

Skeletal System

Skeleton

- Axial Skeleton-Bones that form the longitudinal axis of the body (skull and spinal column).
- Appendicular Skeleton-Bones of the limbs and girdles.
- Also include joints, ligaments and cartilage.

Function of Bones

- Support
- Protection
- Movement
- Storage
- Blood cell formation

Support

- Forms the internal framework that supports and anchors all soft organs.

Protection

- Protect the soft organs like the brain, spinal cord and organs of the digestive, reparatory and reproductive systems.

Movement

- Muscles attached to bones via tendons.

Storage

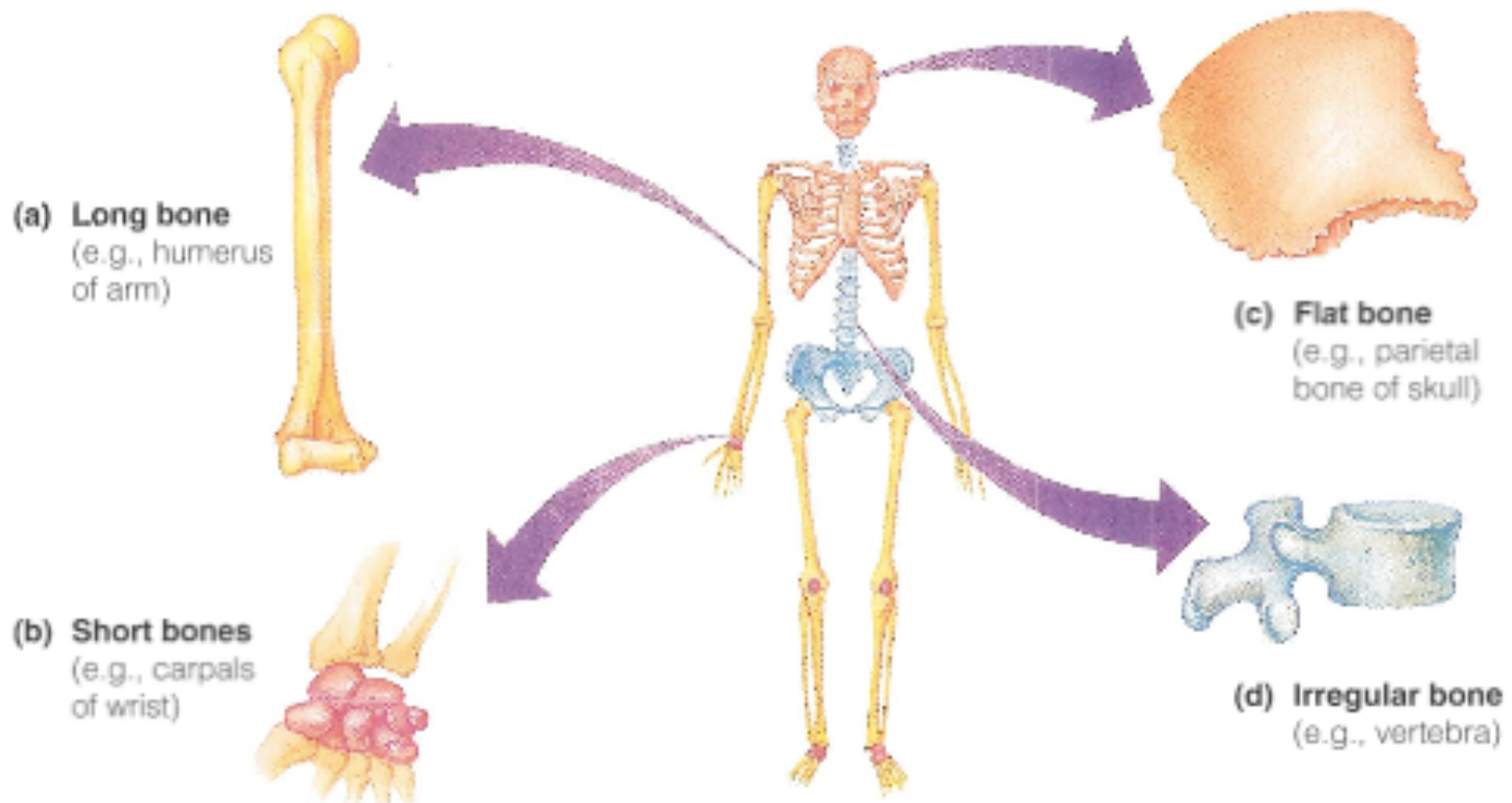
- Fat is stored in the cavities of the bone.
- Minerals like calcium and phosphorus are stored in the actual bone.

Blood Cell Formation

- Blood cells are formed in the marrow cavities of certain bones.

Types of Bones

- Compact Bones-Dense smooth looking bones.
- Spongy Bones-Small needle like pieces of bone and lots of open spaces.
- Long Bones-Longer than they are wide
- Short Bones-Cube shape made of mostly spongy bone.
- Flat Bones-Thin and flat, usually curved.
- Irregular Bones-Found in the backbone.



(a) Long bone
(e.g., humerus
of arm)

(b) Short bones
(e.g., carpals
of wrist)

(c) Flat bone
(e.g., parietal
bone of skull)

(d) Irregular bone
(e.g., vertebra)

Structure of a Long Bone

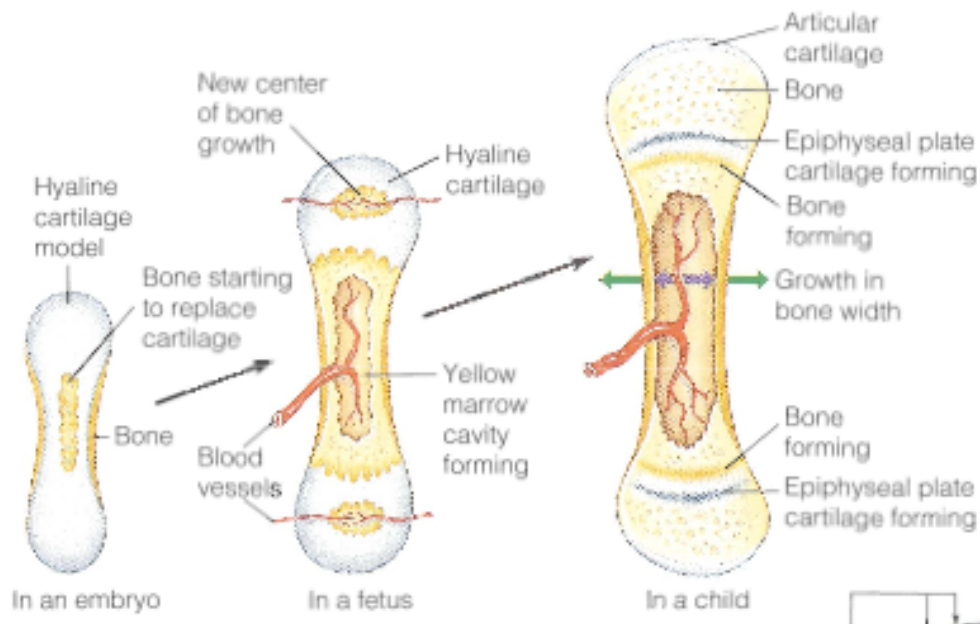
- Long shaft is called the diaphysis (compact bone).
- Covered and protected by a fibrous connective membrane called periosteum.
- Sharpey's fibers secure the the periosteum to the underling bone.
- The end of the long bones are called epiphyses.

Functions Within a Long Bone

- Epiphysis-Site of spongy bone and hematopoiesis (blood formation) in adults.
- Hematopoiesis also occurs in the red marrow of the epiphysis.
- Diaphysis-Long bone shaft containing the compact bone.
- Yellow marrow cavity-Contains yellow marrow and is the site for fat storage.

Growth of the Bone

- Longitudinal growth occurs along the epiphyseal plate.



Articular Cartilage

- A glassy hyaline cartilage at the end of the bones provides a slippery surface that decreases the friction at joints.

Epiphyseal Line

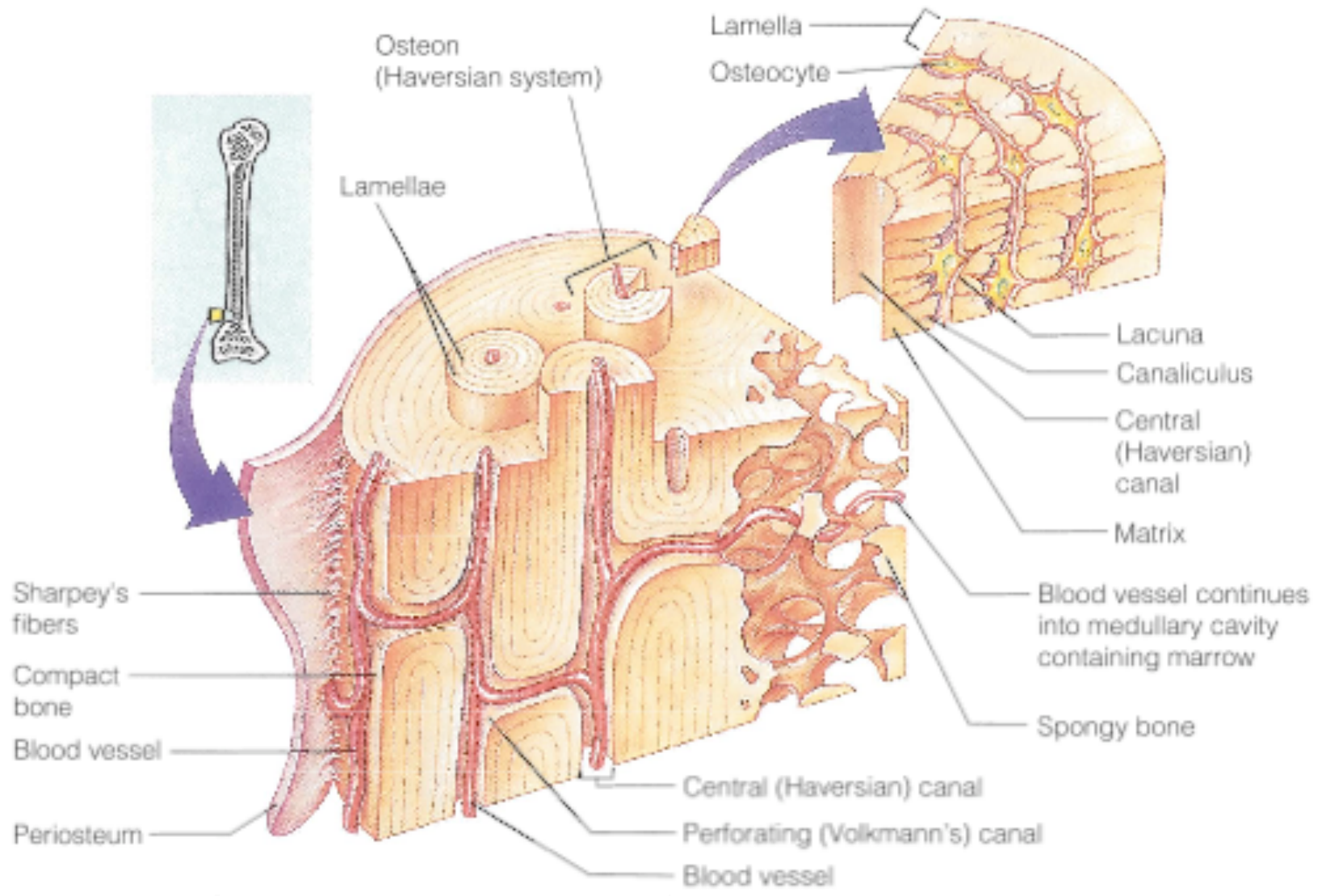
- A remnant of the epiphyseal plate seen in young growing bone which allows for lengthwise growth.

Shaft

- In the cavity of the shaft fat tissue is present called yellow marrow.
- In young bones, red marrow is found there producing blood cells.
- In adults, red marrow is found in the cavities of spongy bone of flat bones.

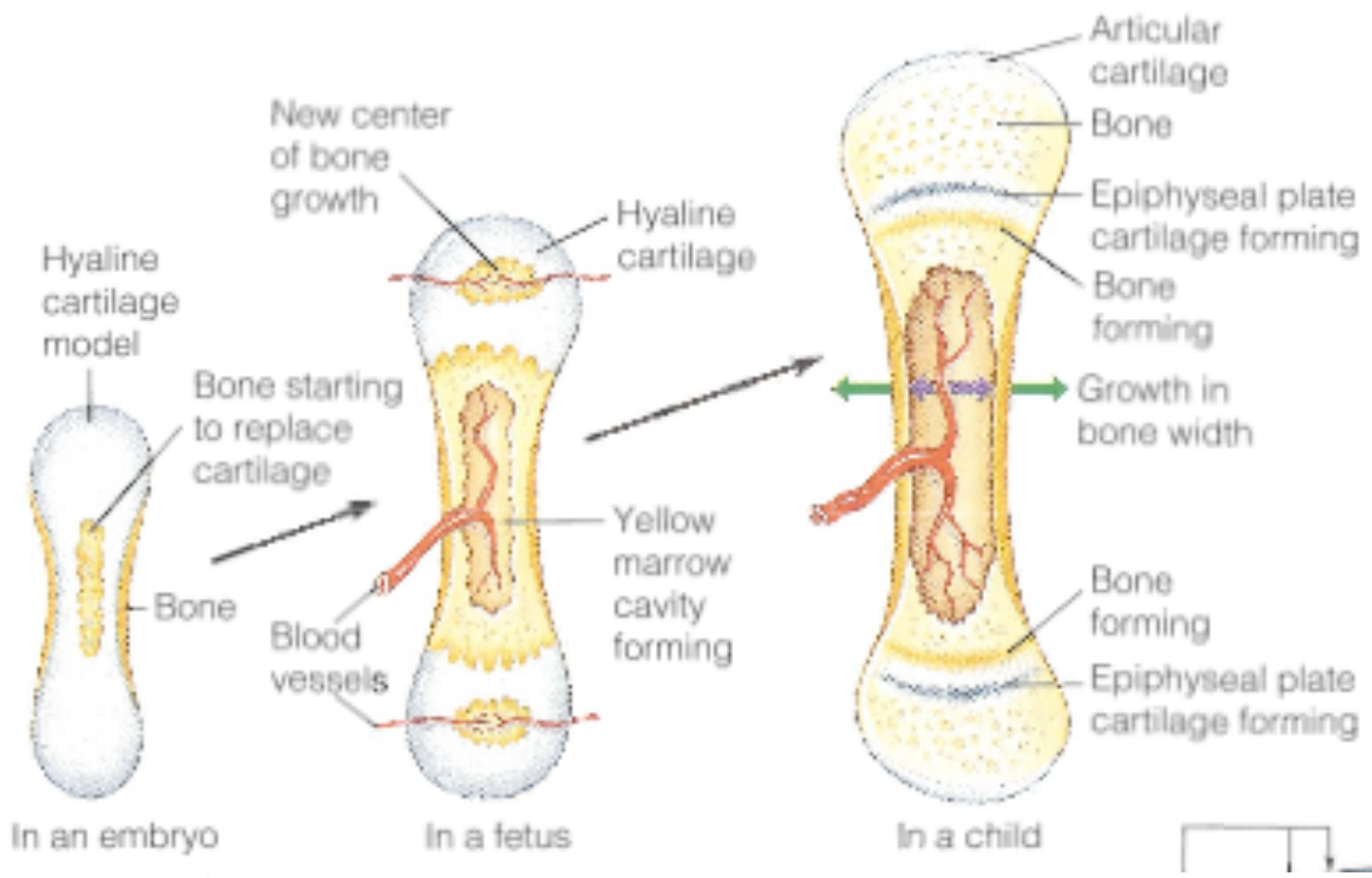
Microscopic Anatomy

- Bone cells called osteocytes are in a matrix called lacunae arranged in tiny circles called lamellae around central (Haversian) canals which run lengthwise and carry blood vessels.
- Tiny canals called canaliculi connect the bone cells to a nutrient supply.



Bone Formation

- Two stages of ossification.
- Hyaline cartilage is covered with bone matrix by cells called osteoblasts.
- The hyaline cartilage is digested away opening a cavity within the newly formed bone.

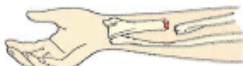


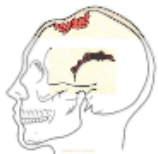
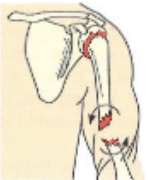



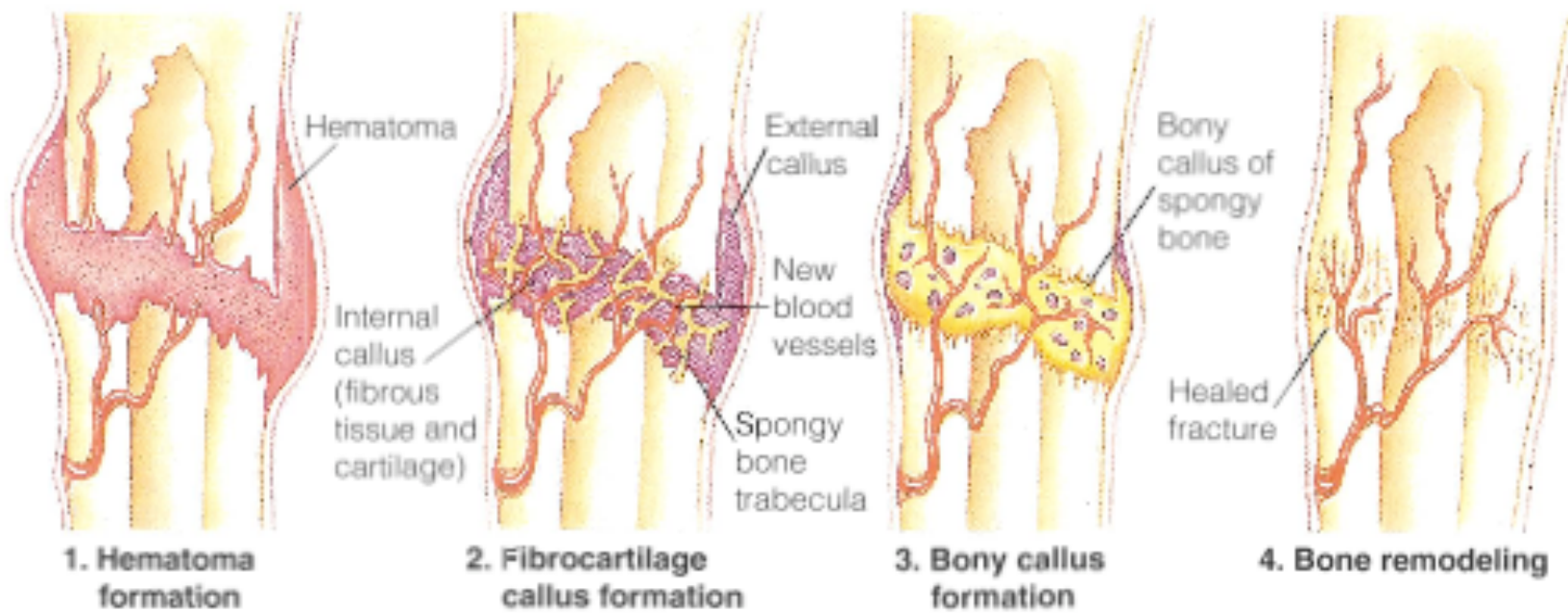
Bone Growth

- Bones widen when osteoblasts add bone tissue to the external face of the diaphysis.
- Bone growth controlled by growth hormone and sex hormones activated during puberty.

Common Types of Fractures

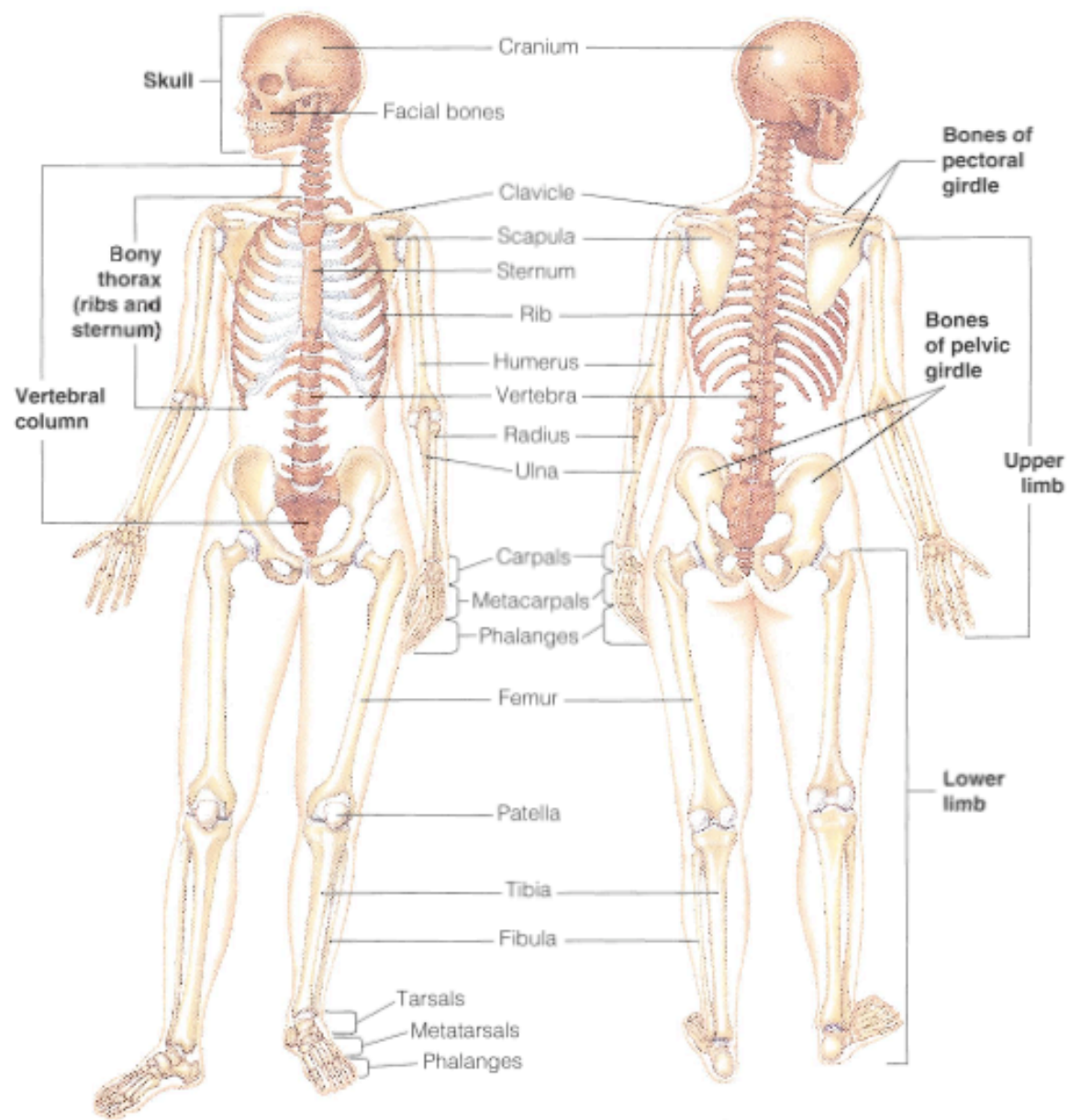
Table 5.2 Common Types of Fractures

Fracture type	Illustration	Description	Comment
Simple		Bone breaks cleanly but does not penetrate the skin.	Sometimes called a "closed fracture."
Compound		Broken ends of the bone protrude through soft tissues and the skin.	An open fracture. More serious than a simple fracture; may result in a severe bone infection (osteomyelitis), requiring massive doses of antibiotics.
Comminuted		Bone breaks into many fragments.	Particularly common in the aged, whose bones are more brittle.
Compression		Bone is crushed.	Common in porous bones (i.e., osteoporotic bones).
Depressed		Broken bone portion is pressed inward.	Typical of skull fracture.
Impacted		Broken bone ends are forced into each other.	Commonly occurs when one falls and attempts to break the fall with outstretched arms; also common in hip fractures.
Spiral		Ragged break occurs when excessive twisting forces are applied to a bone.	Common sports fracture.
Greenstick		Bone breaks incompletely, much in the way a green twig breaks.	Common in children, whose bones have relatively more collagen in their matrix and are more flexible than those of adults.



Axial Skeleton

80 BONES



(a) Anterior view

(b) Posterior view

Skull

- Cranium-Protects the brain
- Facial Bones-Holds the eyes and allows the facial muscles to convey expression.
- All bones fused together by sutures.

Cranium

- Composed of eight large flat bones.
- Frontal, Parietal (2), Temporal (2), Occipital, Ethmoid, and Sphenoid Bones.

Facial Bones

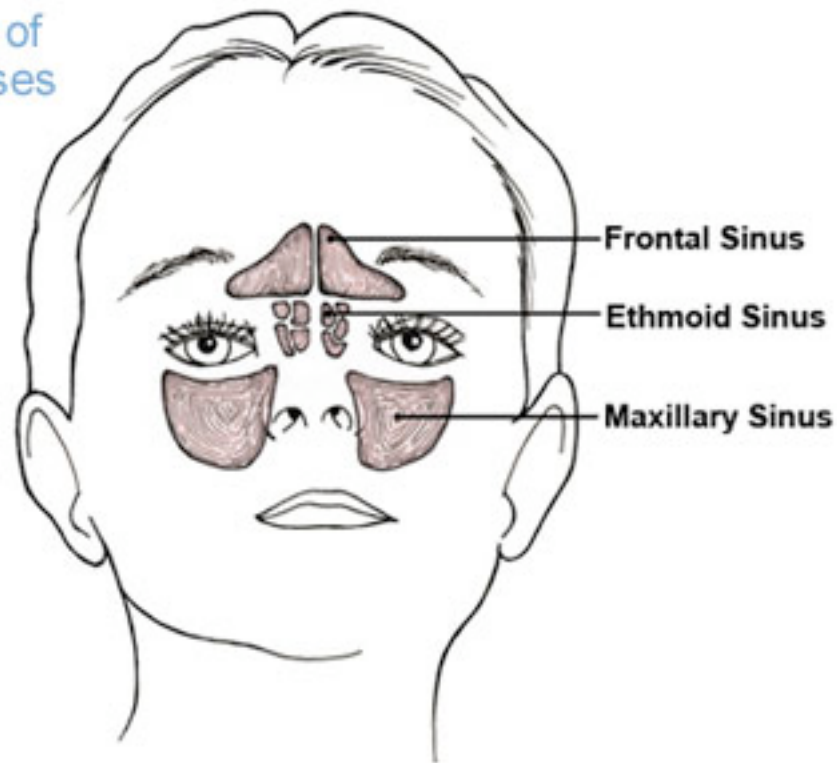
- Fourteen bones make up the face, 12 are paired.
- Paired Bones: Maxillae, Palatine, Zygomatic, Lacimal, Nasal and Interior Nasal Conchae Bones.
- Single Bones include the Mandible and Vomer Bone.

Sinuses

- Sinuses are air pockets that are located within the bones of the skull connected to your nasal passages. These channels permit air to flow from the nose into the sinuses and allow drainage of mucous from each sinus into the nose. Susceptible to infection because they connect to the nasal passage.

Major Sinus Cavities

Front view of
nasal sinuses

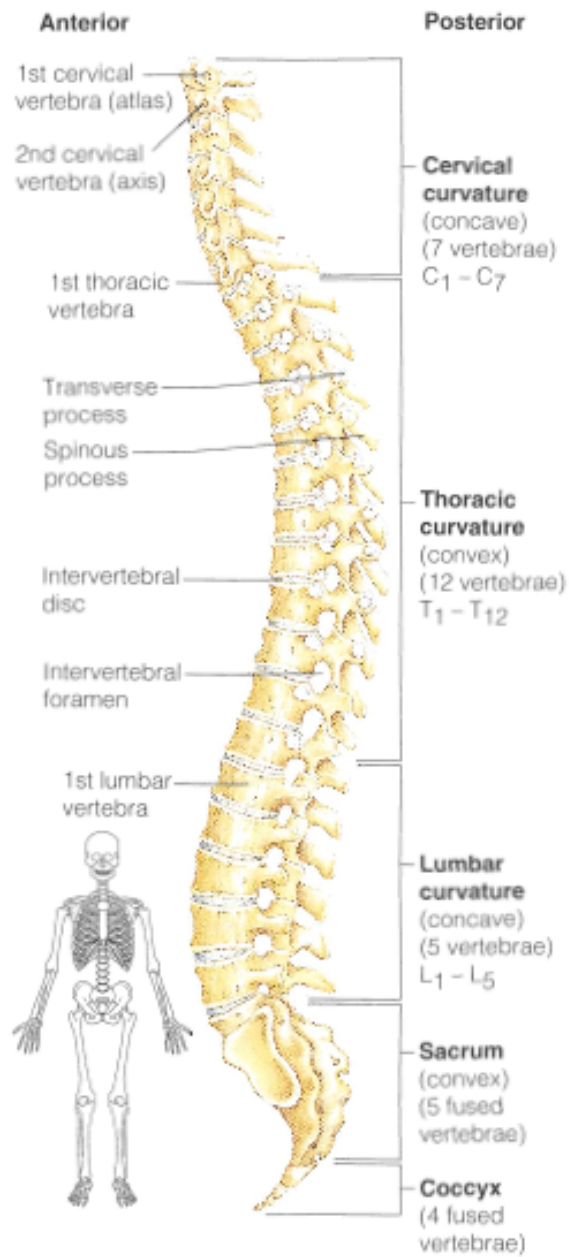


The Hyoid Bone

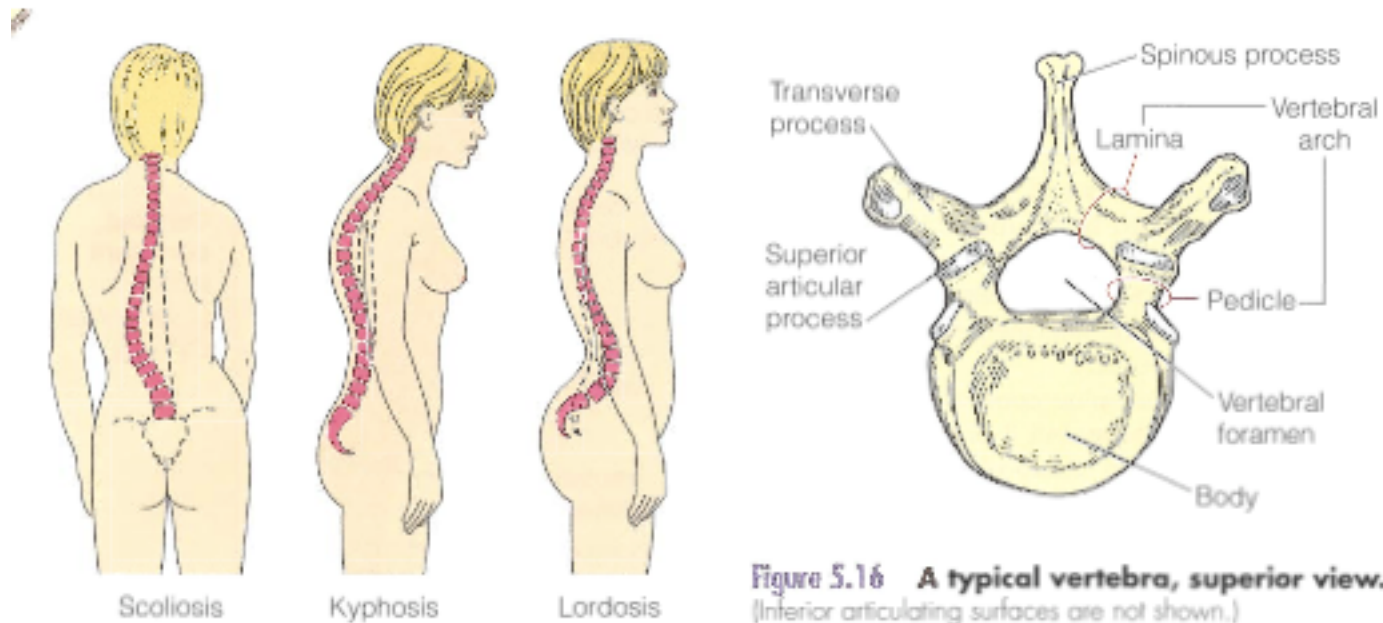
- Not really part of the skull.
- Only bone not connected to any other bone.
- Located suspended in the mid neck about 2 cm above the larynx.

Vertebral Column (Spine)

- Extends from the skull to the pelvis.
- Transmits the weight of the body to the lower limbs.
- Composed of 26 irregular bones.
- Separated by intervertebral discs, which cushion the vertebrae and give the spine flexibility.



Abnormalities of the Spine

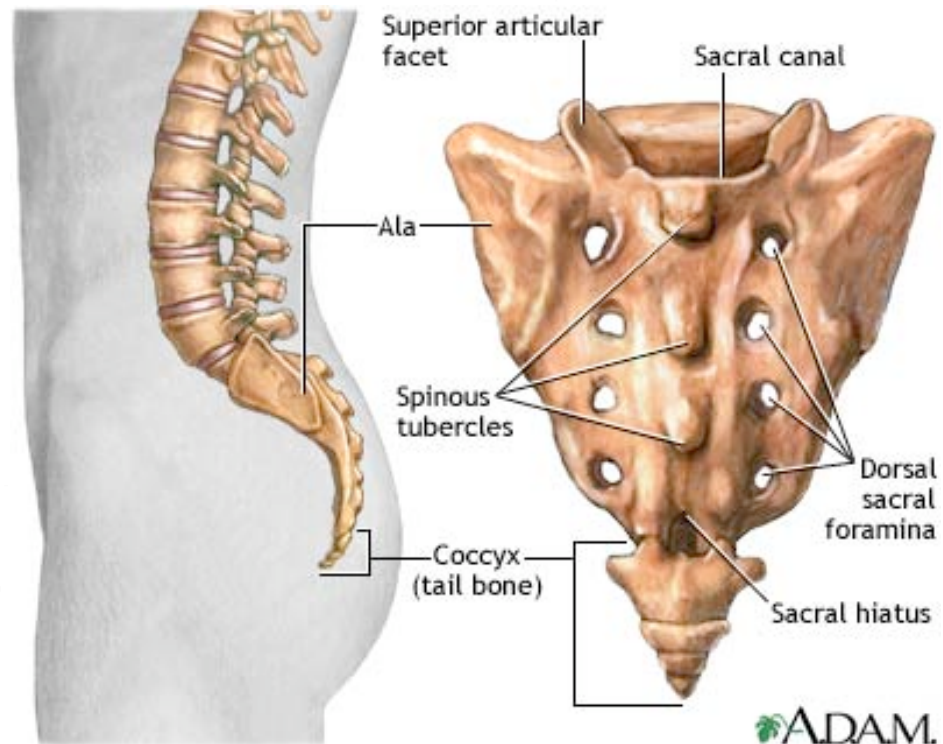


Types of Vertebrae

- Cervical-(C₁ to C₇) compose the neck region.
- Thoracic-(T₁ to T₁₂)-larger bones which the ribs attach to.
- Lumbar-(L₁ to L₅)-large, sturdy block-like bones.

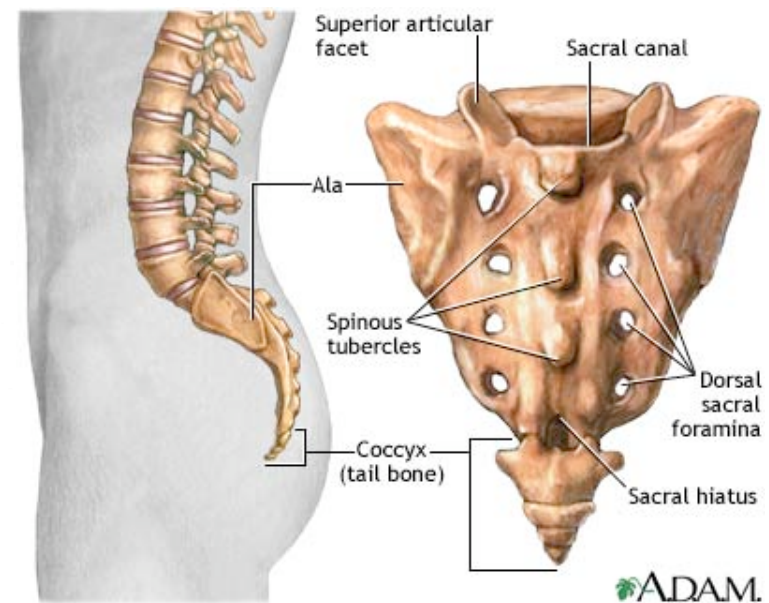
Sacrum

- 5 fused vertebrae located below L₅.



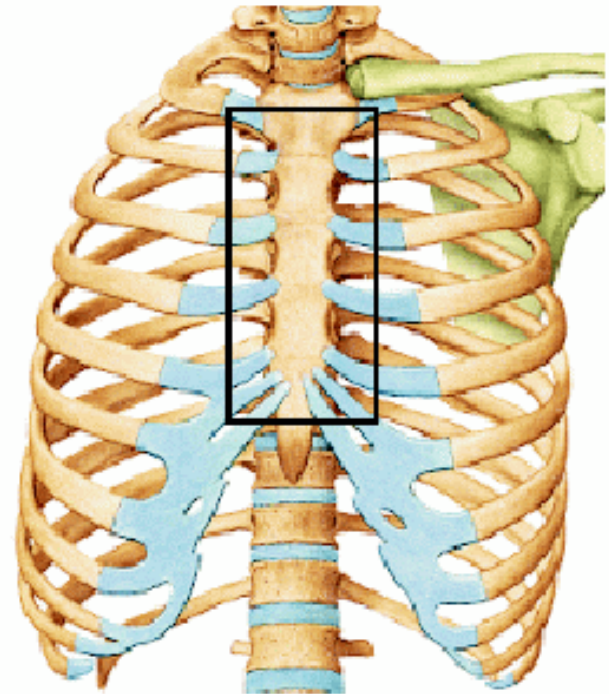
Coccyx

- Human tailbone below the sacrum composed of 3-5 tiny fused vertebrae.



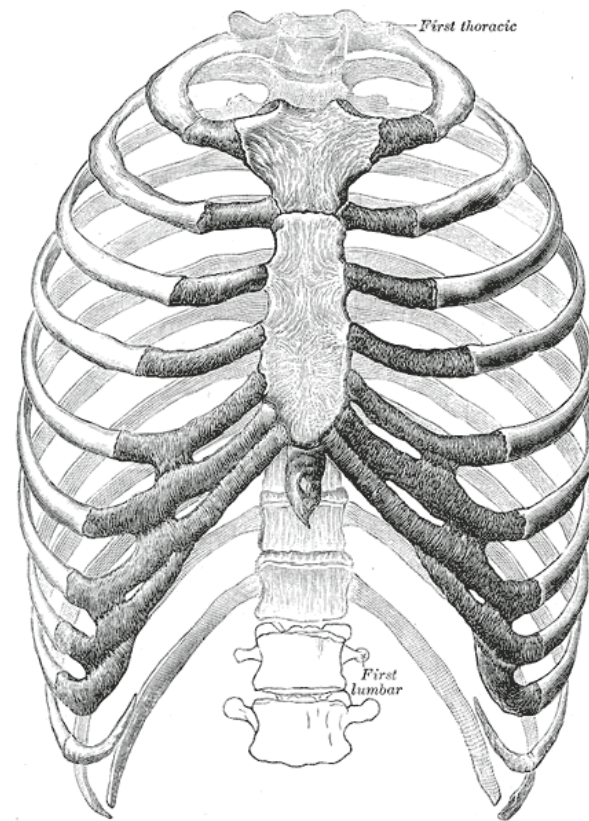
Bony Thorax

- Sternum-three fused flat bones attached to the first seven pairs of ribs anteriorly.
- Protects the heart and lungs.



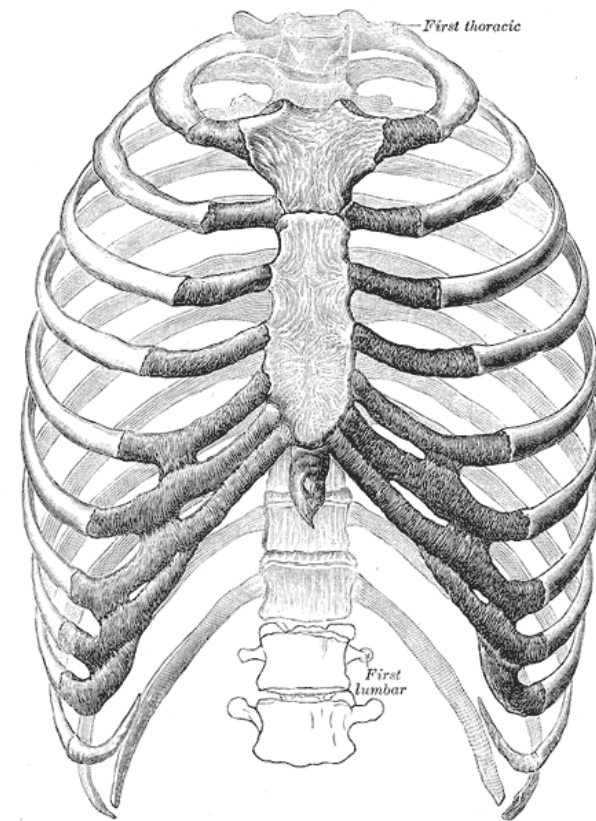
Bony Thorax

- Ribs-12 pairs. All articulate posteriorly with the thoracic vertebrae.
- The true ribs (1-7) are the first seven pairs of ribs attached to the sternum.



False Ribs

- False ribs (8-12) are the next five pairs are either attached indirectly to the sternum or lack attachment at all (floating ribs 11-12)

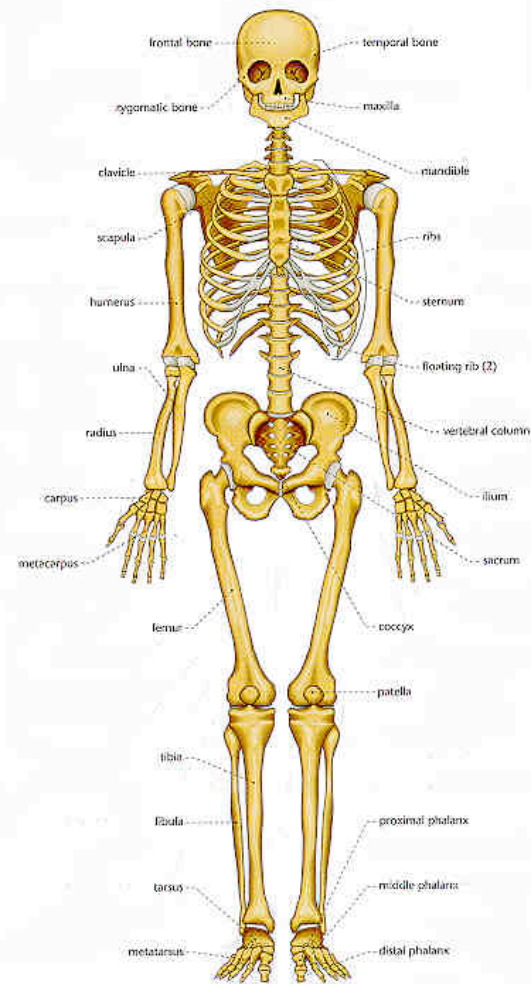


Appendicular Skeleton

126 BONES

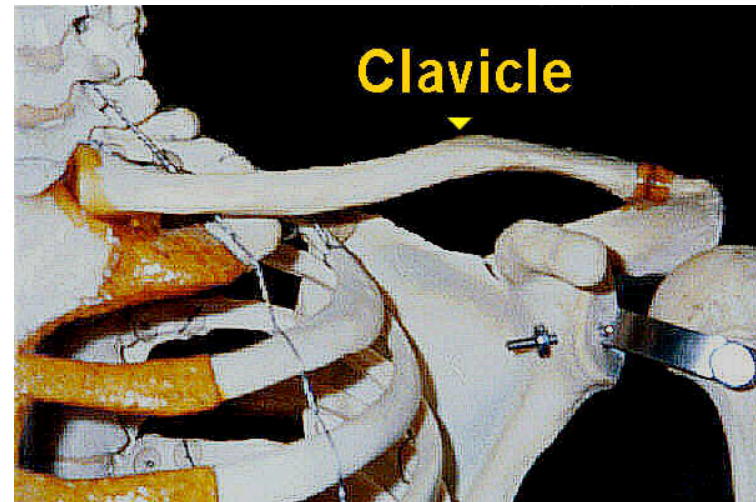
Appendicular Skeleton

- 126 bones of the limbs and girdles (pelvic and pectoral)



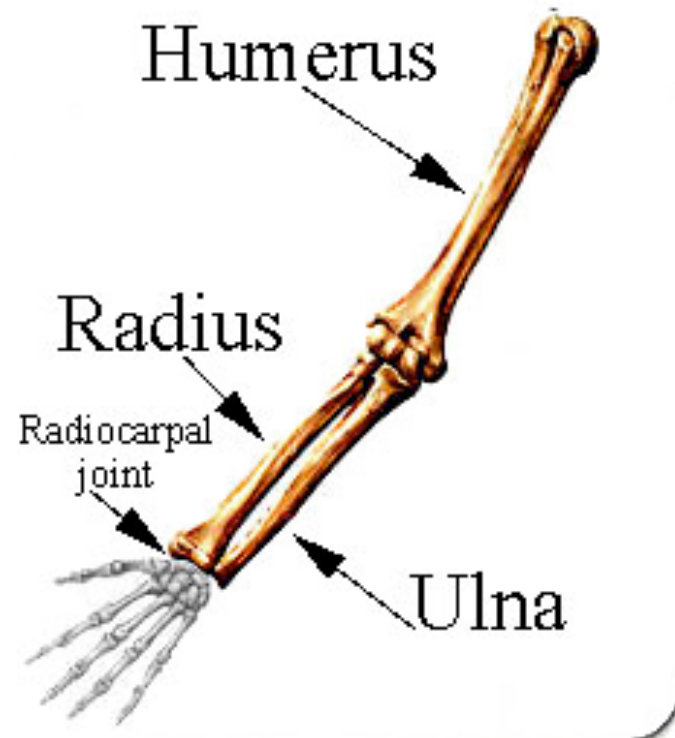
Shoulder (Pectoral) Girdle

- Clavicle or collar bone.
- Scapula
- Flexible
- Lightweight
- Shallow socket for limb attachment.



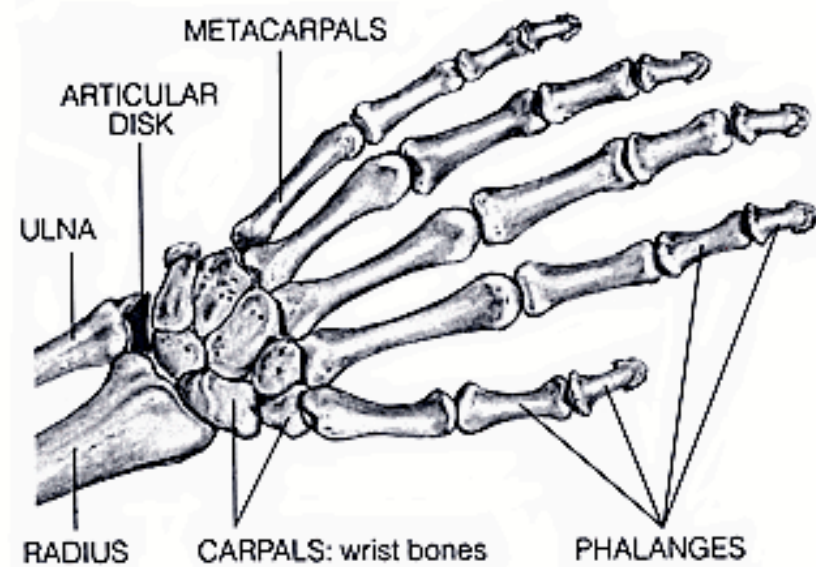
Arm Bones

- Upper arm is called the humerus
- Lower arm bones are the radius and ulna.



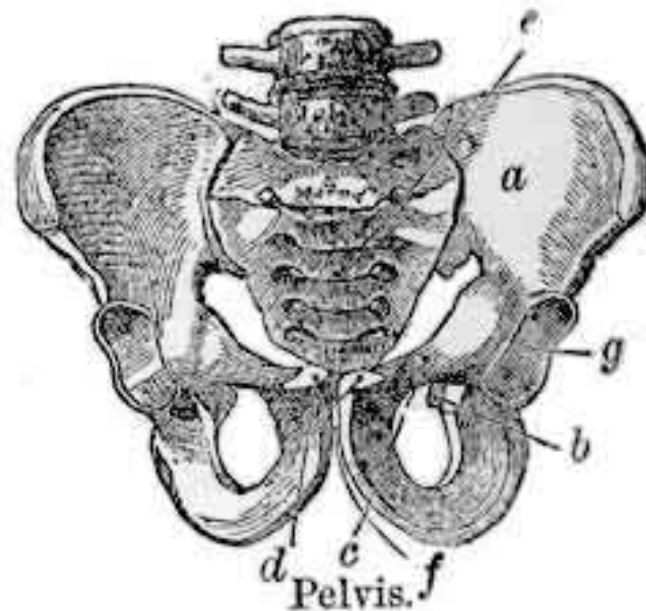
Hand Bones

- Carpal bones
(wrist)
- Metacarpals
(palms)
- Phalanges
(fingers)



Pelvic Girdle

- Composed of three bones, the Ilium, Pubic Bone and the Ischium.
- Massive to bear weight.
- Deep, secure pocket for limb attachment.



a, Ilium; *b*, ischium; *c*, pubis;
d, symphysis pubis; *e*, sacrum; *f*,
coccyx; *g*, acetabulum or cavity for
head of thigh-bone.

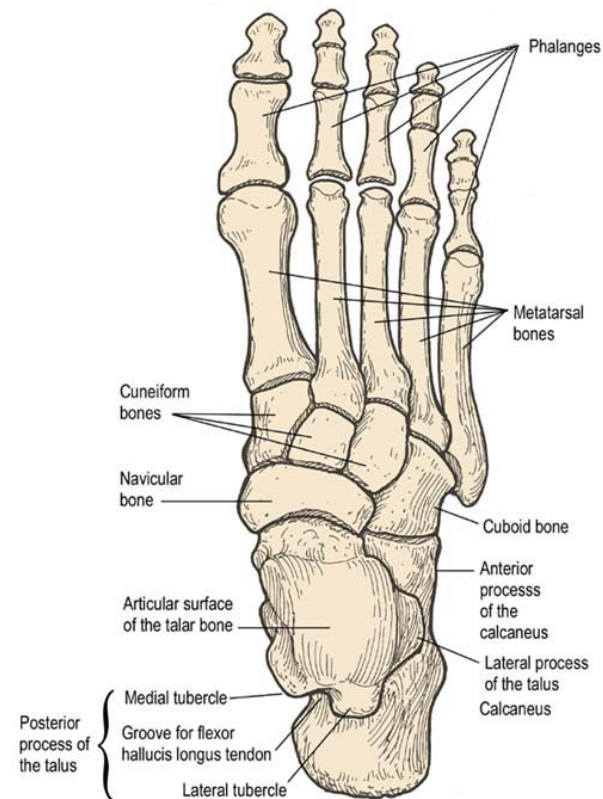
Leg Bones

- Upper leg is the femur, which is the heaviest and longest bone in the body.
- The lower leg bones are the tibia and fibula.



Foot Bones

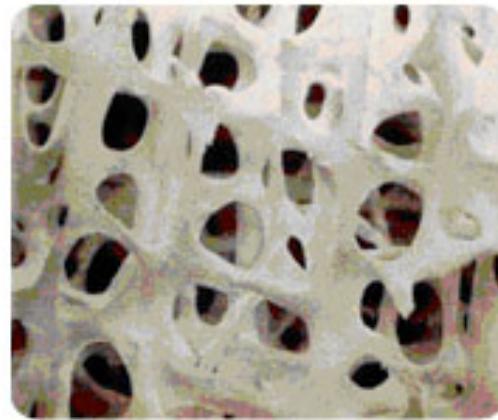
- Tarsal bones make up the posterior part of the foot.
- Metatarsal bones form the sole of the foot.
- Phalanges are the toes.



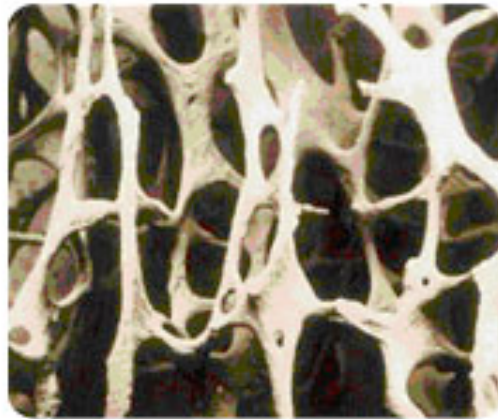
Bone Disorder- Osteoporosis

- A disease that causes a thinning of the bone.
- Affects 50% of women over 65
- Affects 20% of men over 70
- Bones so thin even a hug can break the bone.
- Causes the body to slump as age increases.

Hueso sin Osteoporosis



Hueso con Osteoporosis



Joints

Joints

- All bones (except the hyoid) meet at a joint.
- Hold bones together.
- Allow movement of the rigid skeleton.

Types of Joints

- Fibrous-hold bones of the skull together.
- Cartilaginous-slightly moveable and found in the pelvis and the between the vertebrae.
- Synovial-Keeps the bones separated by a joint cavity.

Types of Synovial Joints

- Plane Joints-Found in the wrist allowing gliding with no rotation.
- Hinge Joints-Uniaxial movement found in the ankle, fingers and elbow.
- Pivot Joint-Found in the knee.
- Condylloid Joint-Knuckles
- Saddle Joints-Thumb
- Ball and Socket Joint-Multiaxial movement of the shoulder and hip.

Disorders of the Joints

- Arthritis-Inflammation of the joints
- Rheumatoid Arthritis-The body attempts to destroy its own tissue. The joints become “bent”
- Gout-Uric acid builds up and crystallizes in the joints. Movement is very painful.



Developmental Aspects

- Endocrine System-Regulates uptake and release of calcium by bones.
- Muscular System-Increases bone strength.
- Nervous System-Conveys sense of pain in the bones and joints

- Integumentary System-Provides vitamin D for proper calcium absorption.
- Urinary System-Activates vitamin D for proper calcium usage.
- Reproductive System-produce hormones that form skeleton and epiphyseal closure.