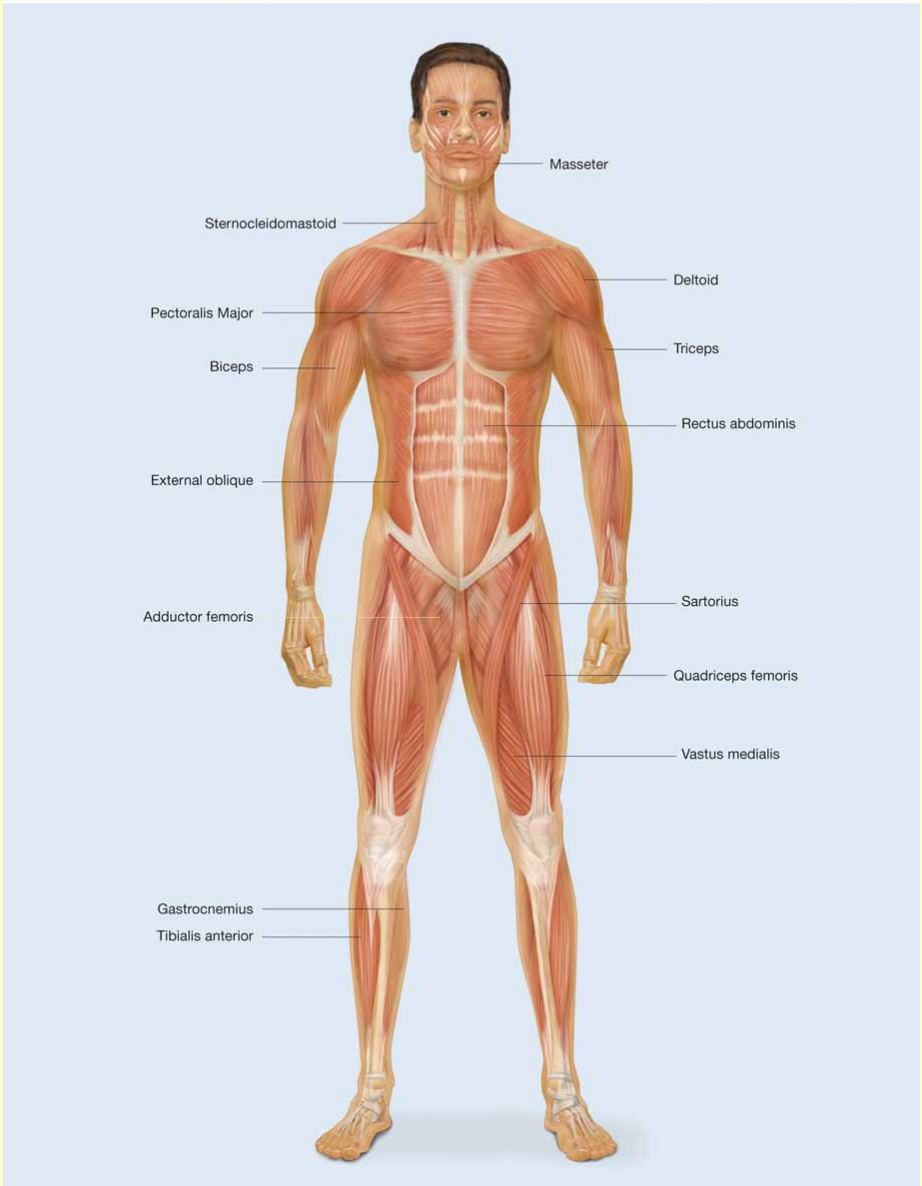
Medical Terminology
A Living Language

Introduction to the Musculoskeletal System for OTA/PTA Students

Skeletal System at a Glance

- Functions of Skeletal System
  - Internal framework of body
  - Supports body
  - Protects internal organs
  - Point of attachment for muscles
  - Produces blood cells
  - Stores minerals

Muscular System Illustrated



Medical Terminology: A Living Language, Fourth Edition
Bonnie F. Fremgen and Suzanne S. Frucht

Skeletal System Combining Forms

- ankyl/o — stiff joint
- arthr/o — joint
- articul/o — joint
- burs/o — sac
- carp/o — wrist
- cervic/o — neck

Skeletal System Combining Forms

- chondr/o — cartilage
- clavicul/o — clavicle
- coccyg/o — coccyx
- cortic/o — outer portion
- cost/o — rib
- crani/o — skull

Skeletal System Combining Forms

- femor/o — femur
- fibul/o — fibula
- humer/o — humerus
- ili/o — ilium
- ischi/o — ischium
- kyph/o — hump

Skeletal System Combining Forms

- lamin/o — lamina, part of vertebra
- lord/o — bent backwards
- lumb/o — loin
- mandibul/o — mandible
- maxill/o — maxilla
- medull/o — inner portion

Skeletal System Combining Forms

- metacarp/o — metacarpals
- metatars/o — metatarsals
- myel/o — bone marrow
- orth/o — straight
- oste/o — bone
- patell/o — patella

Skeletal System Combining Forms

- ped/o — foot
- pelv/o — pelvis
- phalang/o — phalanges/fingers-toes
- pod/o — foot
- pub/o — pubis
- radi/o — radius

Skeletal System Combining Forms

- sacr/o — sacrum
- scapul/o — scapula
- scoli/o — crooked, bent
- spondyl/o — vertebrae
- stern/o — sternum
- synovi/o — synovial membrane

Skeletal System Combining Forms

- synov/o — synovial membrane
- tars/o — ankle
- thorac/o — chest
- tibi/o — tibia
- uln/o — ulna
- vertebr/o — vertebra

Anatomy and Physiology

- **Bones** are body organs with blood supply, nerves, and lymphatic vessels
- Bones are connected to each other to form **skeleton**
  - Framework for the body
  - 206 bones

Anatomy and Physiology

- **Red bone marrow** within bones produces blood cells
- Bones also:
  - Protect vital organs
  - Store minerals

Anatomy and Physiology

- **Joint**
  - Place where two bones meet
  - Held together by **ligaments**
  - Gives flexibility to skeleton

Bones

- Also called **osseous tissue**
- One of hardest materials in body
- Formed from gradual process before birth called **ossification**
- Fetal skeleton is formed from a cartilage model

Bones

- Flexible tissue is gradually replaced by **osteoblasts** (immature bone cells)
- In adult bones osteoblasts mature into **osteocytes**
- Formation of strong bones dependant on adequate supply of minerals

Four Shapes of Bones

Long bones	Short bones	Flat bones	Irregular bones
Longer than wide **Example:** • femur • humerus	Roughly as long as wide **Example:** • carpals • tarsals	Plate-shaped **Example:** • sternum • scapula • pelvis	Shape very irregular **Example:** • vertebrae

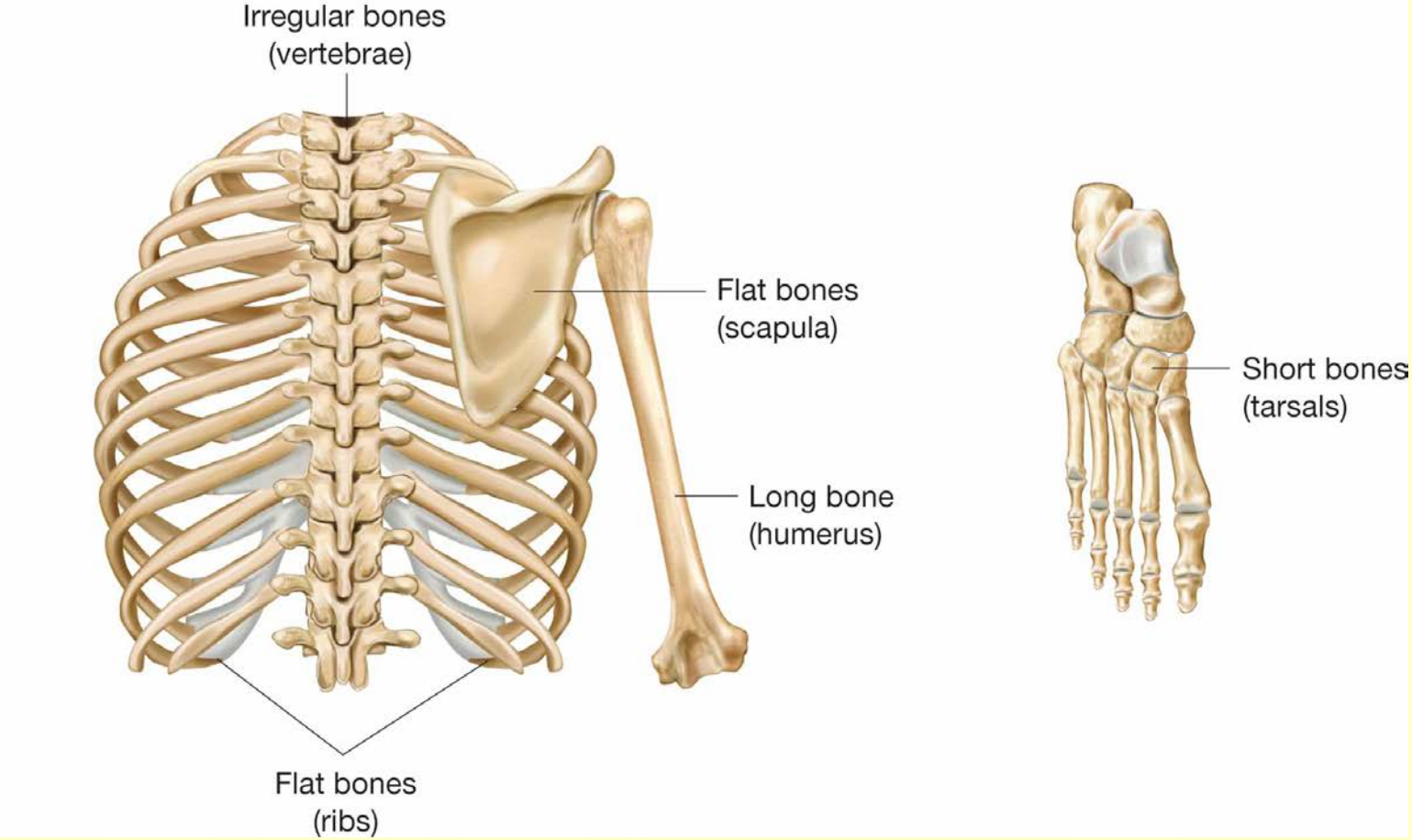


Figure 4.1 – Classification of bones by shape.

Long Bones

- Majority of bones in body
- Divided into:
  - **Diaphysis (middle)**
  - **Epiphysis (ends)**

Diaphysis

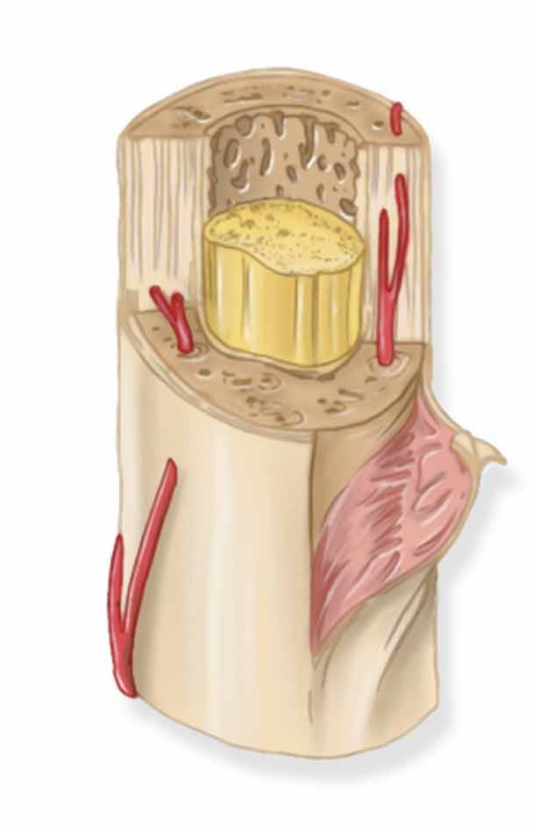
- Central shaft
- **Medullary cavity**
  - Open canal within diaphysis
  - Contains **yellow bone marrow**
    - Mostly fat

Epiphysis

- Wide ends of long bone
  - **Distal epiphysis**
  - **Proximal epiphysis**
- **Articular cartilage**
  - Covers epiphysis
  - Prevents bone rubbing on bone

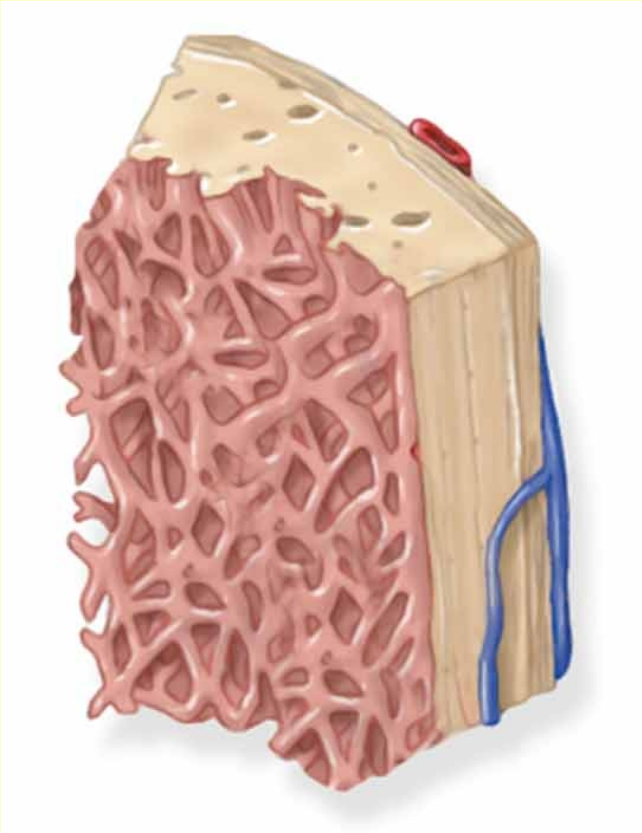
Periosteum

- Covers surface of bone not covered by articular cartilage
- Thin connective tissue membrane
- Contains numerous nerve and lymphatic vessels



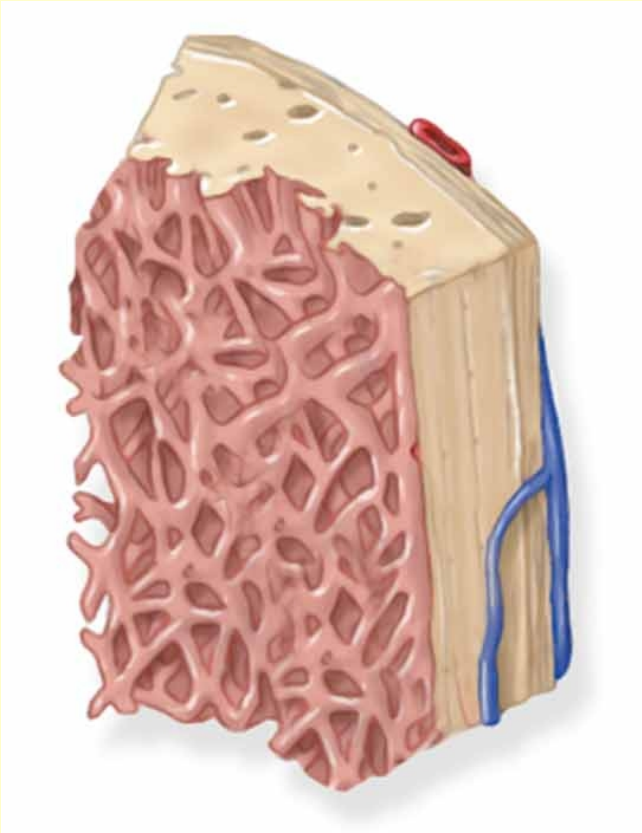
Compact Bone

- Also called **cortical bone**
- Very dense and hard
- Outer layer of bone
- Found in both epiphysis and diaphysis



Cancellous Bone

- Also called **spongy bone**
- Found inside bone
- Has spaces containing **red bone marrow**
  - Manufactures blood cells



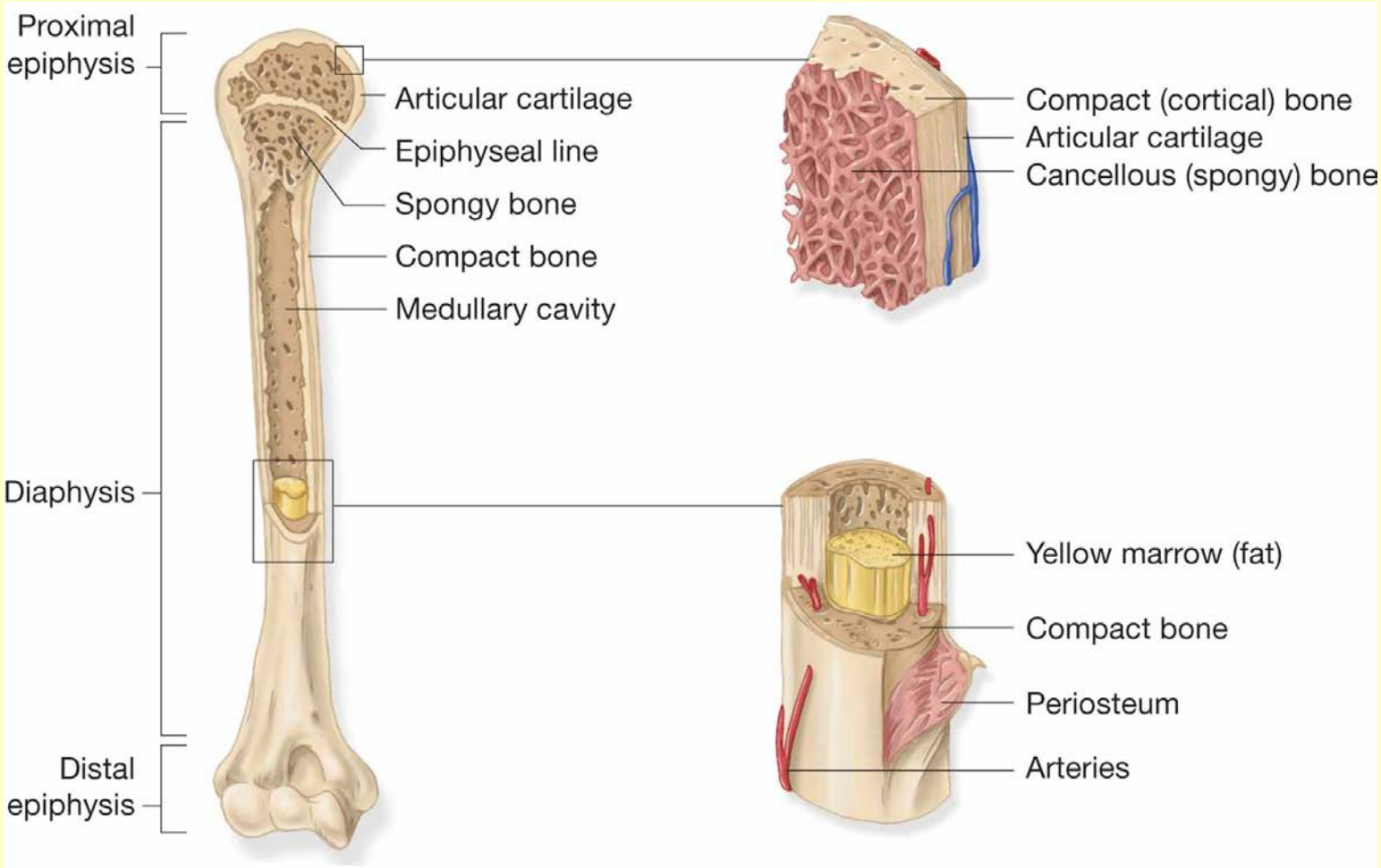


Figure 4.2 – Components of a long bone.

Bony Processes

- Projection from the surface of a bone
- Rough processes provide place for muscle attachment
- Smooth rounded processes articulate with another bone in a joint
- Named for shape and location

Common Bony Process Names

Head	Large smooth ball-shaped end of a long bone
Condyle	Smooth rounded portion at end of bone
Epicondyle	Projection above or on a condyle
Trochanter	Large rough process
Tubercle	Small rough process
Tuberosity	Large rough process

Figure 4.3 – Bony processes found on the femur.

Bony Depressions

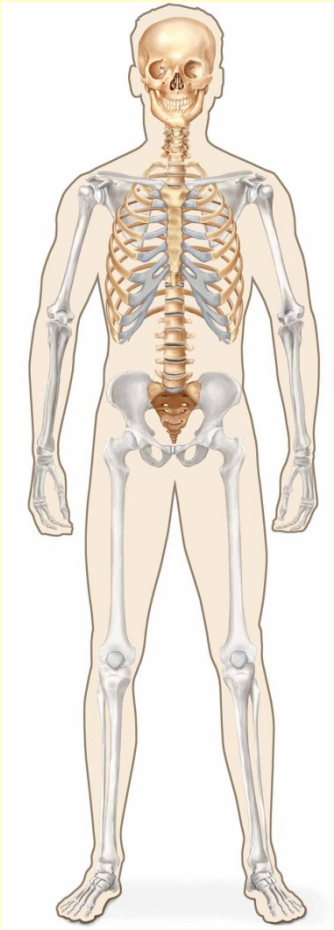
- **Sinus**
  - Hollow cavity within bone
- **Foramen**
  - Smooth opening for nerves and blood vessels
- **Fossa**
  - Shallow cavity or depression within a bone
- **Fissure**
  - Deep groove or slit-like opening

The Skeleton

- Skeleton has two divisions
  - **Axial skeleton**
  - **Appendicular skeleton**

Axial Skeleton

- Includes bones in:
  - Head
  - Neck
  - Spine
  - Chest
  - Trunk



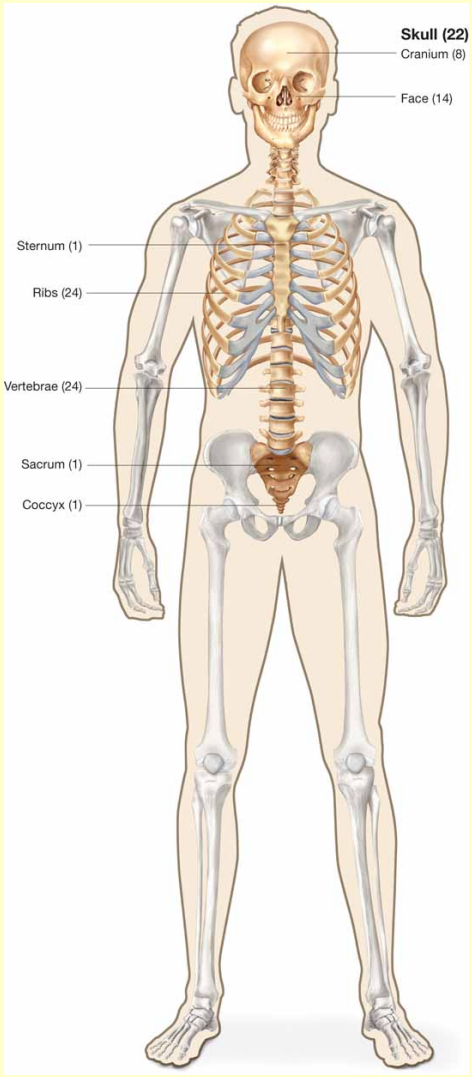


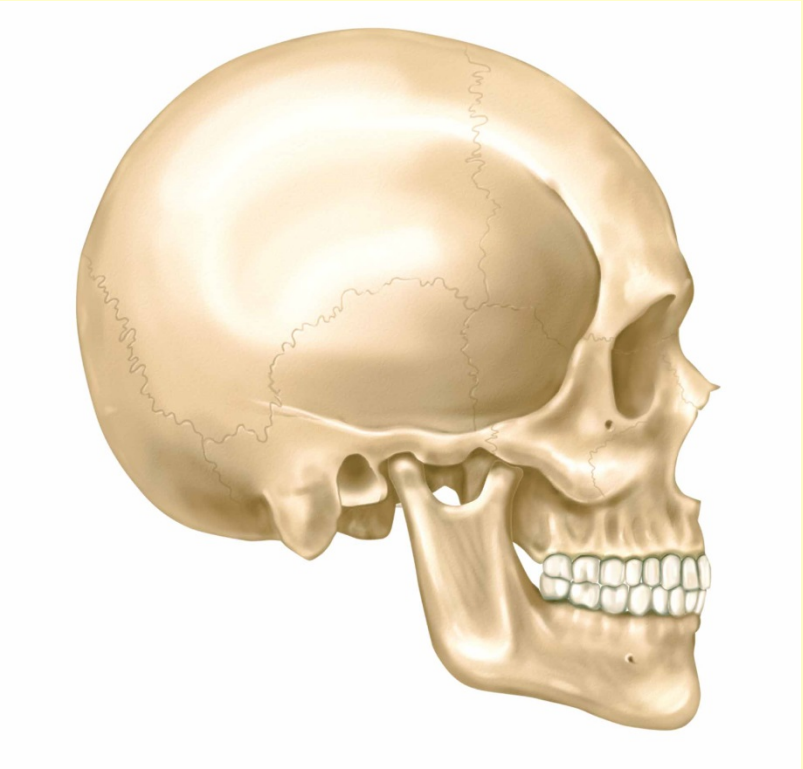
Figure 4.4 – Bones of the axial skeleton.

The Skull

- Is divided into two parts
  - **Cranium**
  - **Facial bones**
- Protects brain, eyes, ears, nasal cavity, and oral cavity
- Attachment for muscles of chewing and turning the head

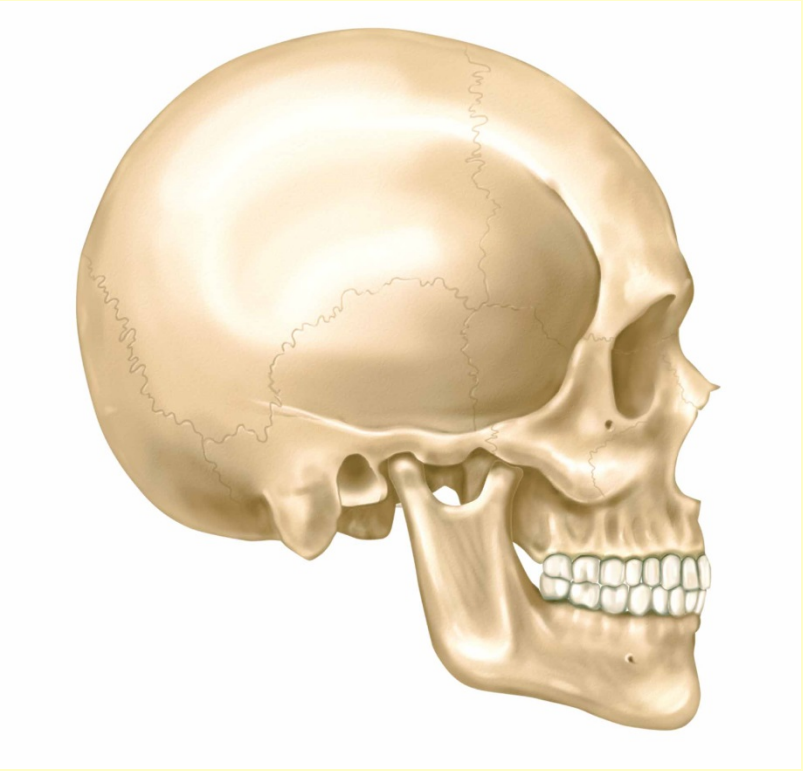
Cranium

- **Frontal** – 1 bone
  - Forehead
- **Parietal** – 2 bones
  - Upper sides and roof of skull
- **Temporal** – 2 bones
  - Sides & base of skull



Cranium

- **Ethmoid** – 1
  - Part of eye orbit, nose, & floor of skull
- **Sphenoid** – 1
  - Part of floor of skull
- **Occipital** – 1
  - Back & base of skull



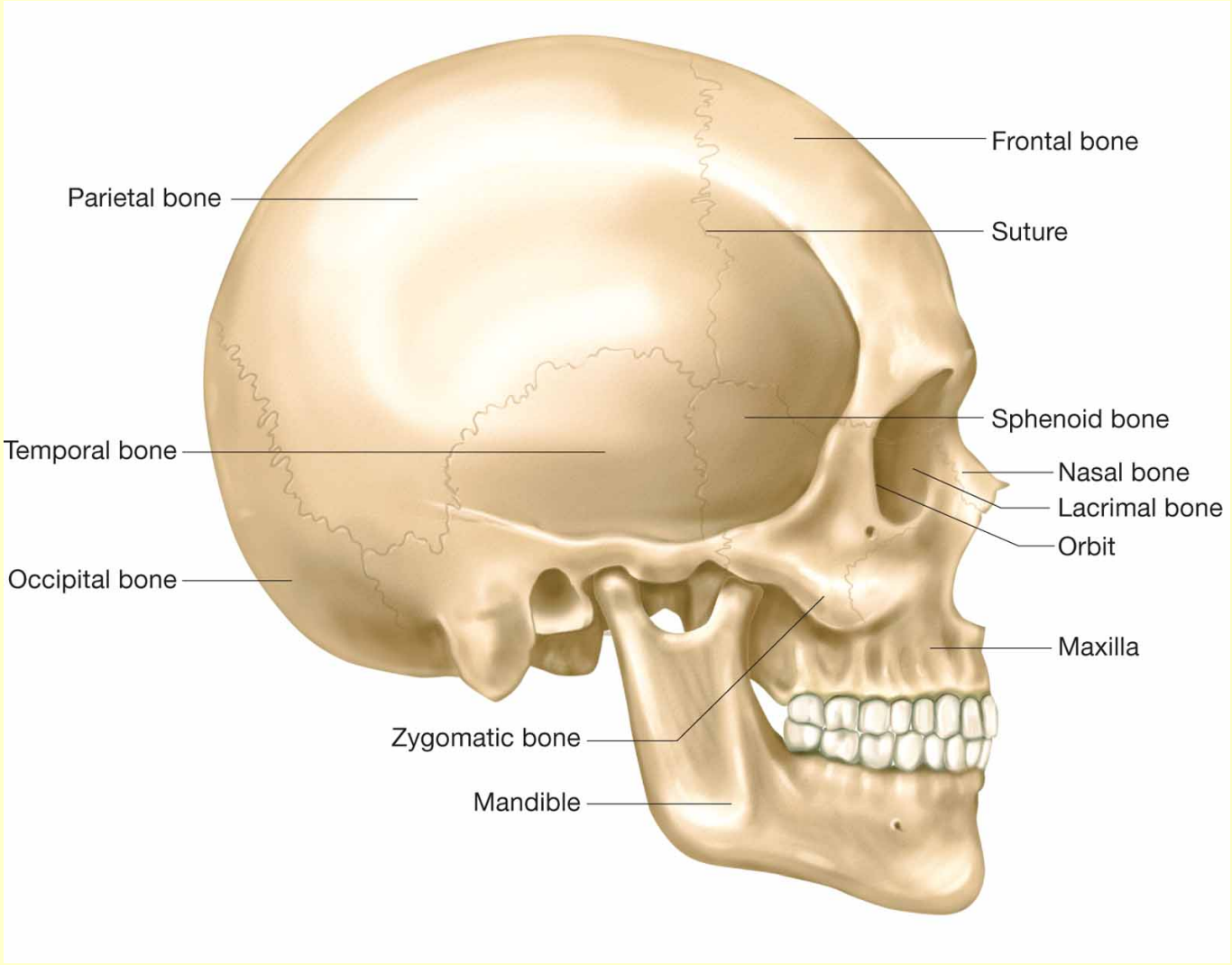
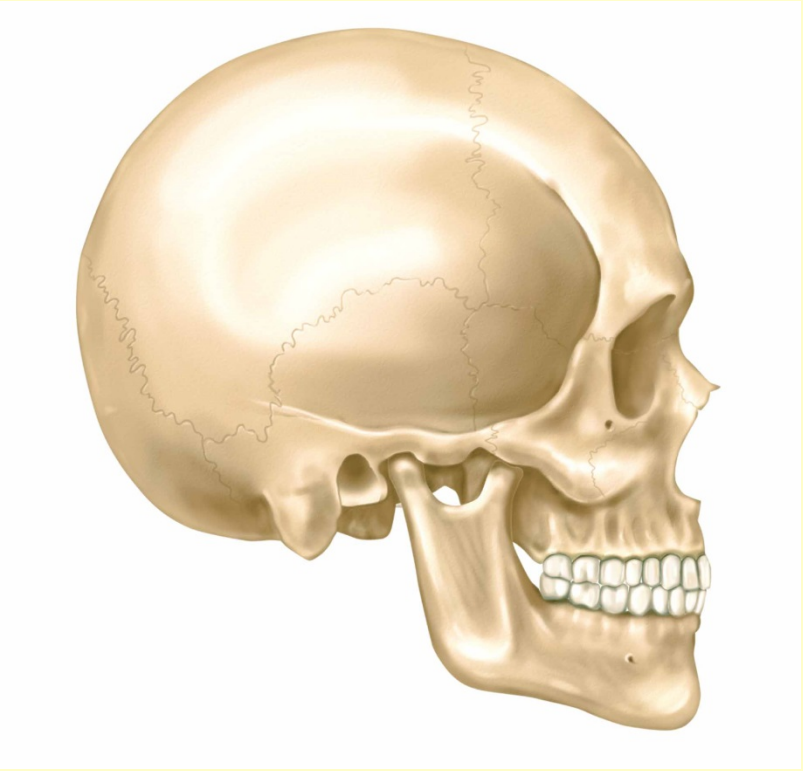


Figure 4.5 – Bones of the skull.

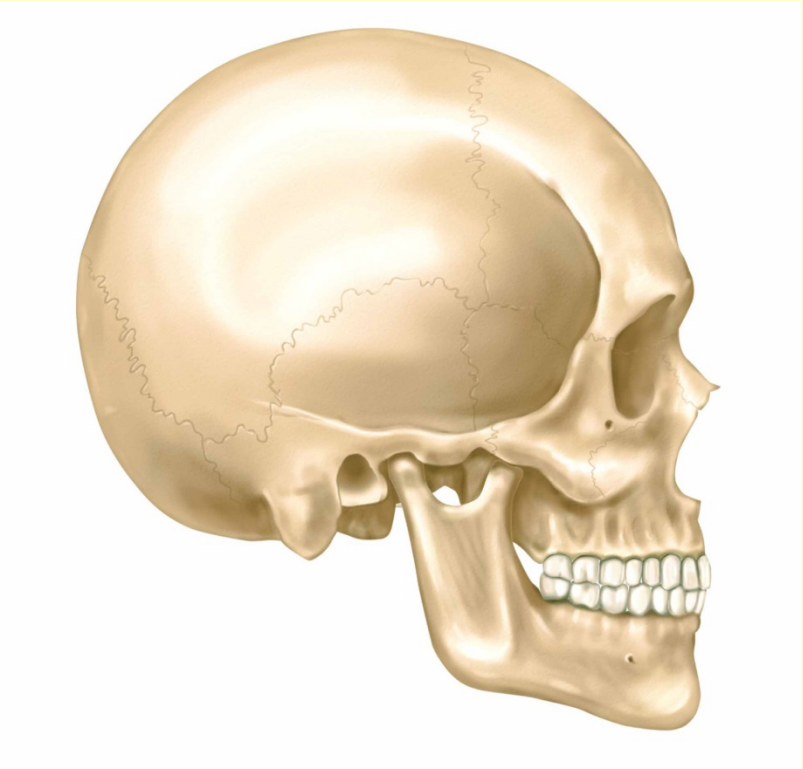
Facial Bones

- **Mandible** – 1
  - Lower jawbone
- **Maxilla** – 1
  - Upper jawbone
- **Zygomatic** – 2
  - Cheek bones
- **Vomer** – 1
  - Part of nasal septum



Facial Bones

- **Palatine** – 1
  - Hard palate and floor of nose
- **Nasal** – 2
  - Part of nasal septum and bridge of nose
- **Lacrimal** – 2
  - Inner corner of eye



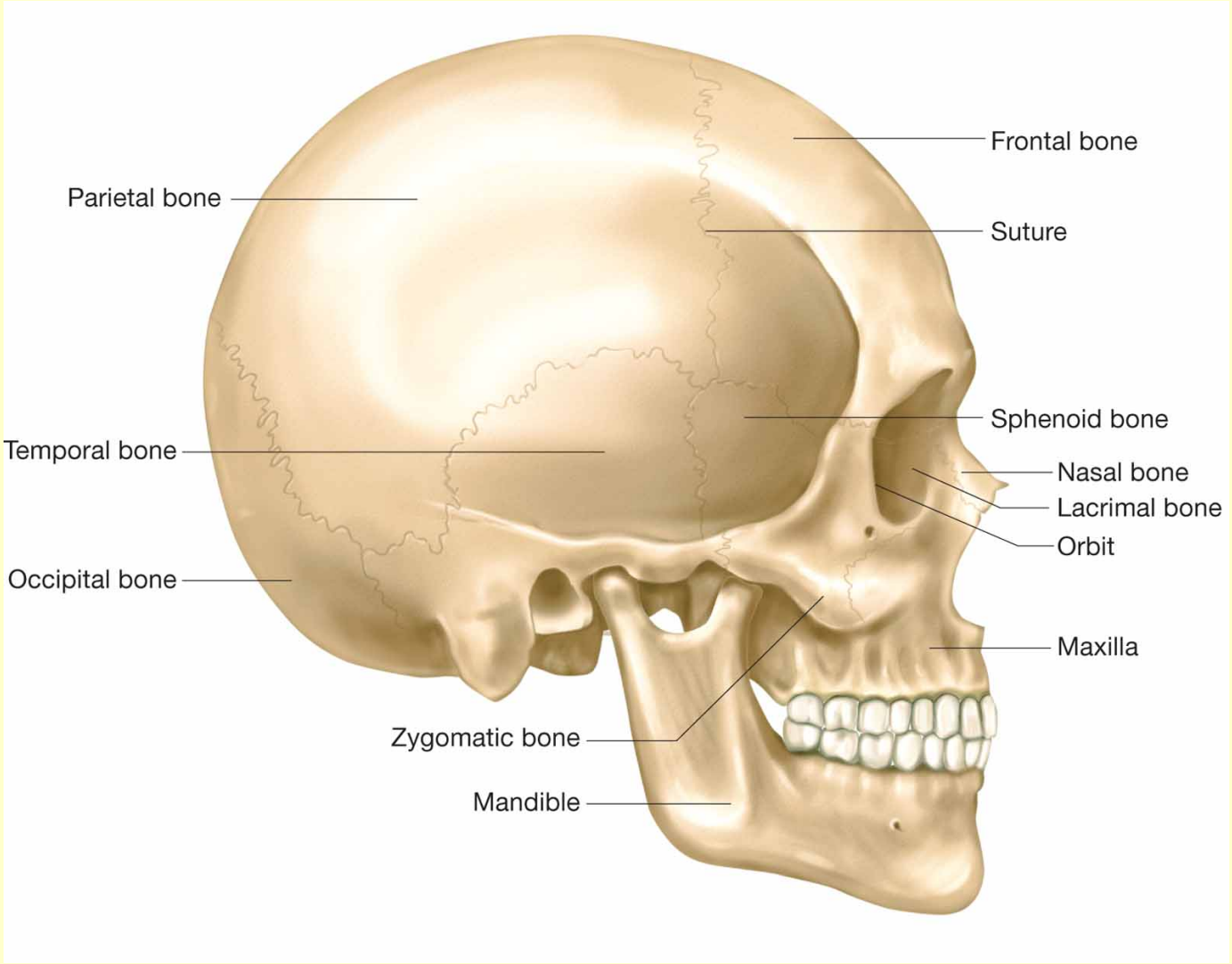


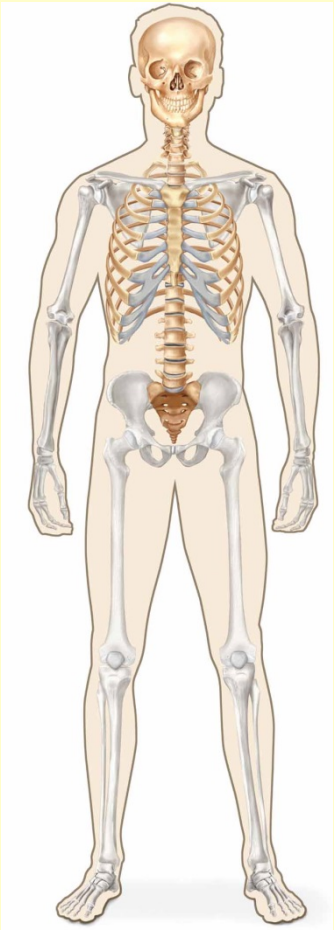
Figure 4.5 – Bones of the skull.

Hyoid Bone

- Single U-shaped bone
- In neck between mandible and larynx
- Attachment point for swallowing and speech muscles

The Trunk

- **Vertebral column**
- **Sternum**
- **Rib cage**



The Vertebral Column

- Divided into five sections
  - **Cervical**
  - **Thoracic**
  - **Lumbar**
  - **Sacrum**
  - **Coccyx**

The Vertebral Column

- Cervical
  - 7 vertebrae of neck
- Thoracic
  - 12 vertebrae of chest
- Lumbar
  - 5 vertebrae of low back
- Sacrum
  - 5 fused vertebrae at base of spine
- Coccyx
  - 3–5 small vertebrae attached to sacrum

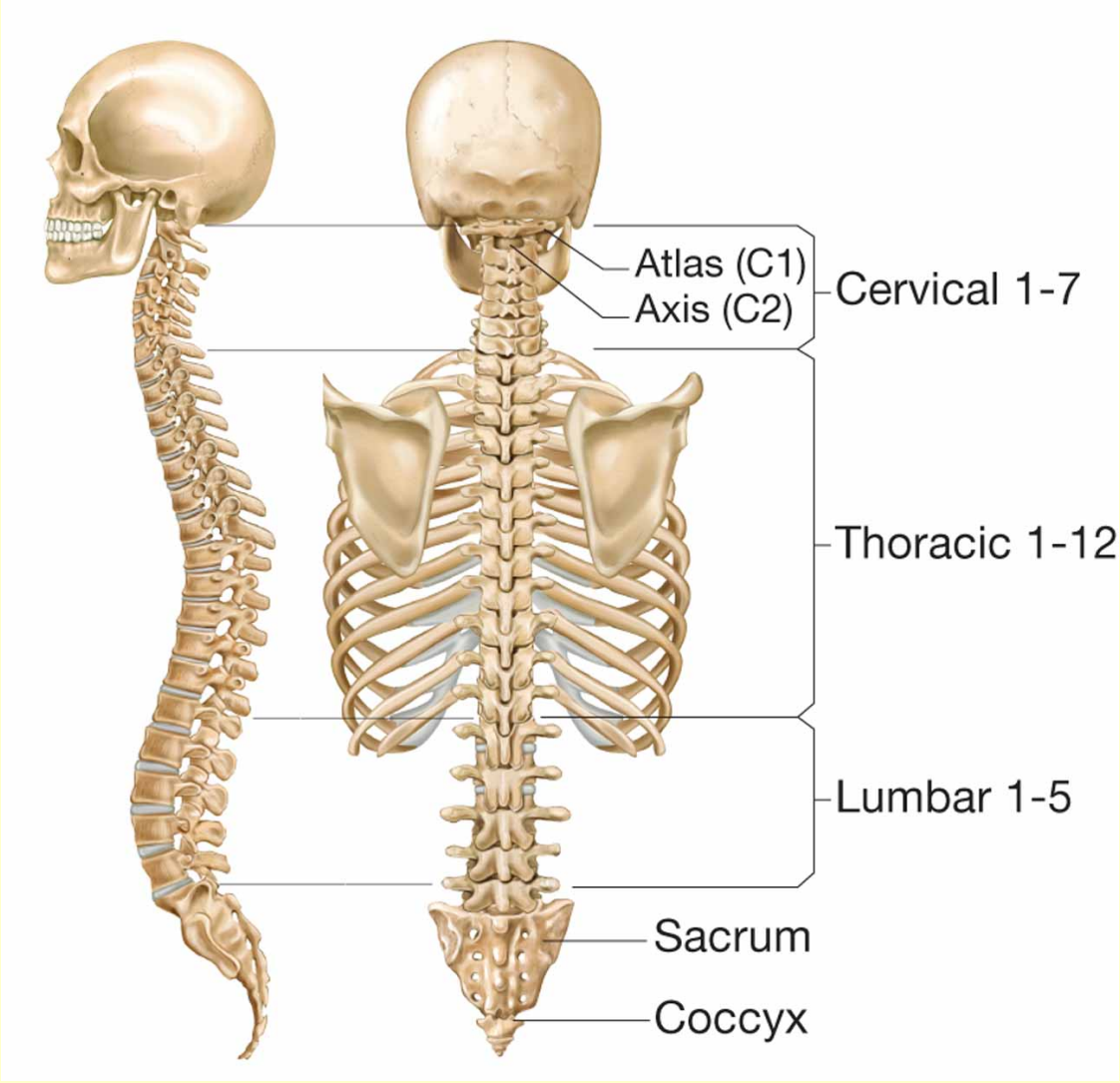
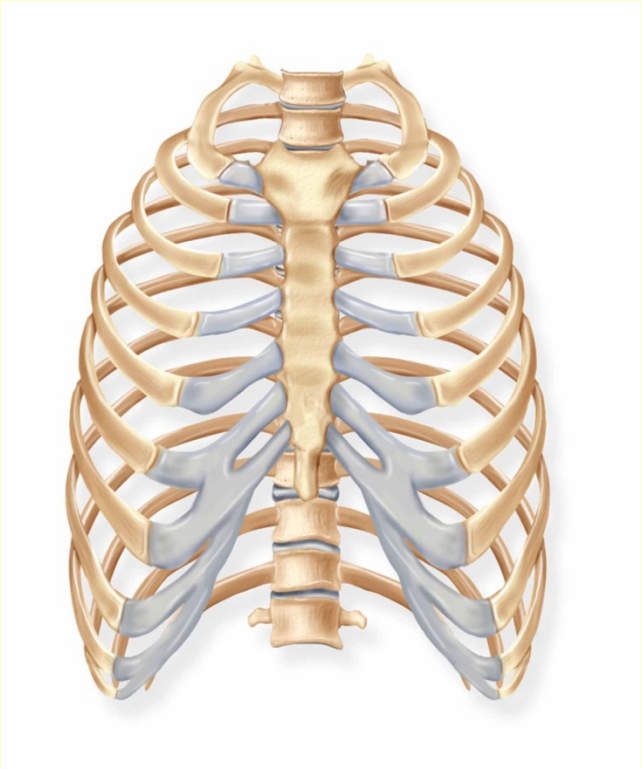


Figure 4.6 – Divisions of the vertebral column.

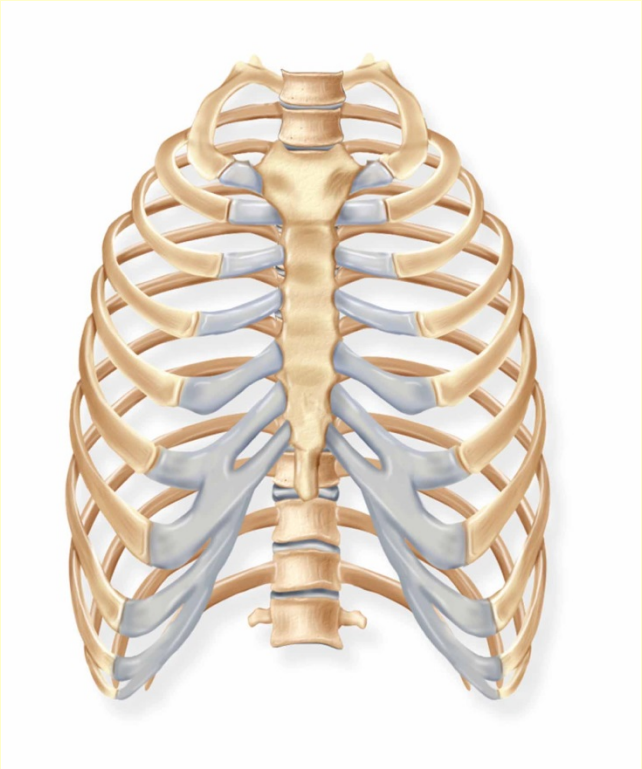
The Rib Cage

- 12 pairs of ribs
- Attached to vertebral column at back
- Provides support for organs, such as heart and lungs



The Rib Cage

- **True ribs**
  - 10 pairs attached to sternum in front
- **Floating ribs**
  - Inferior 2 pairs
  - No attachment in front



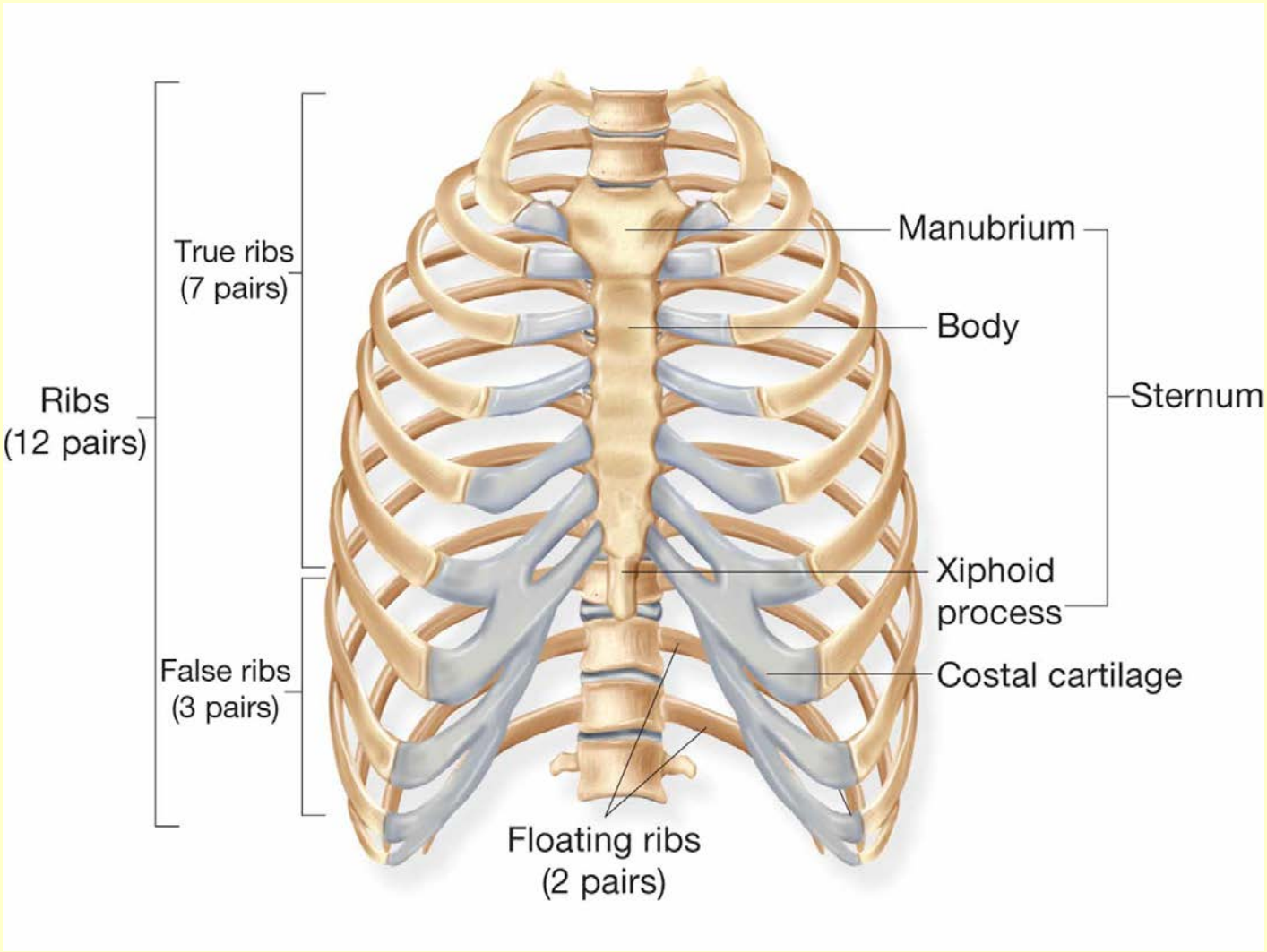
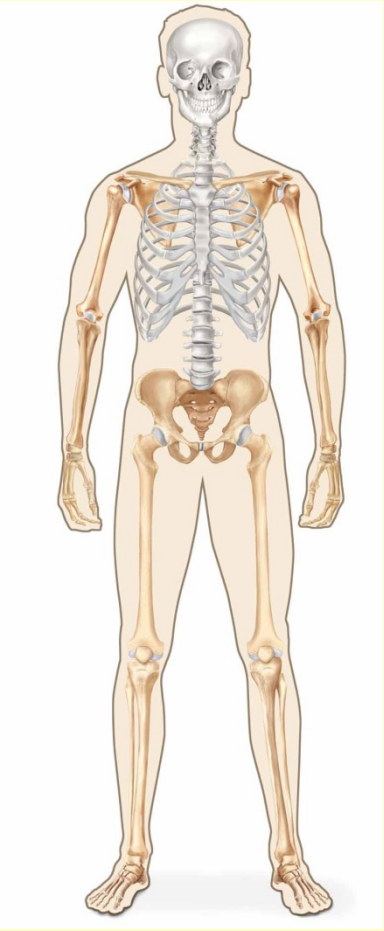


Figure 4.7 – The structure of the rib cage.

Appendicular Skeleton

- Includes bones of:
  - **Shoulder (pectoral) girdle**
  - **Upper extremity**
  - **Pelvic girdle**
  - **Lower extremity**



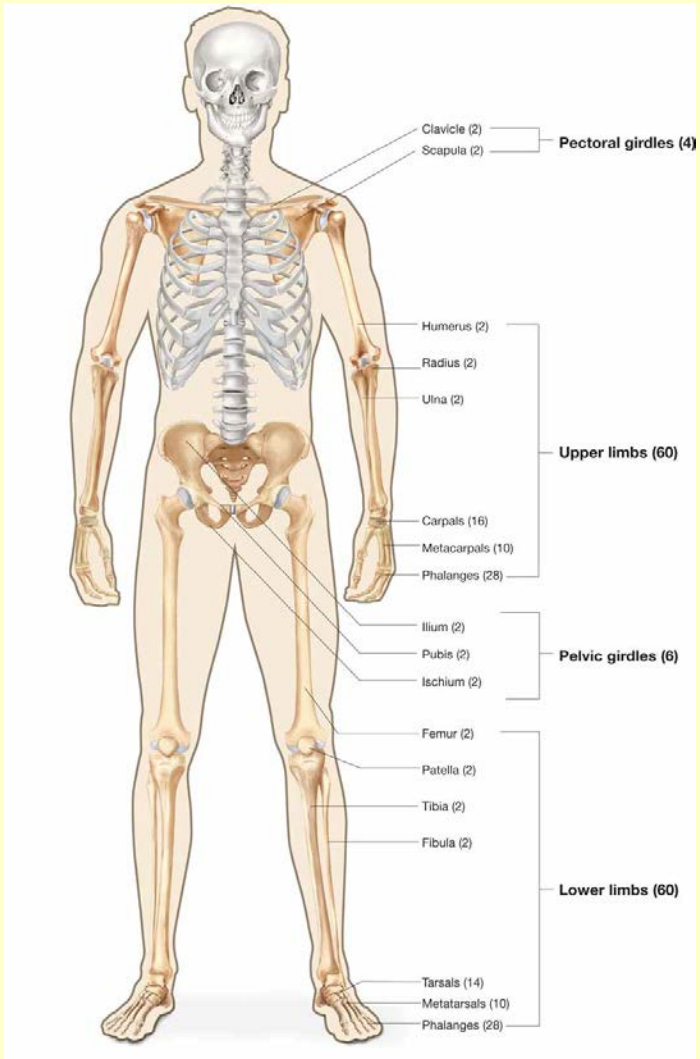


Figure 4.8 – Bones of the appendicular skeleton.

Shoulder Girdle

- Attaches upper extremity to axial skeleton
- Articulates with:
  - Sternum anteriorly
  - Vertebral column posteriorly
- Consists of:
  - **Clavicle** – collar bone
  - **Scapula** – shoulder blade

Upper Extremity

- Arm
- Consists of:
  - **Humerus** – upper arm
  - **Ulna** – part of forearm
  - **Radius** – part of forearm
  - **Carpals** – wrist bones
  - **Metacarpals** – hand bones
  - **Phalanges** – finger bones

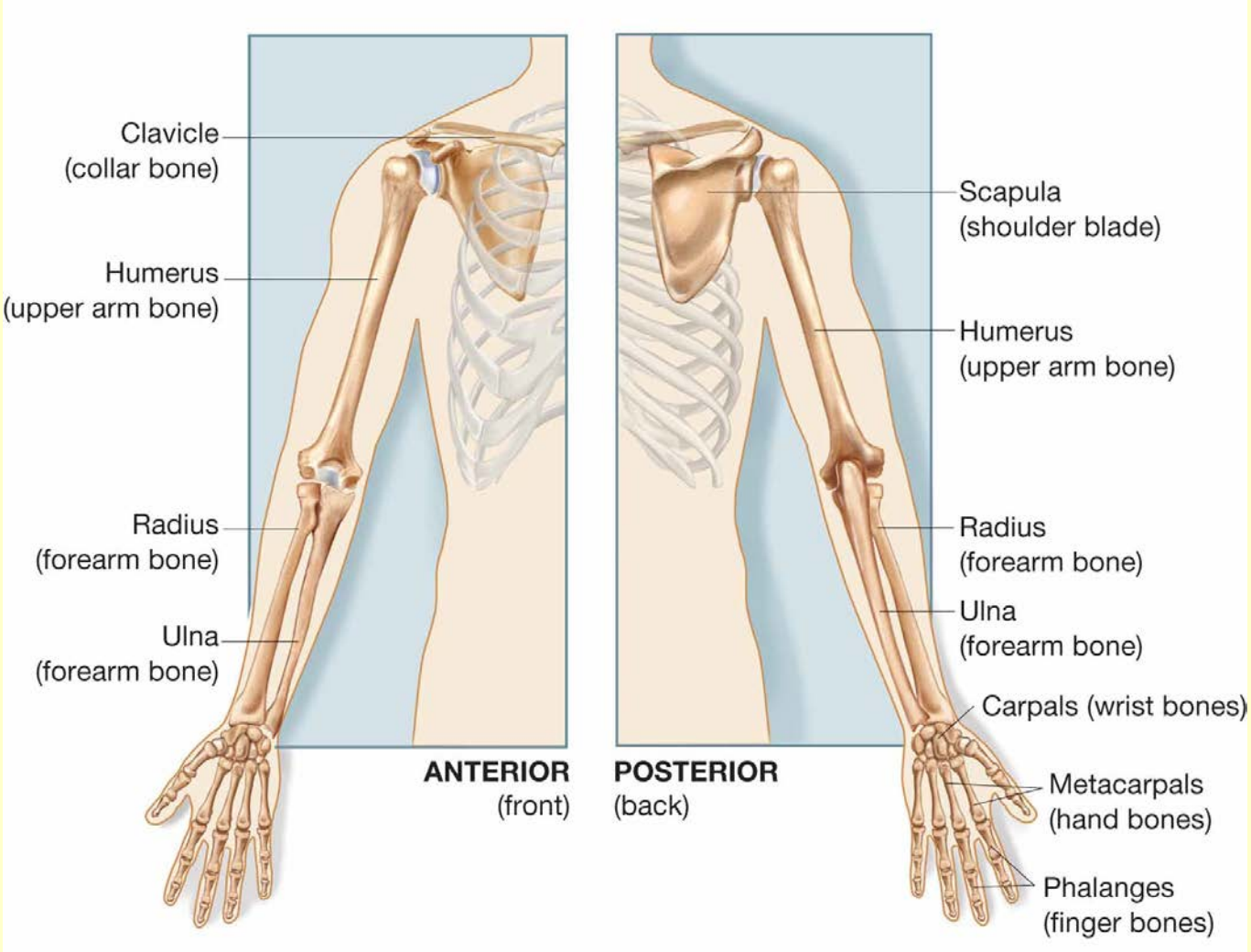


Figure 4.9 – Anatomical and common names for the Shoulder girdle and upper extremity.

Pelvic Girdle

- Also called **innominate bone**, or **hipbone**
- Attaches lower extremity to axial skeleton
- Articulates with sacrum posteriorly
- Consists of:
  - **Ilium**
  - **Ischium**
  - **Pubis**

Lower Extremity

- Leg
- Consists of:
  - **Femur** – thigh bone
  - **Patella** – knee cap
  - **Tibia** – shin bone
  - **Fibula** – lower leg bone
  - **Tarsals** – ankle bones
  - **Metatarsals** – foot bones
  - **Phalanges** – toe bones

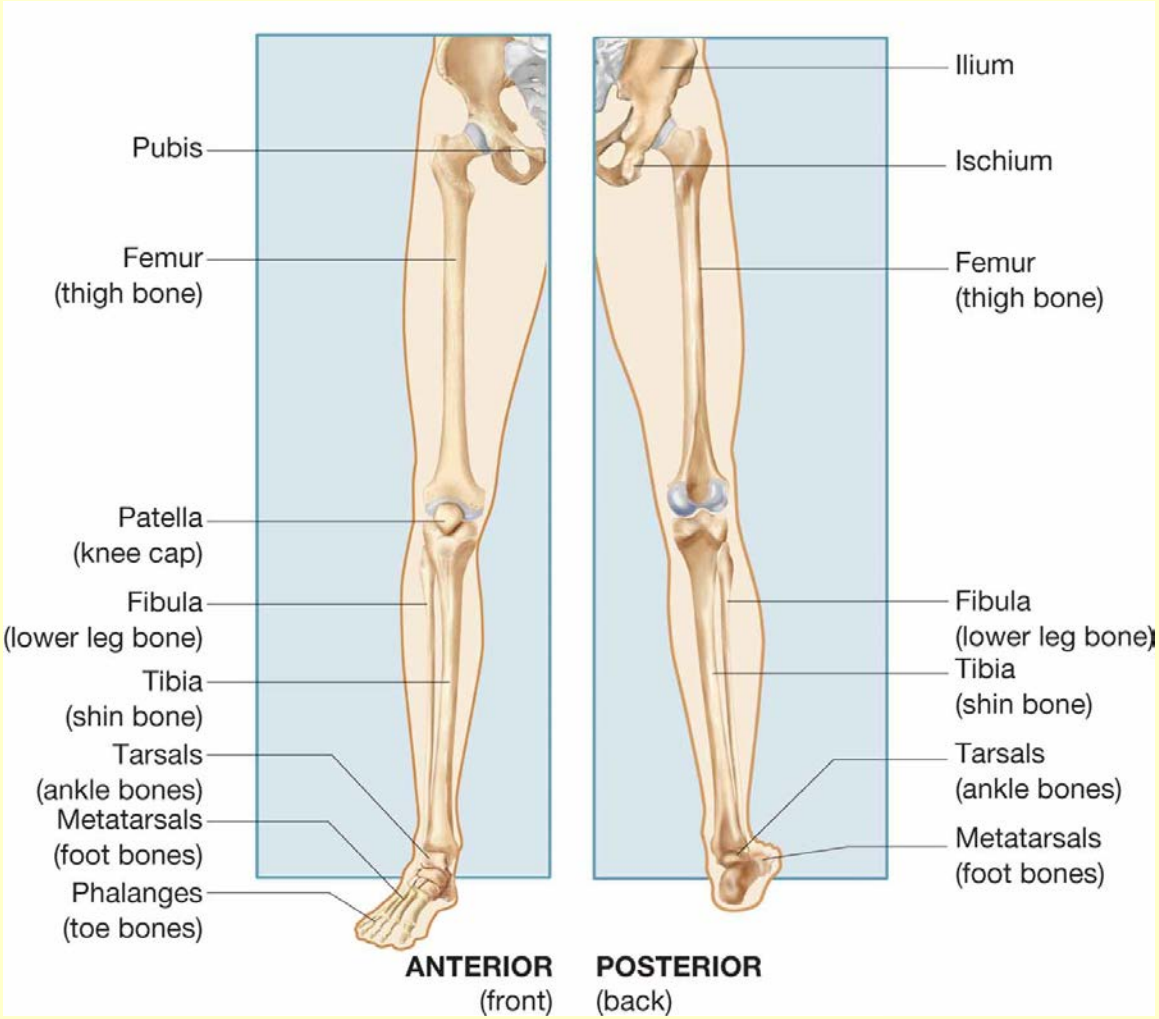


Figure 4.10 – Anatomical and common names for the pelvic girdle and lower extremity.

Joints

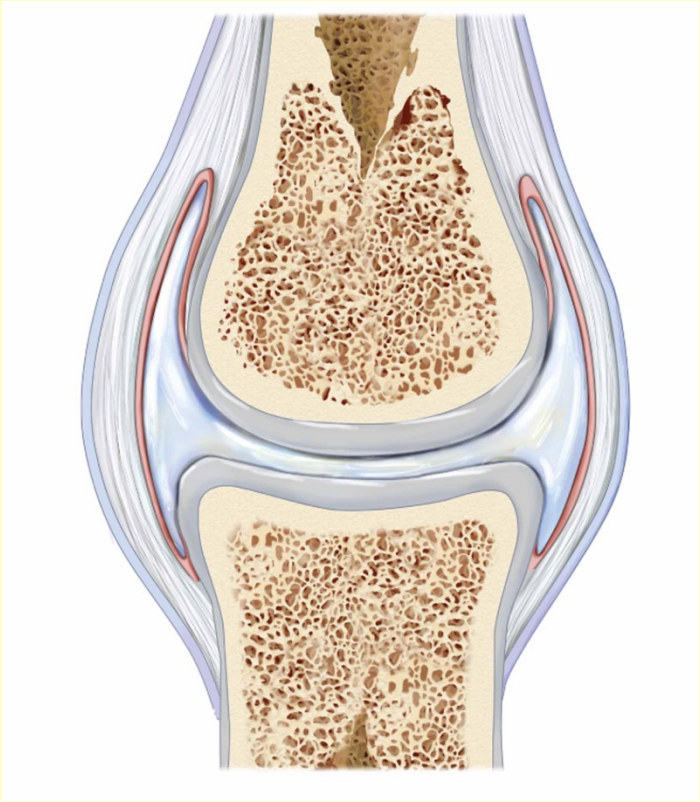
- Formed where two bones meet
- Also called an **articulation**
- Three types based on movement allowed between the 2 bones:
  - **Synovial**
  - **Cartilaginous**
  - **Fibrous**
  - **Syndesmosis**

Synovial Joints

- AKA Diarthroses
- Freely moving joints
- Most common type of joint
- Example is ball-and-socket joint
- Bones held together by **ligaments**
  - Strong bands of connective tissue
- May have bursa – fluid filled sac to protect structures

Synovial Joints

- Enclosed in an elastic **joint capsule**
- Contains **synovial fluid**
  - Lubricant secreted by **synovial membrane**
- Ends of bones are covered with **articular cartilage**



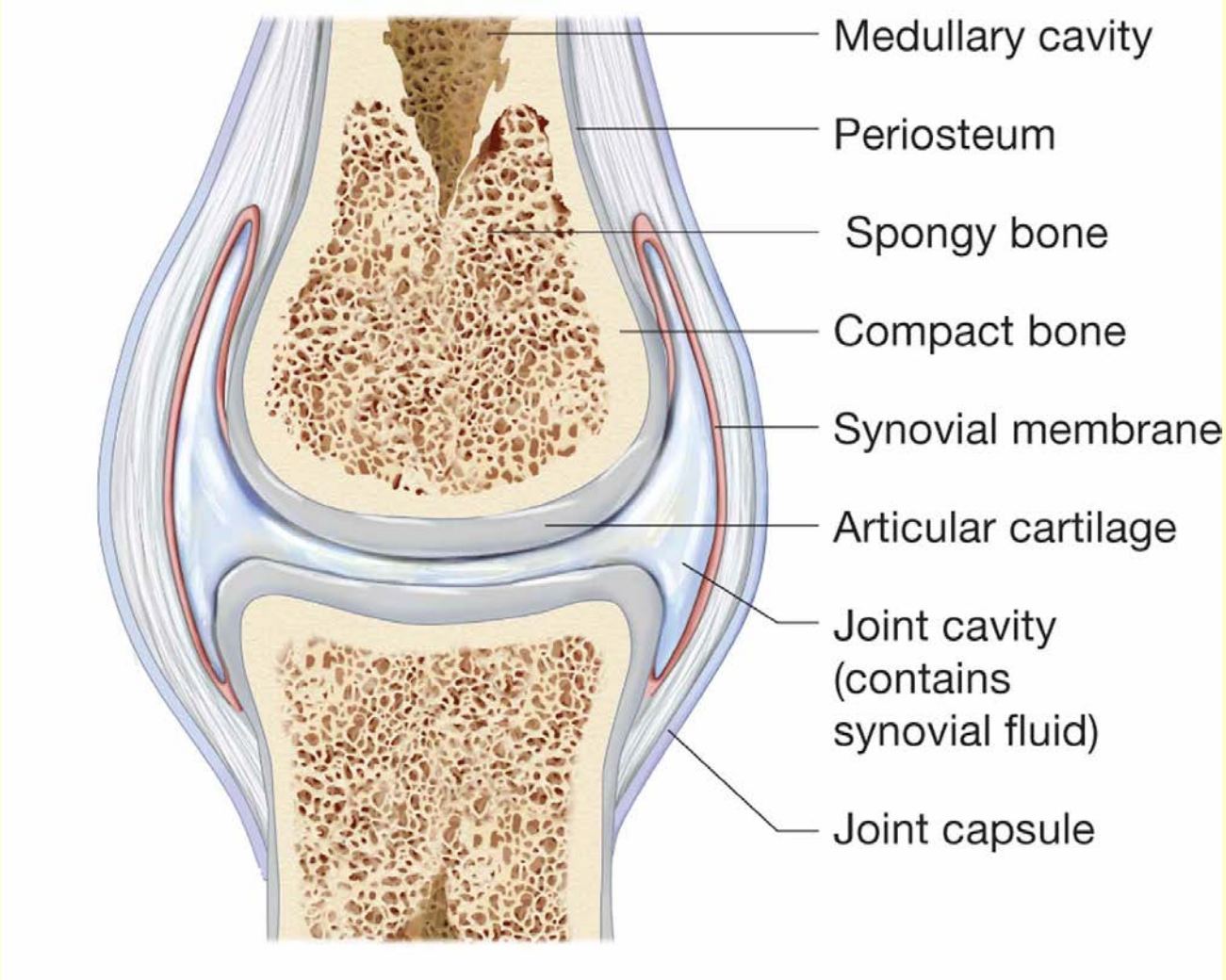


Figure 4.12 – Structure of a synovial joint.

Cartilaginous Joints

- AKA Amphiarthroses
- Allow slight movement
- Hold bones firmly in place by solid piece of cartilage
- Example
  - Pubic symphysis

Fibrous Joints

- Allow almost no movement
- Joined by thick fibrous tissue
- Example
  - Sutures of the skull
- Syndesmosis

Syndesmosis

- A band between two bones
  - Interosseus membrane
- Seen between ulnar and radius and tibia and fibula

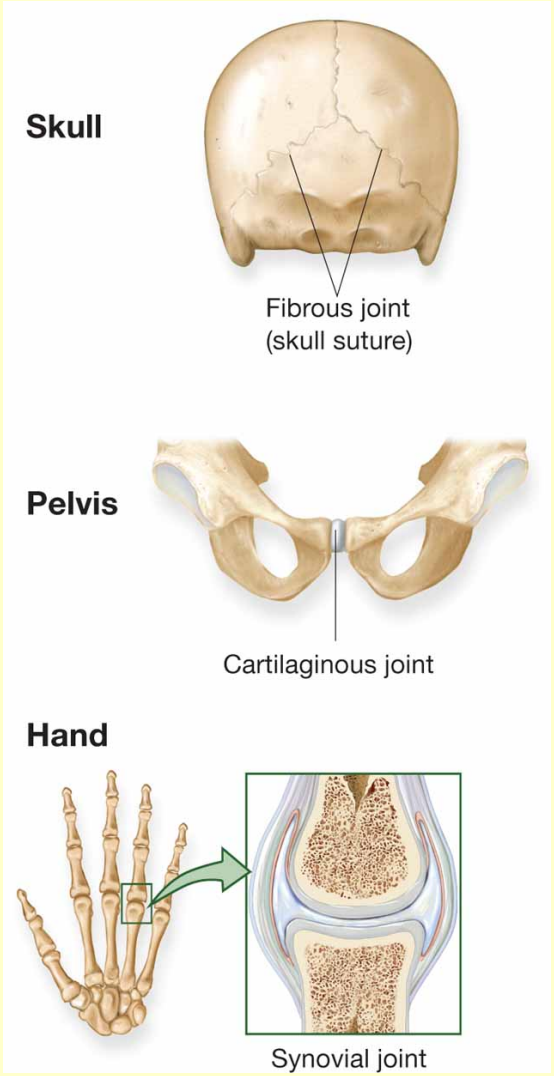


Figure 4.11 – Examples of three types of joints found in the body.

Word Building with arthr/o

–algia	arthralgia	joint pain
–centesis	arthrocentesis	puncture to withdraw fluid from joint
–clasia	arthroclasia	surgically break a joint
–desis	arthrodesis	fusion of a joint
–gram	arthrogram	record of a joint
–itis	arthritis	joint inflammation
–otomy	arthrotomy	incision into a joint
–scope	arthroscope	instrument to view joint

Word Building with burs/o & chondr/o

–ectomy	bursectomy	surgical removal of bursa
–itis	bursitis	inflammation of bursa

–ectomy	chondrectomy	surgical removal of cartilage
–malacia	chondromalacia	softening of cartilage
–oma	chondroma	cartilage tumor
–plasty	chondroplasty	surgical repair of cartilage

Word Building with cortic/o and crani/o

–al	cortical	pertaining to the outer portion

intra– –al	intracranial	pertaining to inside the skull
–otomy	craniotomy	incision into the skull

Word Building with medull/o & myel/o

–ary	medullary	pertaining to the inner portion

–oma	myeloma	red bone marrow tumor

Word Building with oste/o

–algia	ostealgia	bone pain
chondr/o –oma	osteochondroma	bone and cartilage tumor
–clasia	osteoclasia	surgically break a bone
myel/o –itis	osteomyelitis	bone and bone marrow inflammation
–otomy	osteotomy	incision into bone
–pathy	osteopathy	bone disease
–tome	osteotome	instrument to cut bone

Word Building with synov/o & vertebr/o

–itis	synovitis	inflammation of synovial membrane
–ectomy	synovectomy	surgical removal of synovial membrane

inter– –al	intervertebral	pertaining to between vertebrae

Adjective Forms of Bone Names

iliac	ilium
carpal	carpus
cervical	neck
costal	rib
cranial	cranium
femoral	femur
humeral	humerus

ischial	ischium
metacarpal	metacarpus
metatarsal	metatarsus
radial	radius
sacral	sacrum
sternal	sternum
tarsal	tarsus

Adjective Forms of Bone Names

tibial	tibia
clavicular	clavicle
fibular	fibula
lumbar	low back
mandibular	mandible
patellar	patella
scapular	scapula

ulnar	ulna
maxillary	maxilla
coccygeal	coccyx
phalangeal	phalanges
pelvic	pelvis
pubic	pubis
thoracic	thorax

Skeletal System Vocabulary

callus	mass of bone tissue that forms at fracture site during healing
manipulation	Moving a joint beyond the normal anatomical range of motion
crepitation	noise produced by bones or cartilage rubbing together
osteophyte	bone spur

Skeletal System Vocabulary

kyphosis	abnormal increase in curve of thoracic spine; humpback
lordosis	abnormal increase in forward curvature of lumbar spine; swayback
orthopedics	branch of medicine specializing in diagnosis and treatment of musculoskeletal system; physician is an orthopedist

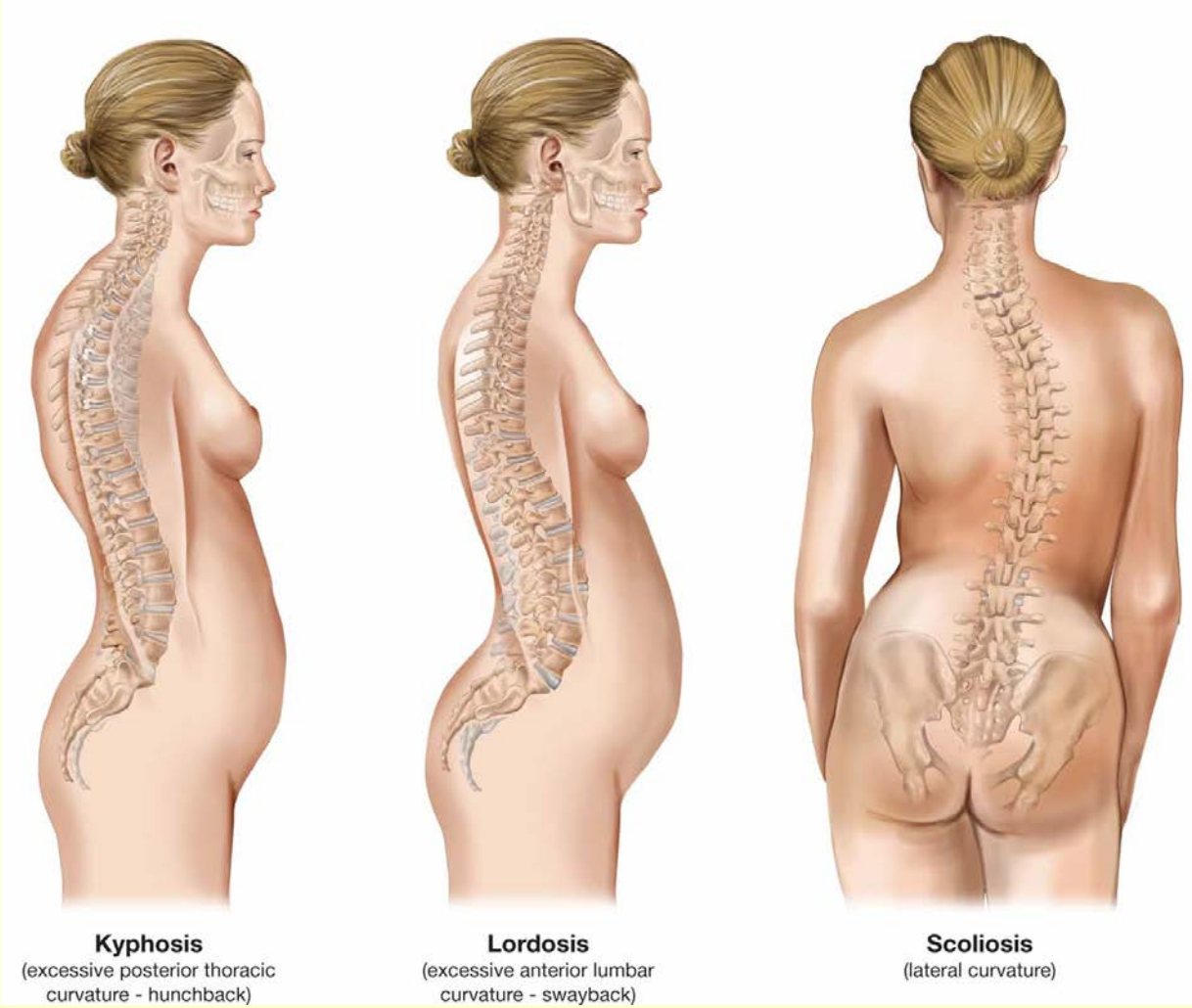


Figure 4.13 – Abnormal spinal curvatures: kyphosis, lordosis, and scoliosis.

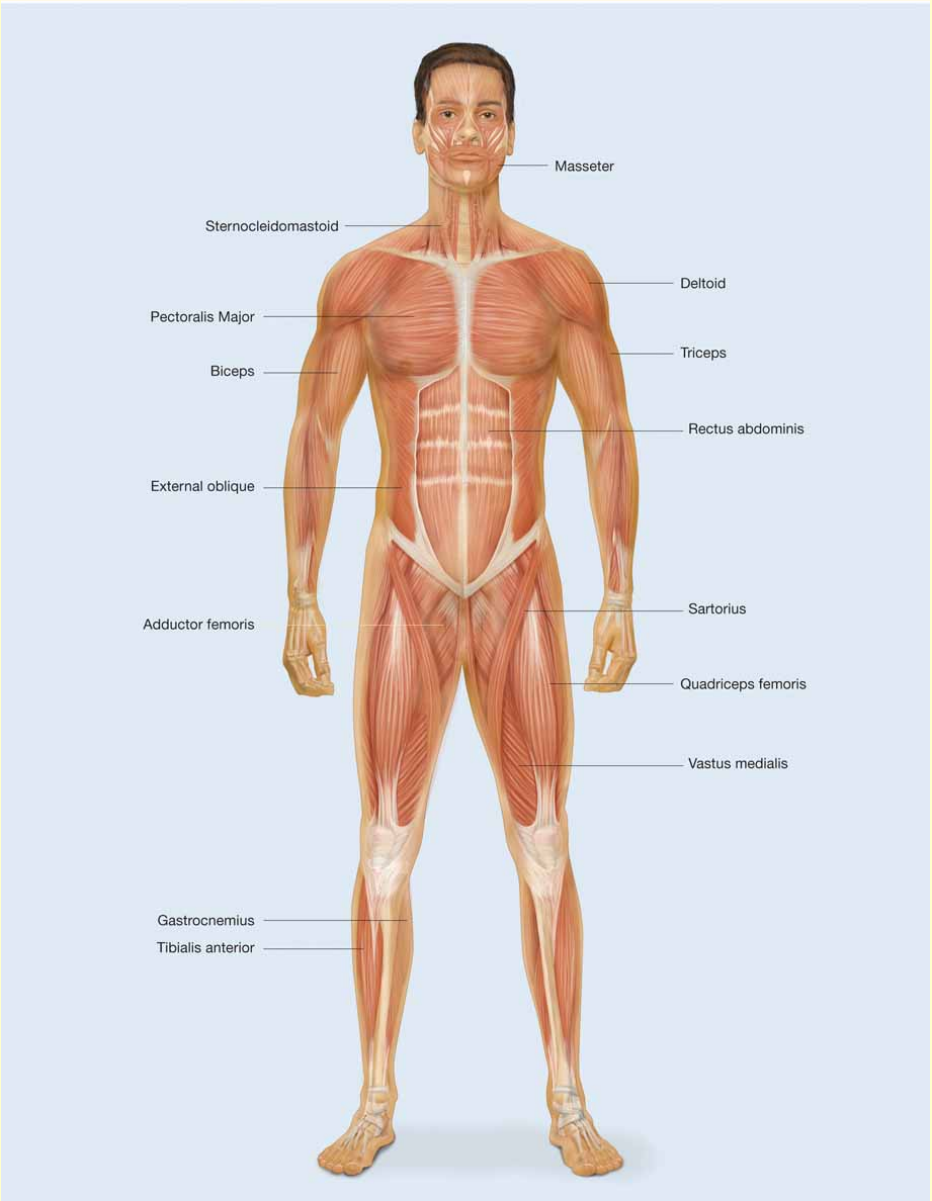
Muscular System at a Glance

- Function of Muscular System
  - Individual cells are able to contract or shorten in length
  - Shortening produces movement

Muscular System at a Glance

- Organs of Muscular System
  - Muscles

Muscular System Illustrated



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Muscular System Combining Forms

- fasci/o fibrous band
- fibr/o fibers
- kinesi/o movement
- muscul/o muscle
- my/o muscle

Muscular System Combining Forms

- myocardi/o heart muscle
- myos/o muscle
- plant/o sole of foot
- ten/o tendon
- tend/o tendon
- tendin/o tendon

Muscular System Suffixes

- –asthenia weakness
- –kinesia movement
- –tonia tone

Muscular System Prefixes

- ab– away from
- ad– towards
- circum– around

Anatomy and Physiology

- Bundles of parallel **muscle tissue fibers**
- Fibers contract
  - Shorten in length
  - Produce movement
  - Move bones closer together
  - Push food through digestive system
  - Pump blood through blood vessels

Types of Muscles

- **Skeletal muscle**
- **Smooth muscle**
- **Cardiac muscle**
- Voluntary muscles
  - Consciously choose to contract the muscle
  - Skeletal muscles
- Involuntary muscles
  - Under control of subconscious brain
  - Smooth muscles and cardiac muscle

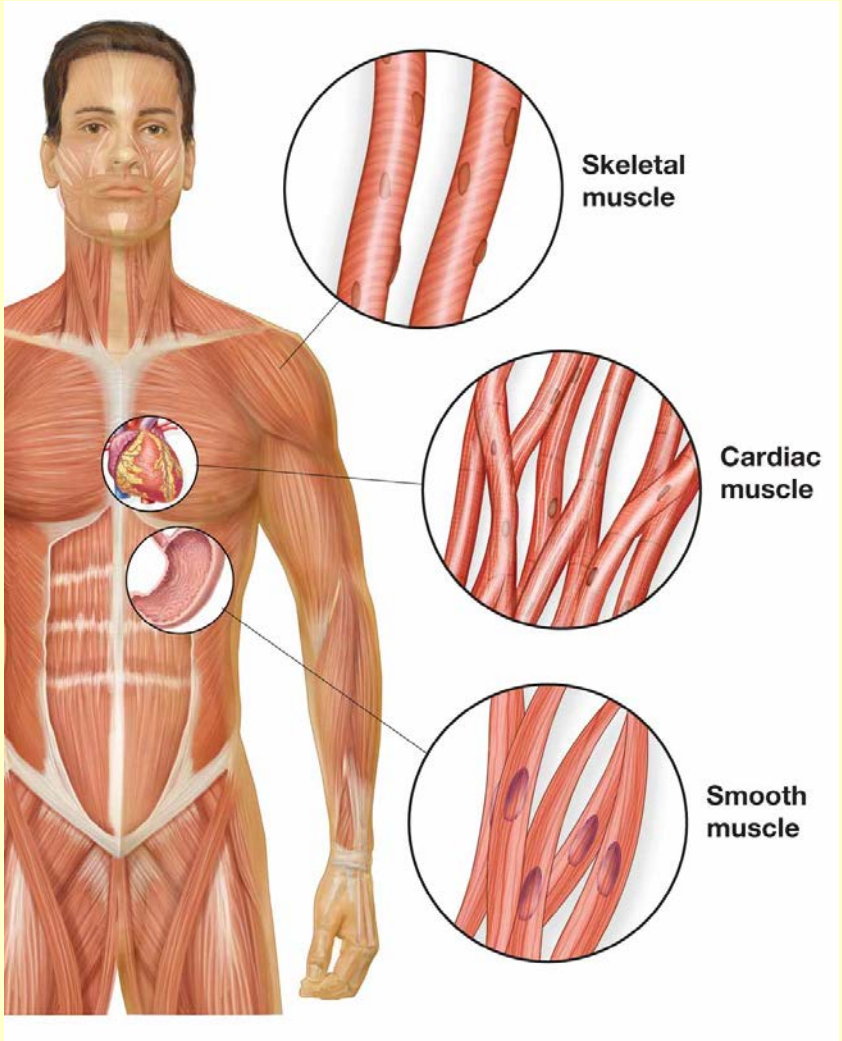

Figure 4.21 – The three types of muscles: skeletal, smooth, and cardiac.

Skeletal Muscles

- Attached to bones
- Produce voluntary movement of skeleton
- Also referred to as **striated muscle**
  - Looks striped under microscope

Skeletal Muscles

- Muscle is wrapped in layers of connective tissue
  - Called **fascia**
  - Tapers at the end to form **tendon**
  - Inserts into periosteum to attach muscle to bone
- Are stimulated by **motor neurons**
  - Point of contact with muscle fiber is called **neuromuscular junction**

Smooth Muscles

- Associated with internal organs
  - Also called **visceral muscle**
  - Stomach
  - Respiratory airways
  - Blood vessels
- Called smooth because has no microscopic stripes
- Produces involuntary movement of these organs

Cardiac Muscle

- Also called **myocardium**
- Makes up walls of heart
- Involuntary contraction of heart to pump blood

A Few Muscle Names – but how?

By location	rectus abdominis	straight abdominal muscle
By origin and insertion	sternocleidomastoid	named for its two origins: sternum and clavicle
By size	gluteus maximus	large buttock muscle

A Few Muscle Names – but how?

By action	flexor carpi	muscle that bends the wrist
By fiber direction	external oblique	abdominal with fibers running on an angle
By number of attachment points	biceps	muscle with two heads

Skeletal Muscle Actions

- Skeletal muscles attach to two different bones and overlap a joint
- When muscle contracts both bones move, but not equally
  - **Origin**: less moveable of 2 bones
  - **Insertion**: more moveable of 2 bones

Movement Terminology

abduction	movement away from midline of body
adduction	movement toward midline of body

flexion	act of bending or being bent
extension	brings limb into a straight condition

dorsiflexion	backward bending of foot
plantar flexion	bending sole of foot; pointing toes

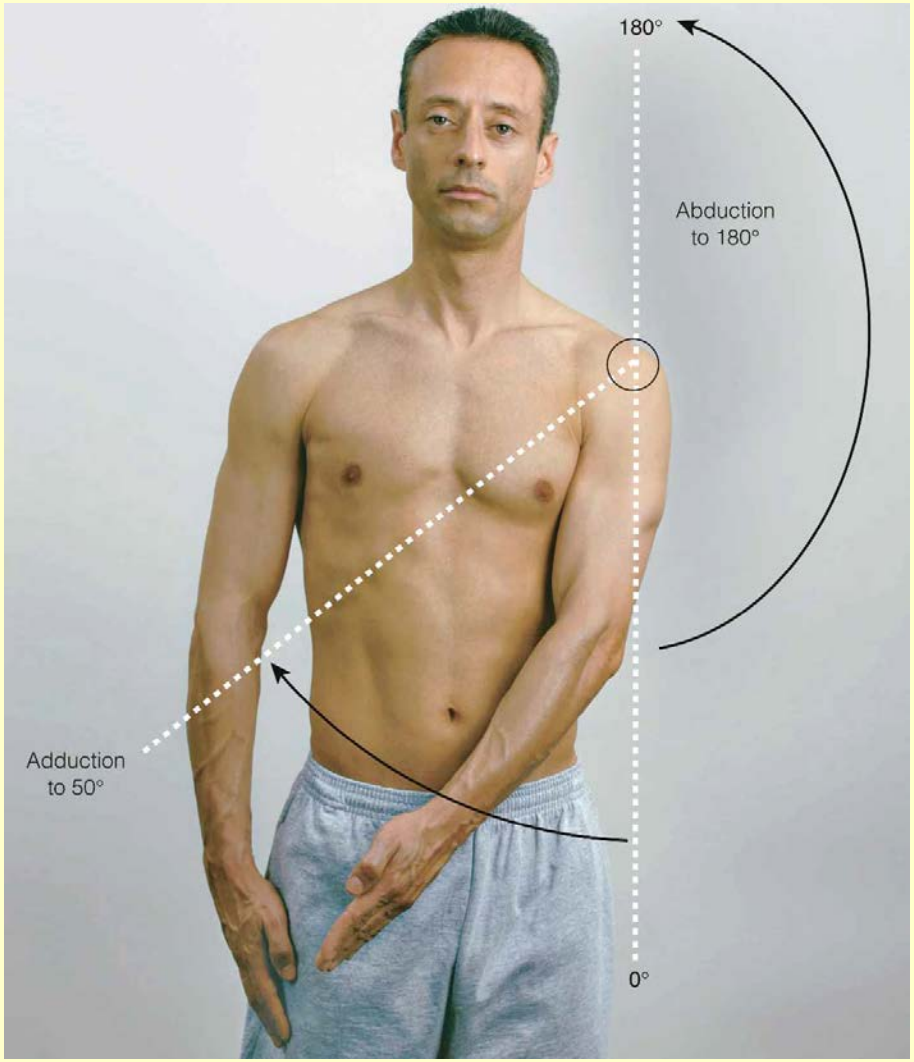

Figure 4.23 – Abduction and adduction.

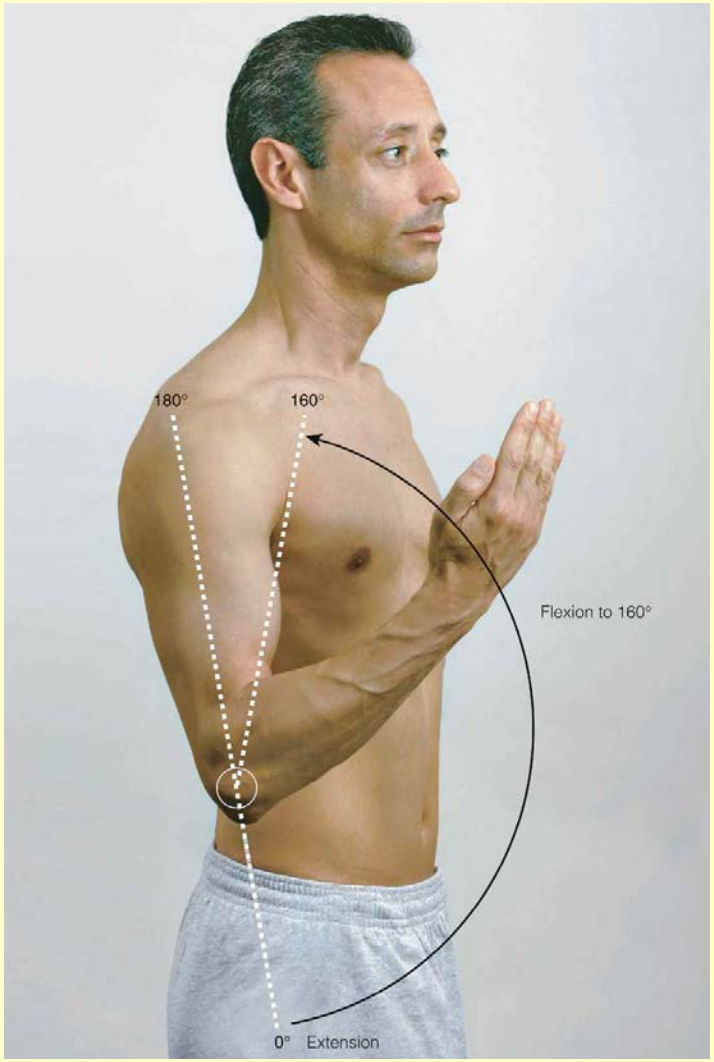

Figure 4.24 – Flexion and extension.

Figure 4.25 – Dorsiflexion and plantar flexion.

Movement Terminology

eversion	turning outward
inversion	turning inward

pronation	turning palm downward
supination	turning palm upward

elevation	to raise
depression	to drop down

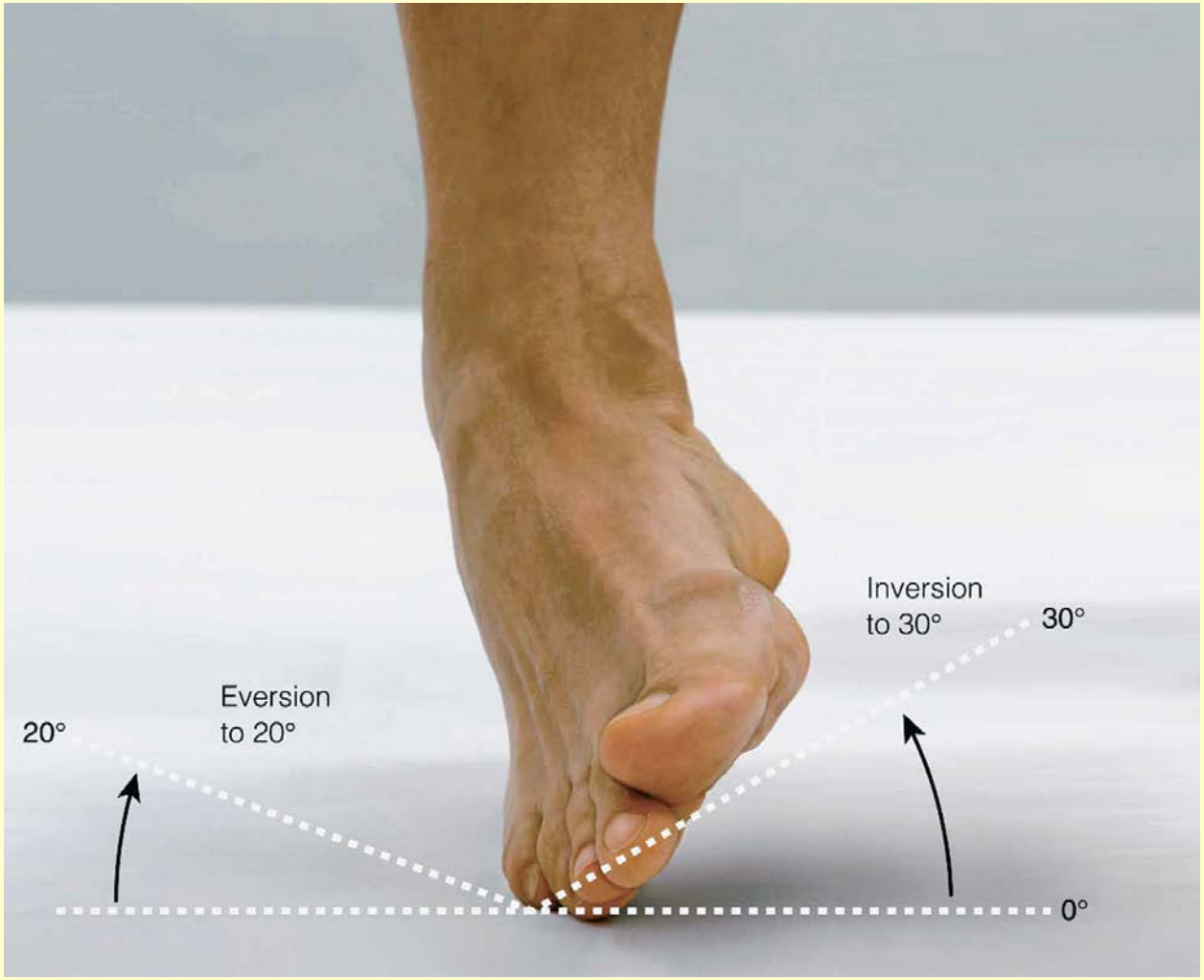

Figure 4.26 – Eversion and inversion.

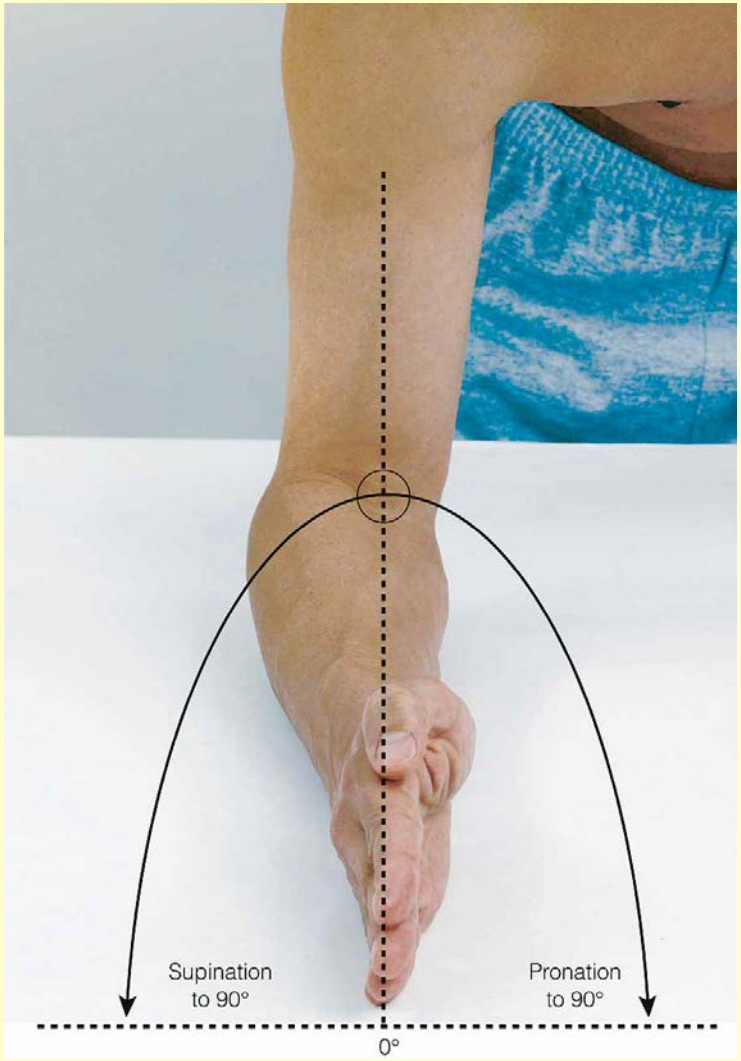

Figure 4.27 – Pronation and supination.

Different Circular Movements

- **Circumduction**
  - Movement in circular direction from a central point
- **Opposition**
  - Moving thumb away from palm to contact tip of other fingers
- **Rotation**
  - Moving around a central axis