

Introduction into Human Morphology Osteology

Lecture from Human Morphology
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Human Morphology as a Subject

- **GROSS ANATOMY**
 - systemic
 - regional (topographical)
- **MICROSCOPIC ANATOMY**
 - cytology
 - histology
- **EMBRYOLOGY**

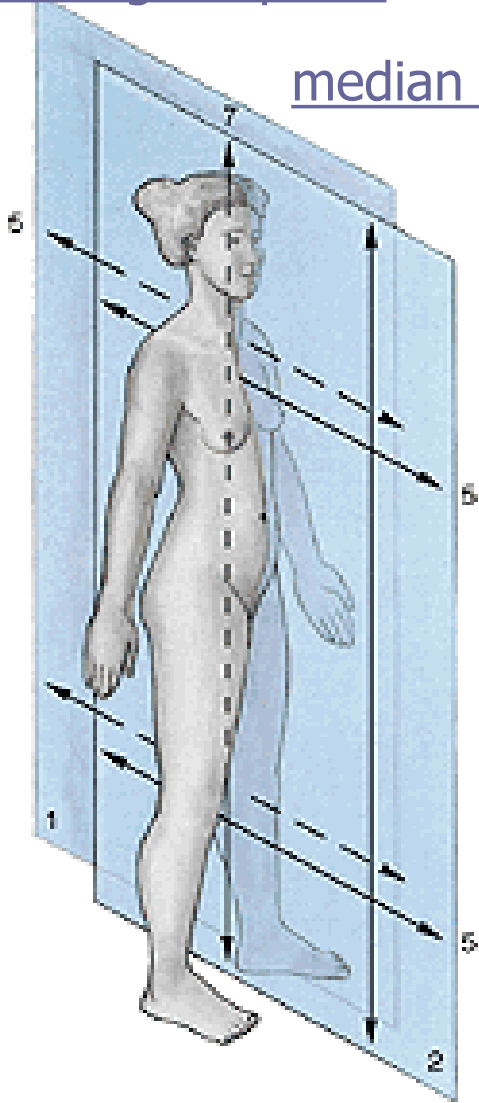


BASIC ANATOMICAL PLANES

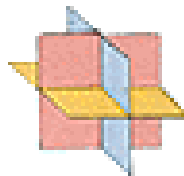
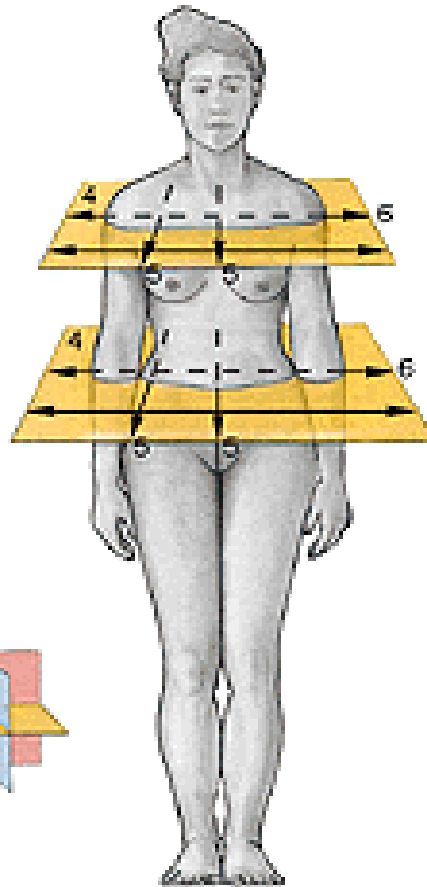
- description is derived from upright posture, feet together pointing forward with palms forward and arms at sides
- MEDIAN, MIDSAGITTAL PLANE – sagittal plane that divides the body into equal right and left regions
- PARASAGITTAL PLANE – sagittal plane that divides the body into unequal right and left portions
- FRONTAL (CORONAL) PLANE – divides the body into front (anterior) and back (posterior) regions
- TRANSVERSE (axial, horizontal) PLANE – slices through body at any height, perpendicular to sagittal and coronal planes, divides the body into upper (superior) and lower (inferior) regions

parasagittal plane

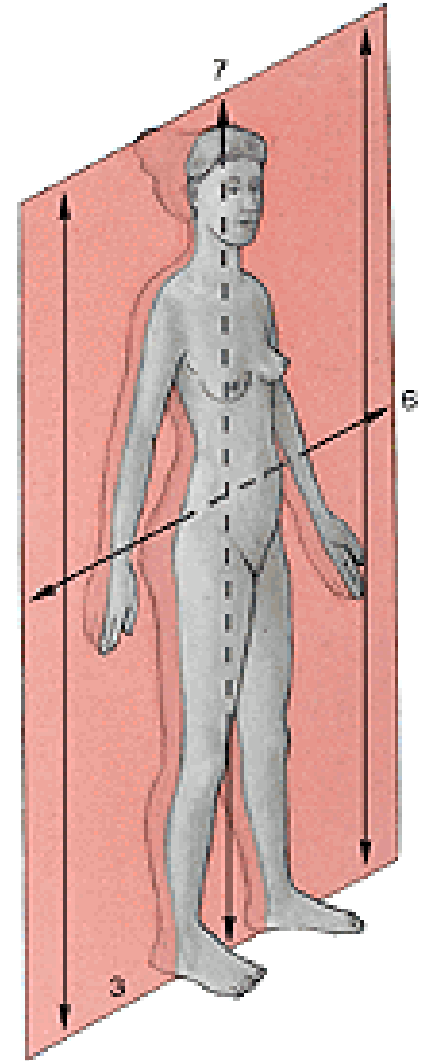
median plane



transversal plane



frontal plane

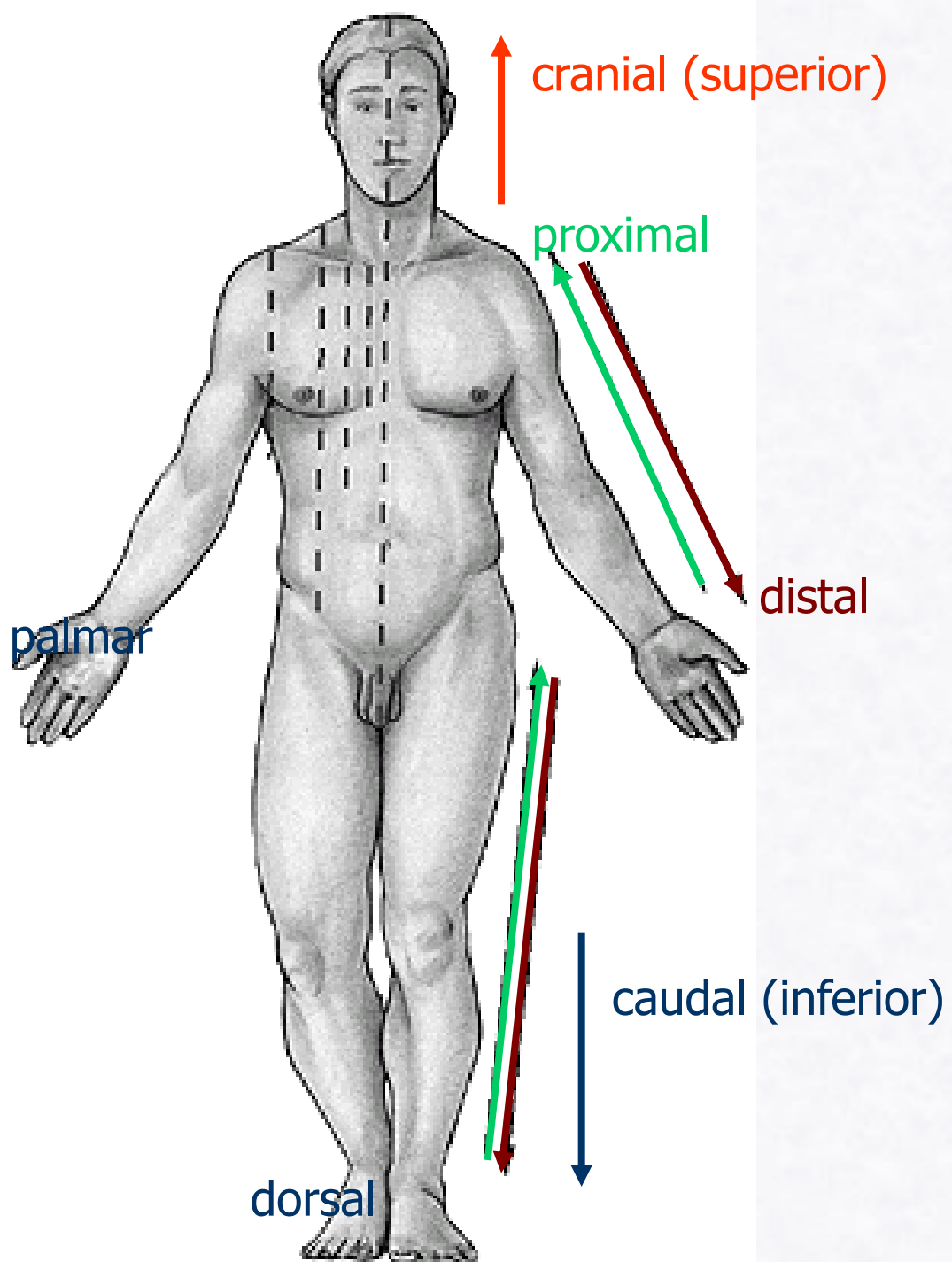


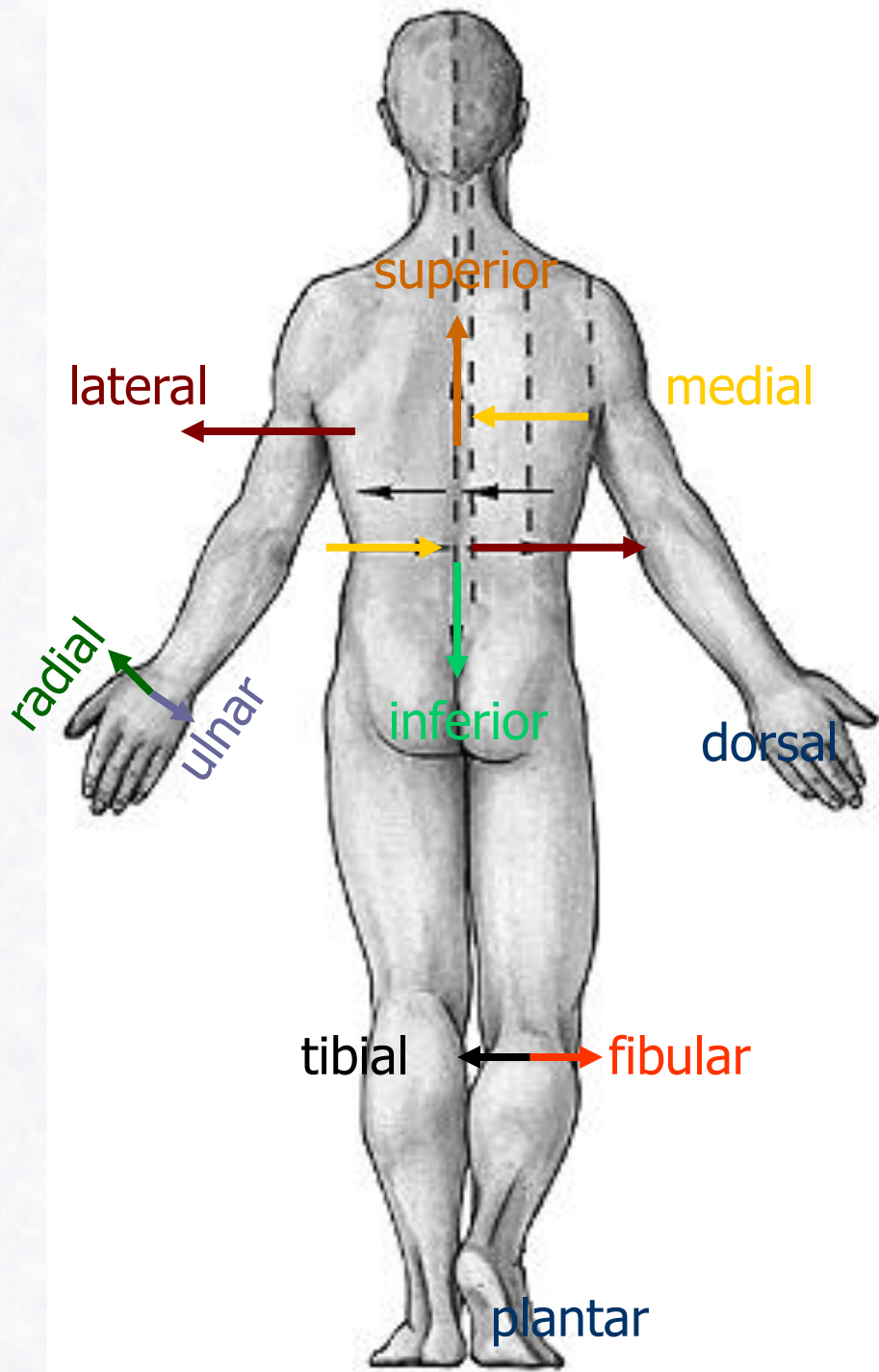
BASIC ANATOMICAL DIRECTIONS

- cranial (superior) (toward the head)
caudal (inferior) (toward the tail end)
- anterior (in front)
posterior (at the back)
- ventral (referring to the abdomen)
dorsal (referring to the back)
- medial (toward the midline of the body)
lateral (toward the side, away the midline of the body)
- dexter (right)
sinister (left)

BASIC ANATOMICAL DIRECTIONS

- proximal (near the midline, the central part)
distal (further away from the centre of the body)
- radial (referring to the radius)
ulnar (referring to the ulna)
- tibial (referring to the tibia)
fibular (referring to the fibula)
- palmar (referring to the palm)
dorsal (referring to the back of the hand)
- plantar (referring to the sole of the foot)
dorsal (referring to the back of the foot)





OSTEOLOGY

- description of bones and their conjunctions
- bones = **passive locomotory system**

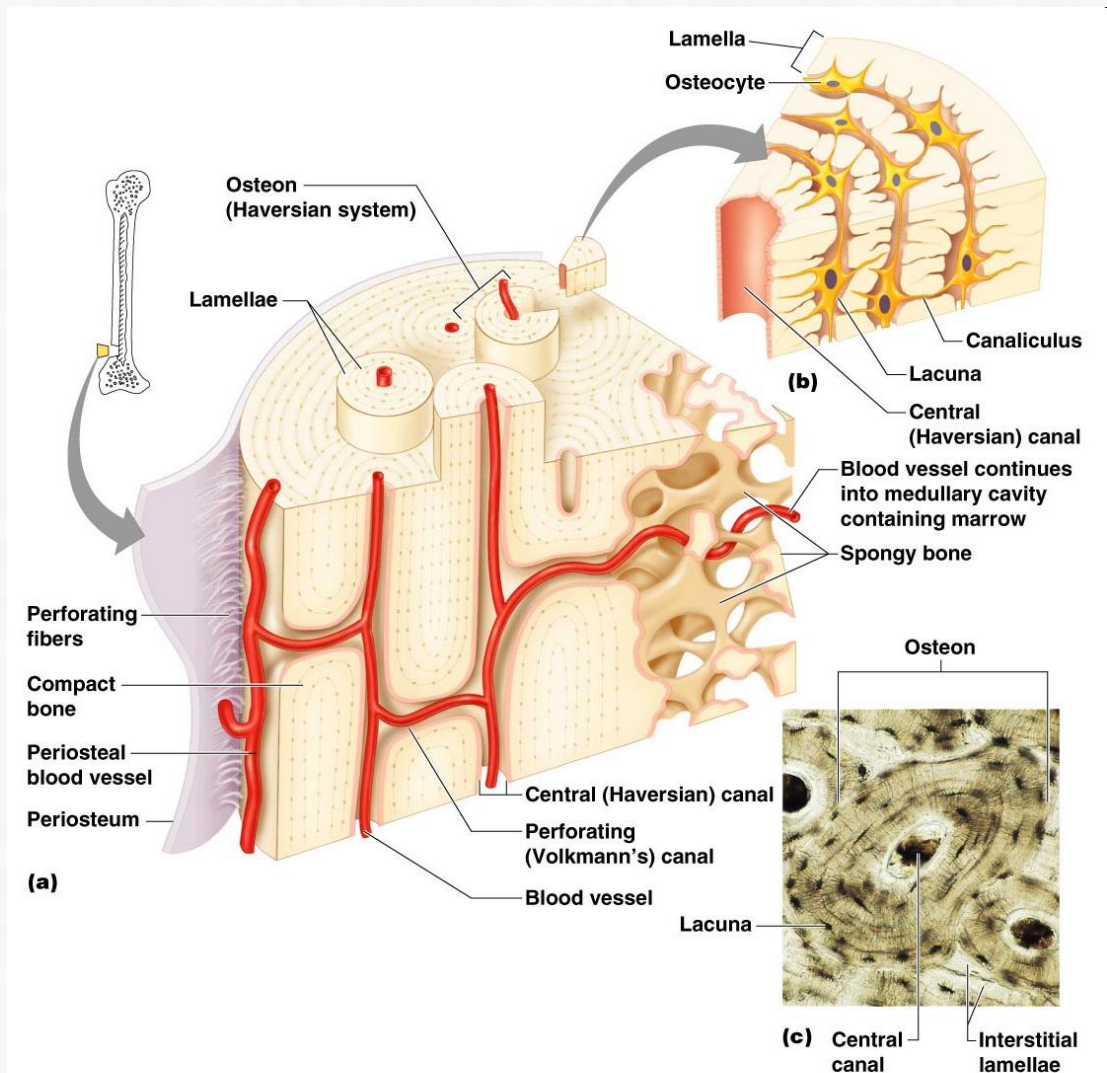
BONES – classification by the shape

- long (ossa longa) – femur, tibia, humerus
- short (ossa brevia) – vertebrae, metatarsal bones
- flat (ossa plana) – skull, sternum, hip bone

Types of osseous tissue

- primary osseous tissue, woven
 - transient type in embryonic period
 - in adult only ear labyrinth, cementum and osseal tuberosities
- secondary osseous tissue, lamellar
 - **compact (cortical) bone**: diaphyses of long bones, lamina externa and interna of flat skull bones
 - **spongy (trabecular) bone**: epiphyses of long bones, diploe of skull bones

Structure of lamellar bone



Bone structure

BONE MARROW

- inside medullar cavity
- red bone marrow – hematopoiesis, after birth only in flat bones (sternum, hip bone), in long bones is converted to yellow type
- yellow bone marrow – consisting mainly of fat cells, hematopoiesis
- grey bone marrow – in old age, progressive loss of hematopoietic activity

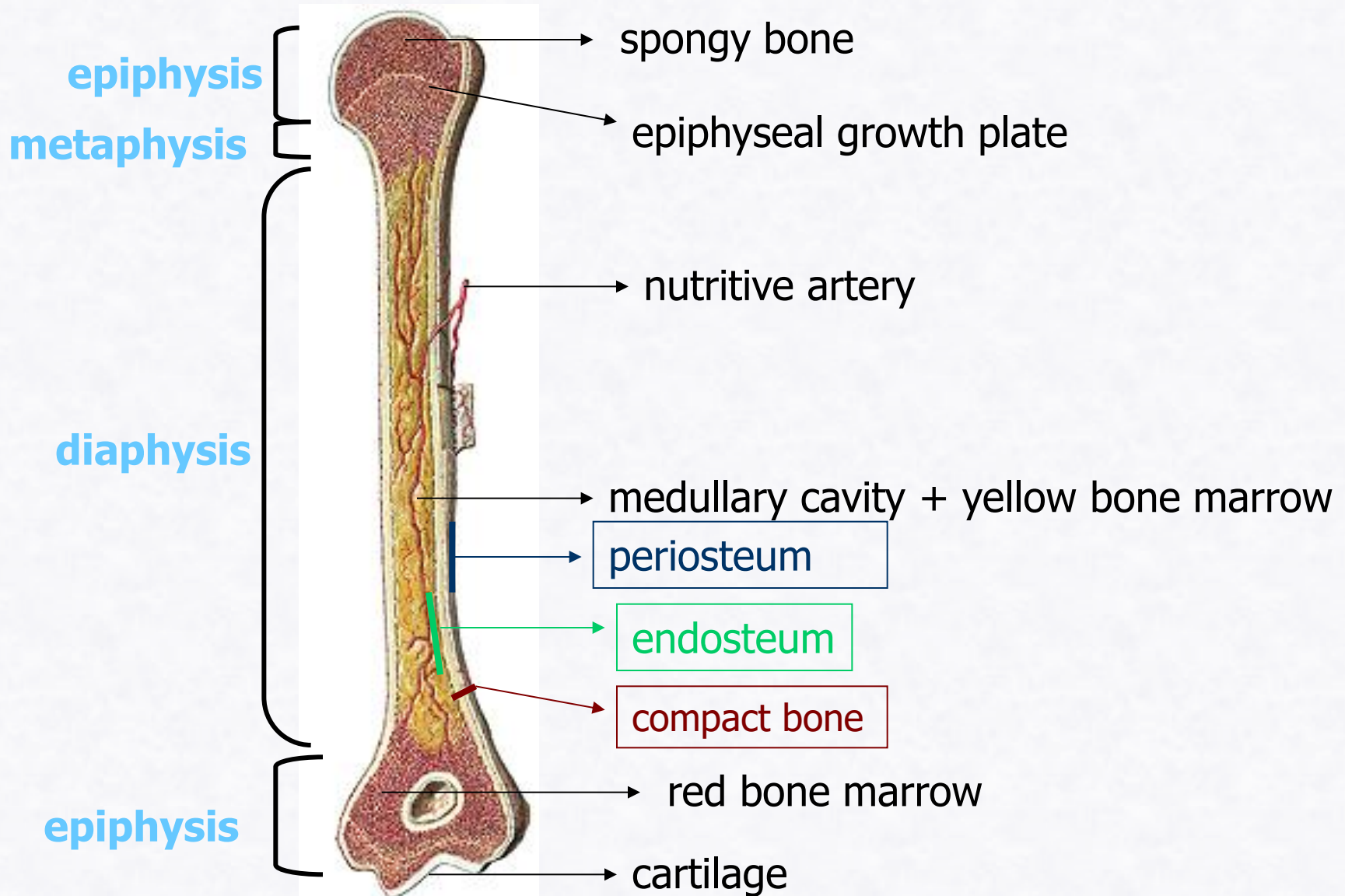
PERIOSTEUM

- thin fibrous membrane that lines the outer surface of all bones
- nutrition – *aa. nutrientes*
- bone growth abroad
- sensitive innervation

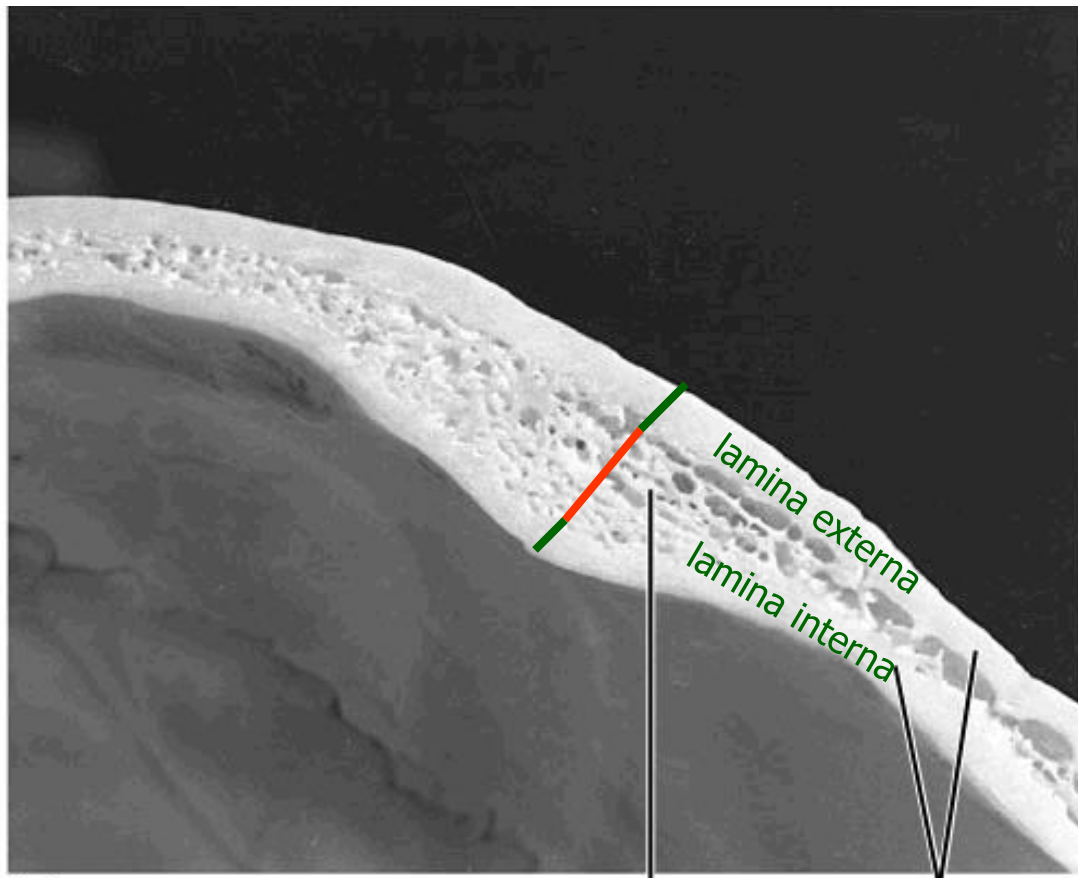
ENDOSTEUM

- lines the inner surface of all bones

Long bones structure humerus



Structure of flat skull bones parietal bone

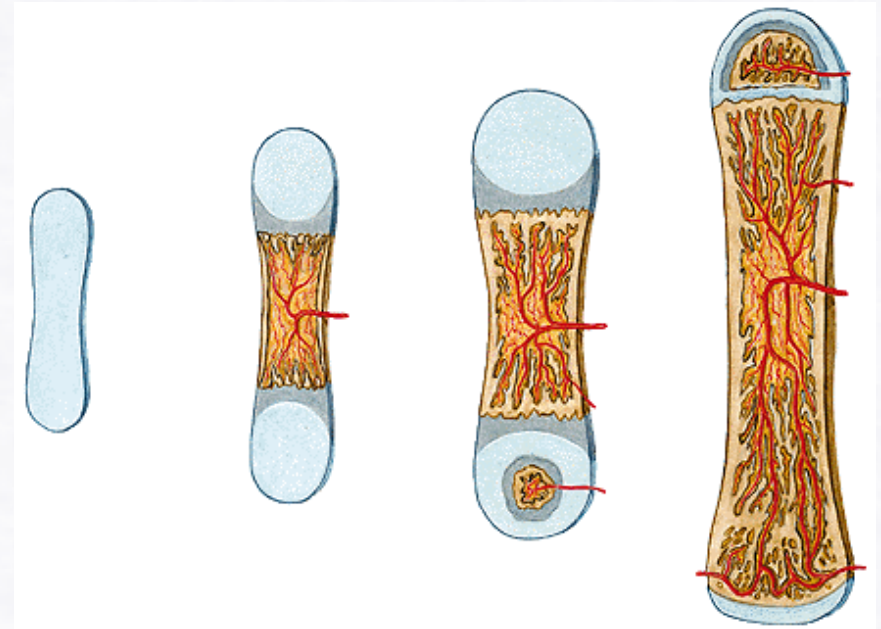


spongy bone (diploe)

compact bone

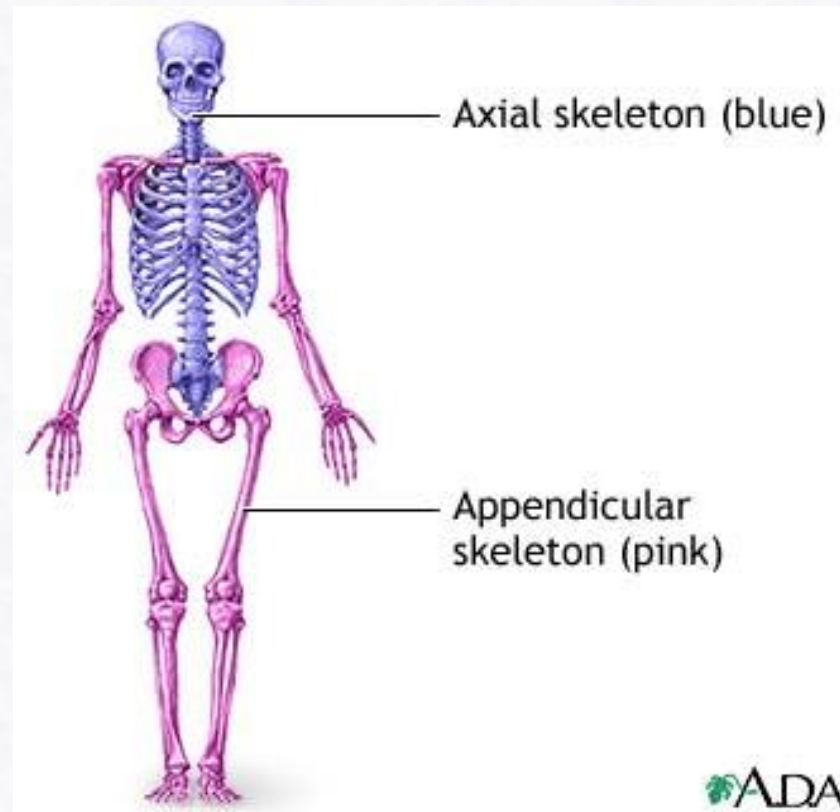
Bone formation, growth and remodeling

- the embryo forms the skeleton of **hyaline cartilage**
- this slowly turns to bone during fetal development, as the **osteoblasts** (bone forming cells) change the cartilage model to bone in a process called **ossification**
- **osteoclasts** (bone destroying cells) work during this process to remodel the shape as the bone lengthens during growth
- by birth, all but the **epiphyseal plates** have changed to bone
- growth continues at the inner plate, lengthening long bones



SKELETON

- AXIAL
 - SKULL (CRANIUM)
 - neurocranium
 - facial bones
 - TRUNK
 - vertebral column
 - thorax
- APPENDICULAR =
SKELETON OF EXTREMITIES



Vertebral column (backbone, spine)

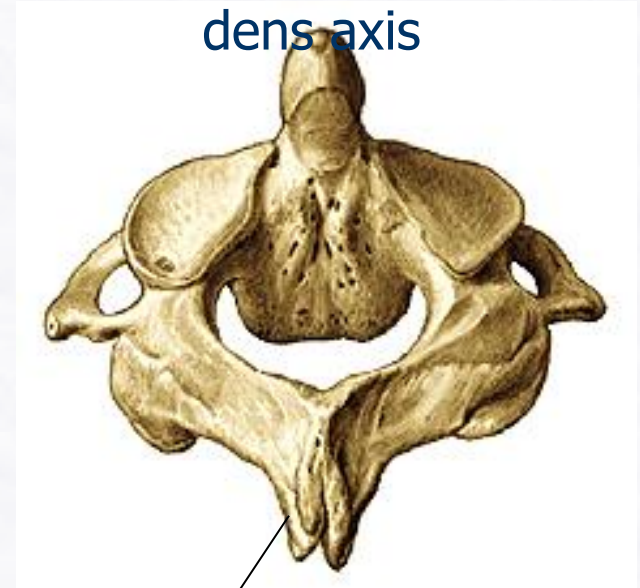
- **7 cervical vertebrae (vertebrae cervicales) C1–C7**
 - C1=atlas, C2=axis
 - support head and provide its movements
- **12 thoracic vertebrae (vertebrae thoracicae) Th1–Th12**
 - contain costal facets for the articulation with the heads of ribs
- **5 lumbar vertebrae (vertebrae lumbales) L1–L5**
- **5 sacral vertebrae (vertebrae sacrales) S1–S5**
 - fuse about 20. – 25. year in **sacral bone**
(**os sacrum**)
- **4–5 coccygeal vertebrae (vertebrae coccygeae) Co1–Co4/5**
 - rudiment, fused into **coccyx (tailbone)**

Cervical vertebrae

ATLAS



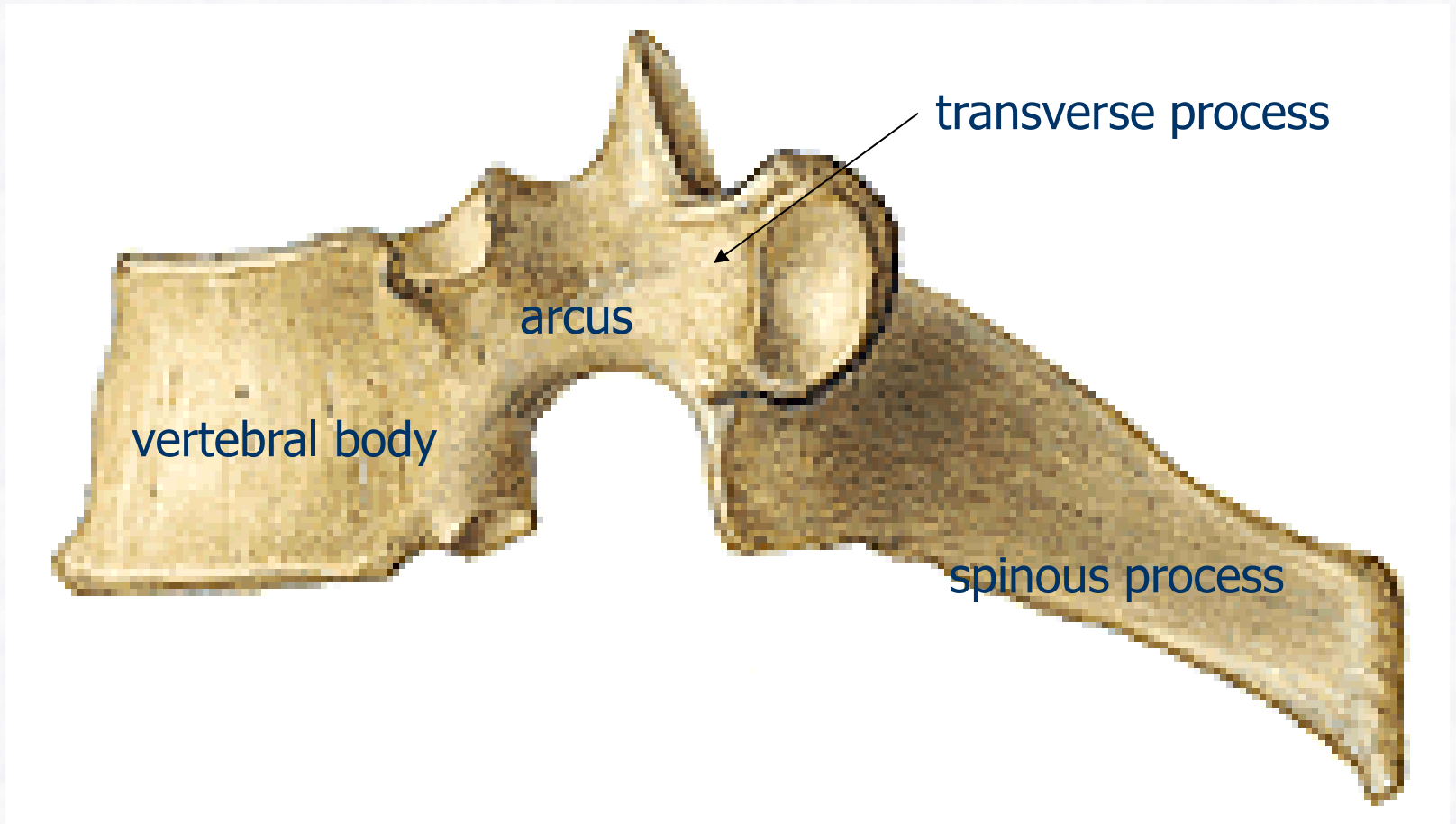
AXIS



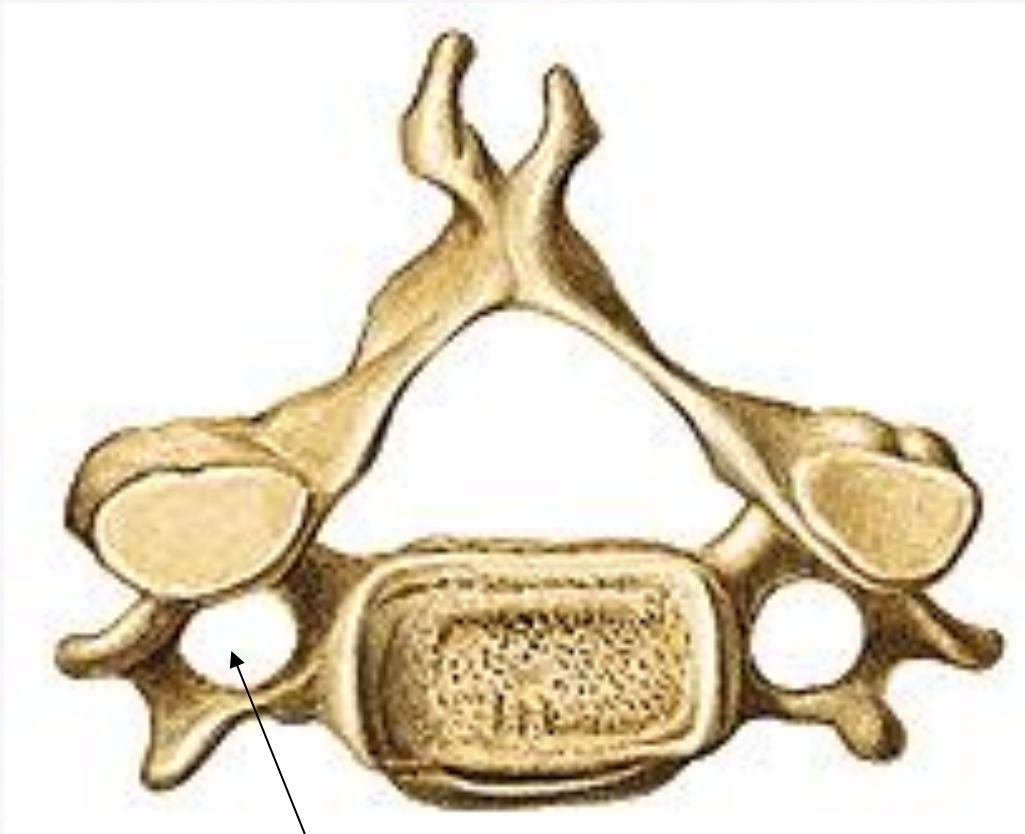
dens axis

spinous process

Thoracic vertebra (vertebra thoracica)



CERVICAL VERTEBRA



vertebral artery

LUMBAR VERTEBRA



Physiological curves of vertebral column

- vertebral column curved in sagittal and frontal plane
- in sagittal plane twice curved
 - ❖ LORDOSIS – convex forward
 - CERVICAL
 - LUMBAR
 - ❖ KYPHOSIS – concave forward
 - THORACIC

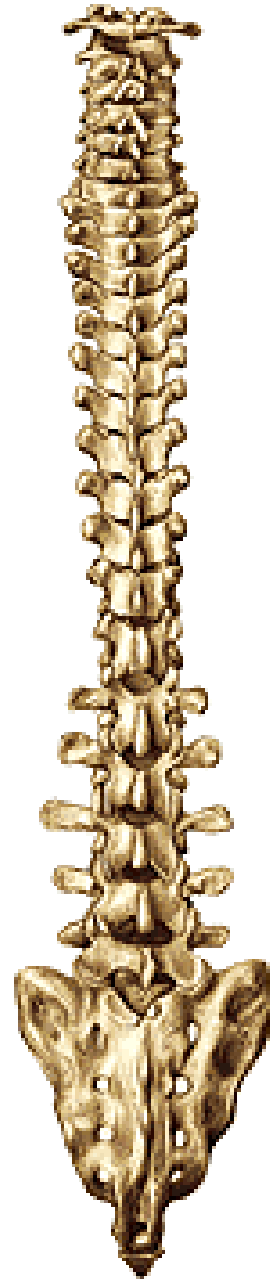
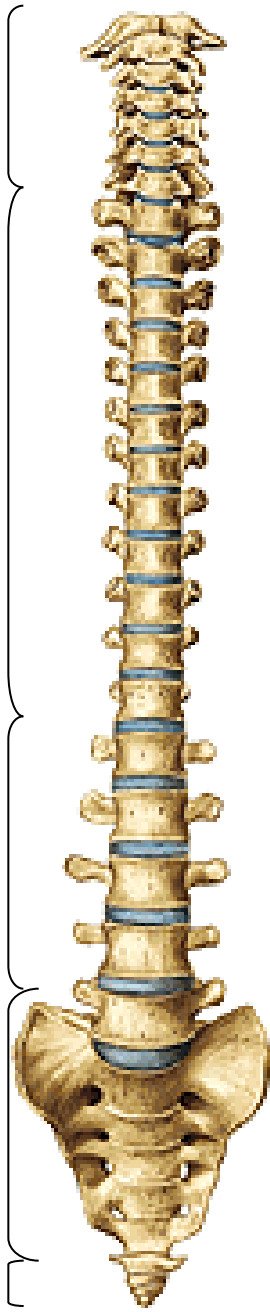
cervical vertebrae
C1-C7

thoracic vertebrae
Th1-Th12

lumbal vertebrae
L1-L5

sacral vertebrae
S1-S5, sacral bone

coccyx



cervical lordosis

thoracic kyphosis

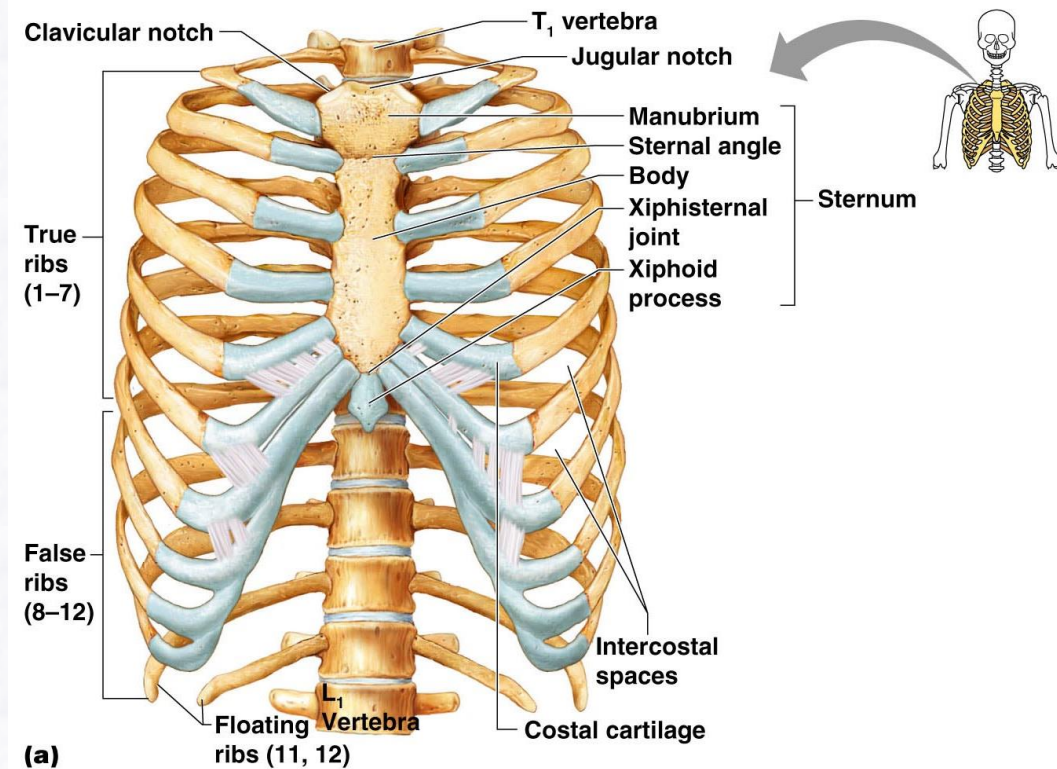
lumbar lordosis

Skeleton of thorax

RIBS (costae)

- long curved bones forming the ribcage
- composed of a thin layer of compact bone, spongy bone is inside
- each rib has osseous and cartilagenous part
- true ribs (costae verae) I.–VII. couple – directly attached to the sternum through the costal cartilage
- false ribs (costae spuriae) VIII.–X. couple – sharing a common cartilaginous connection to the sternum
- floating ribs (costae fluctuantes) XI.–XII. couple – attached to the vertebrae only

BREASTBONE (sternum)



SKELETON OF SKULL

BRAINCASE (neurocranium)

- flat bones held together by cranial sutures

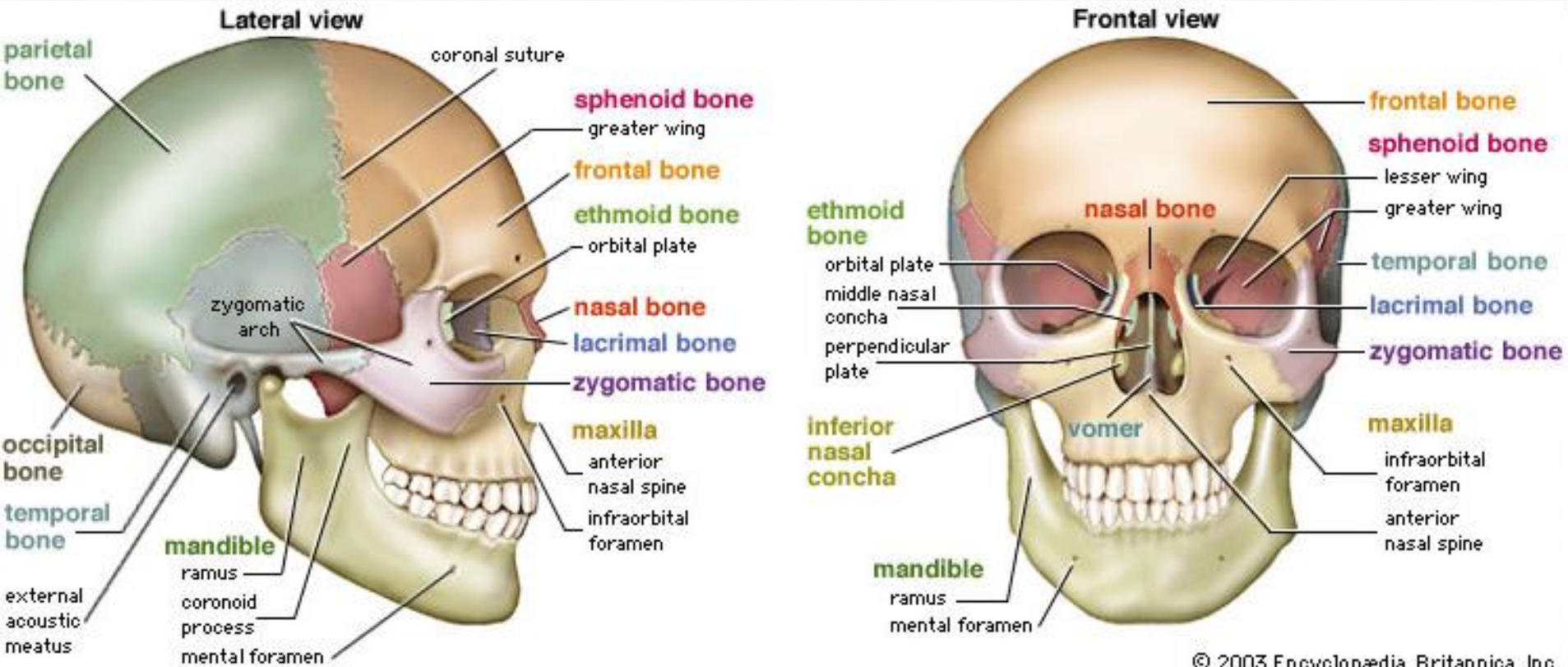
- 1) OCCIPITAL BONE (os occipitale)
- 2) SPHENOID BONE (os sphenoidale)
- 3) ETHMOID BONE (os ethmoidale)
- 4) FRONTAL BONE (os frontale)
- 5) TEMPORAL BONE (os temporale)
- 6) PARIETAL BONE (os parietale)

FACIAL BONES (splanchnocranium)

- flat bones with sutures except mandible: attached to the temporal bone by the **temporomandibular joint**

- 1) MAXILLA
- 2) ZYGOMATIC BONE (os zygomaticum)
- 3) PALATINE BONE (os palatinum)
- 4) MANDIBLE
- 5) HYOID BONE (os hyoideum)
- 6) AUDITORY OSSICLES (ossicula auditus)
- 7) INFERIOR NASAL TURBINATE (concha nasalis inferior)
- 8) NASAL BONE (os nasale)
- 9) LACRIMAL BONE (os lacrimale)
- 10) VOMER BONE (vomer)

Skeleton of skull



Skull – inferior view

maxilla

- incisive fossa
- palatine process
- median palatine suture
- nasal aperture

sphenoid bone

- pterygoid process
- greater wing
- foramen ovale
- foramen spinosum
- foramen lacerum

parietal bone

occipital bone

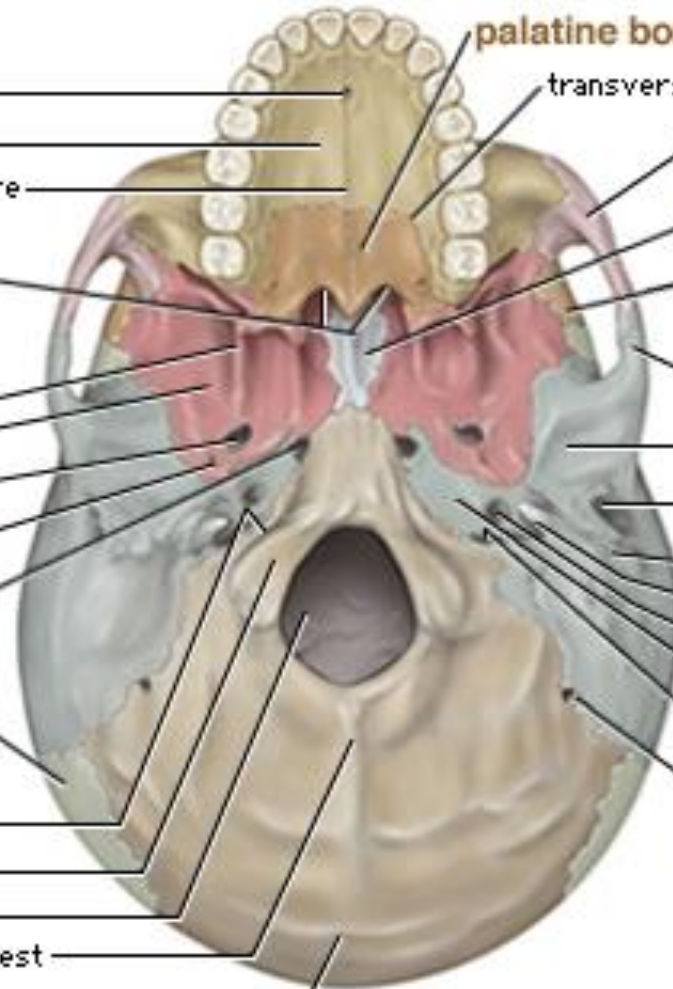
- hypoglossal canal
- occipital condyle
- foramen magnum
- external occipital crest
- external occipital protuberance

palatine bone

- transverse palatine suture
- zygomatic bone
- vomer
- frontal bone

temporal bone

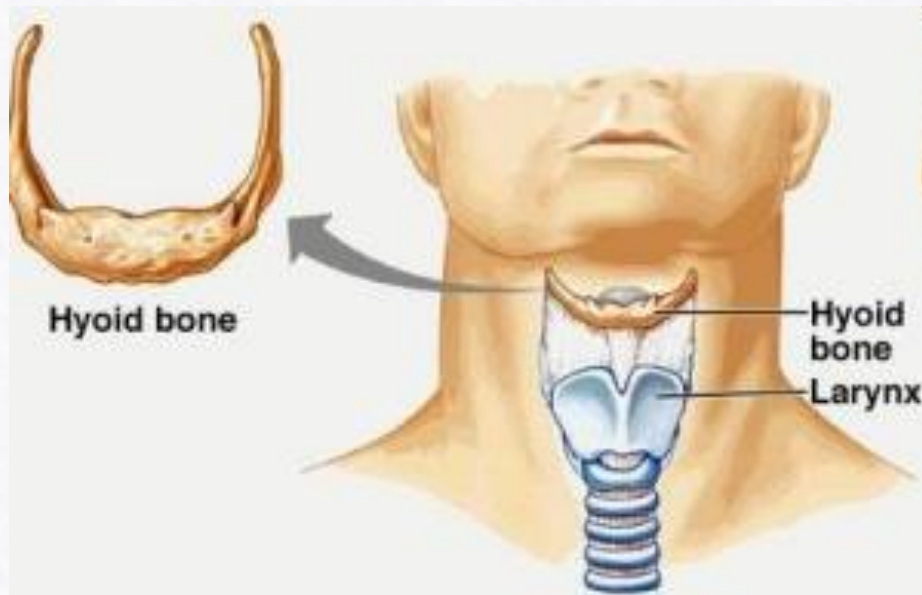
- zygomatic process
- mandibular fossa
- external acoustic meatus
- mastoid process
- styloid process
- carotid canal
- petrous temporal bone
- jugular fossa (to jugular foramen)
- mastoid foramen



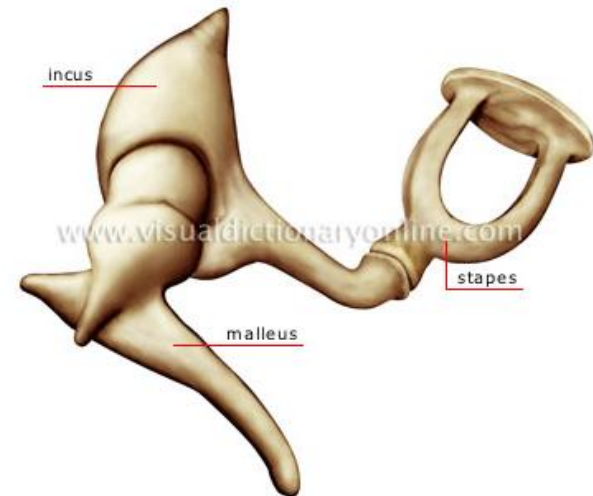
Skull – X-rays



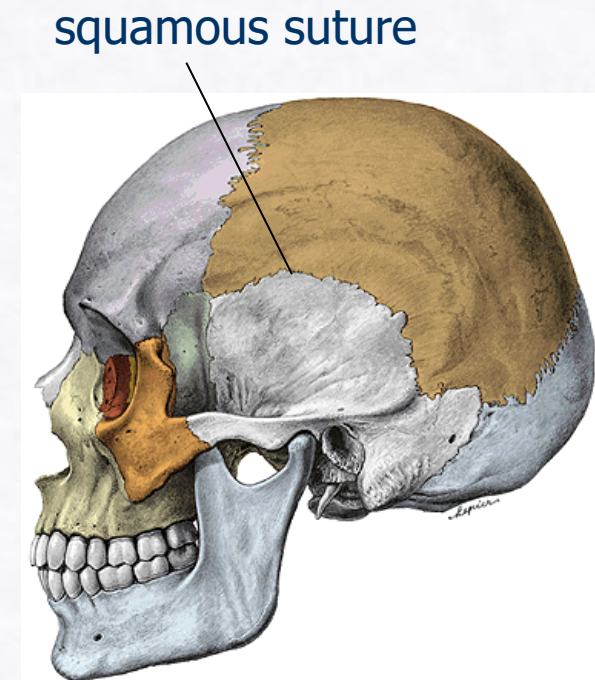
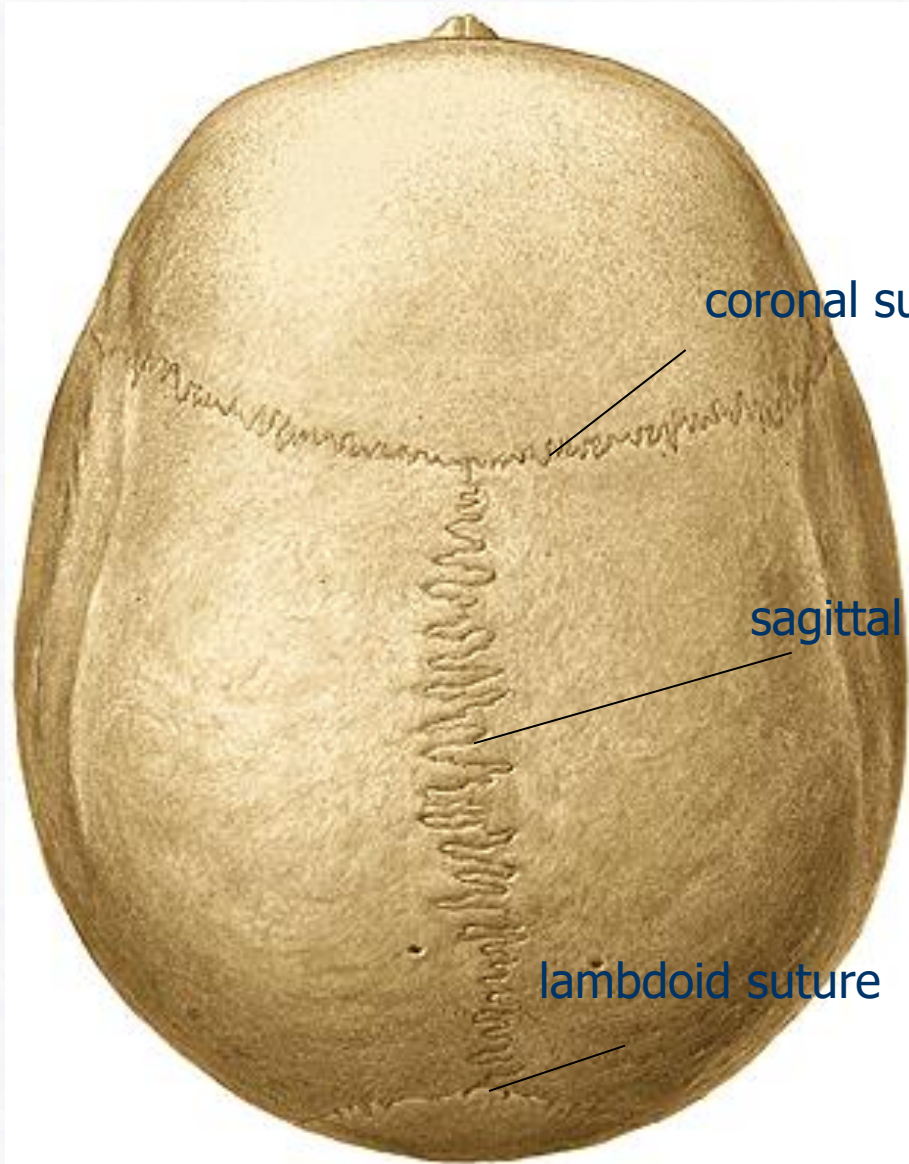
HYOID BONE (os hyoideum)



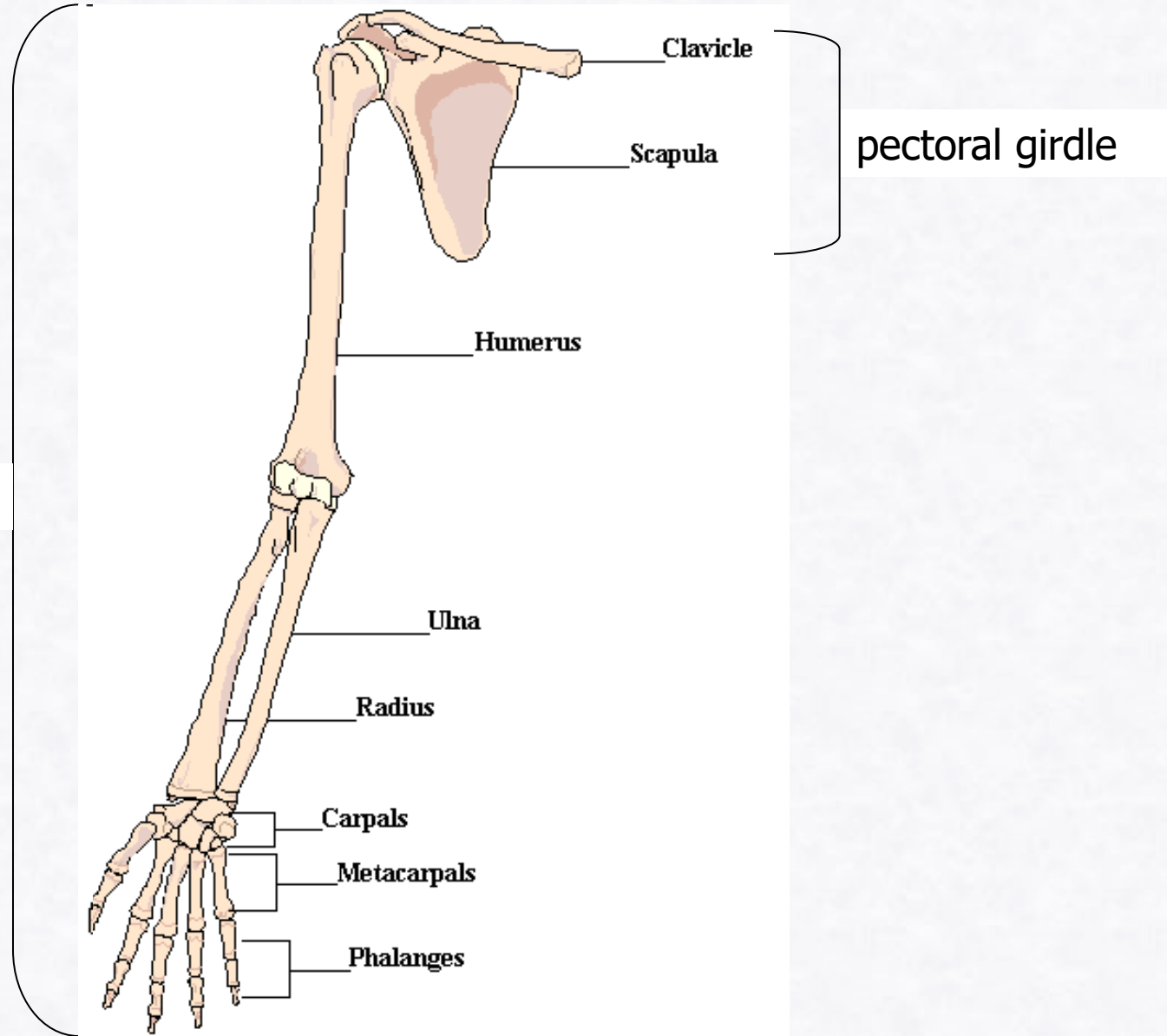
AUDITORY OSSICLES



Skull with sutures



Upper limb/extremity skeleton



upper extremity

pectoral girdle

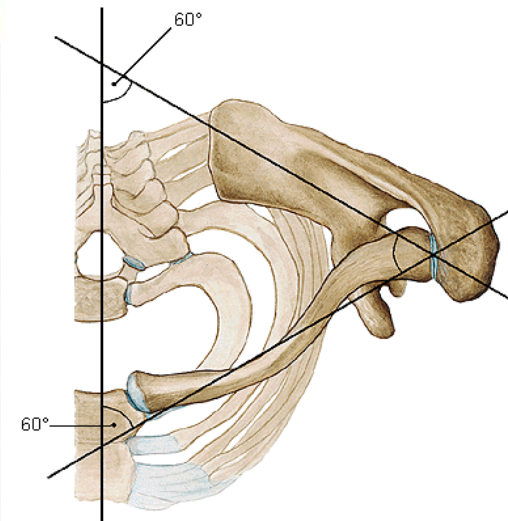
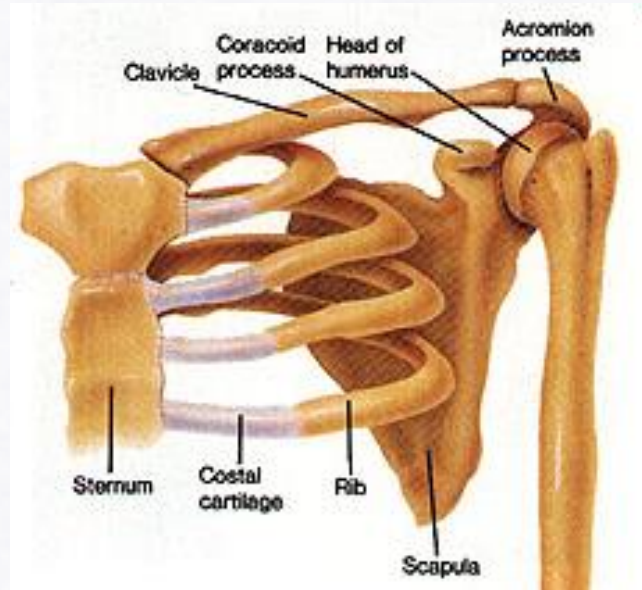
Pectoral/shoulder girdle

1) CLAVICLE (collar bone)

- long sigmoid bone

2) SCAPULA (shoulder blade)

- flat triangular bone



Skeleton of upper limb/extremity

1) HUMERUS

2) ULNA

3) RADIUS

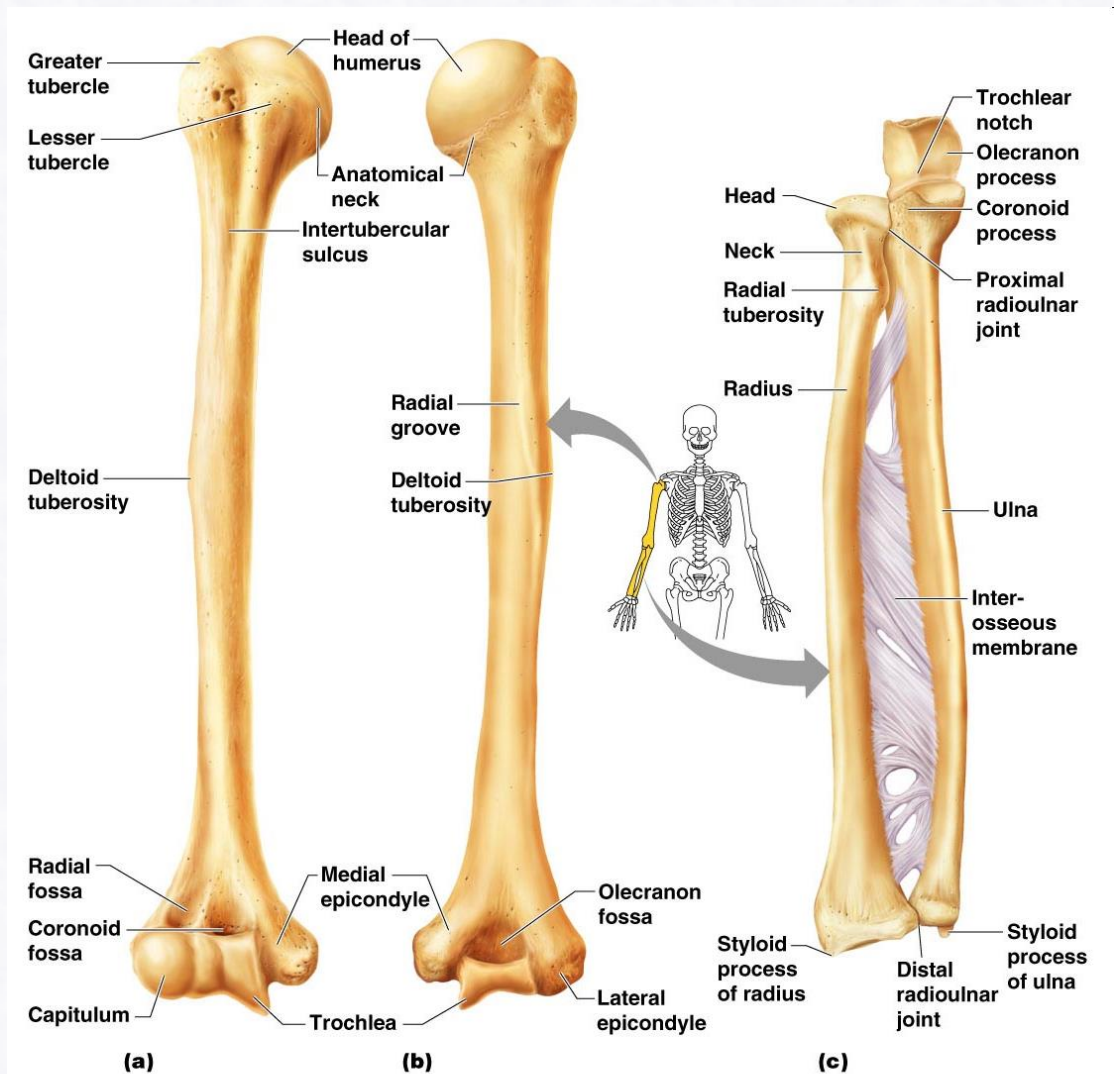
4) CARPAL BONES

- proximal: scaphoid ♦ lunate ♦ triquetrum ♦ pisiform
- distal: trapezium ♦ trapezoideum ♦ capitate ♦ hamate

5) METACARPAL BONES

6) PHALANGES (proximal, medial and distal phalanges)

Humerus, ulna, radius



Positions of the Forearm Bones

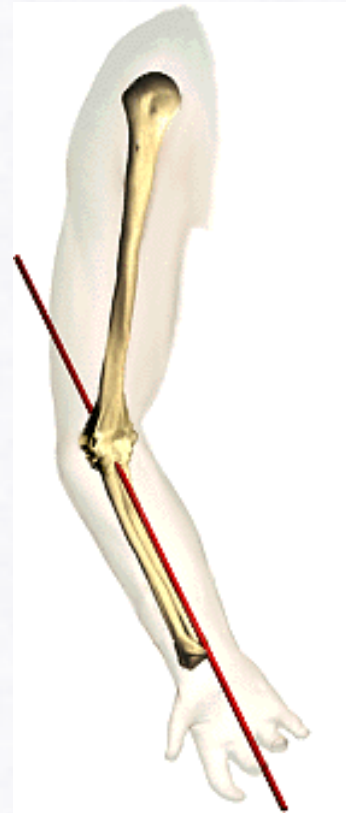
- PRONATION

– turning the arm round so that palms face downwards



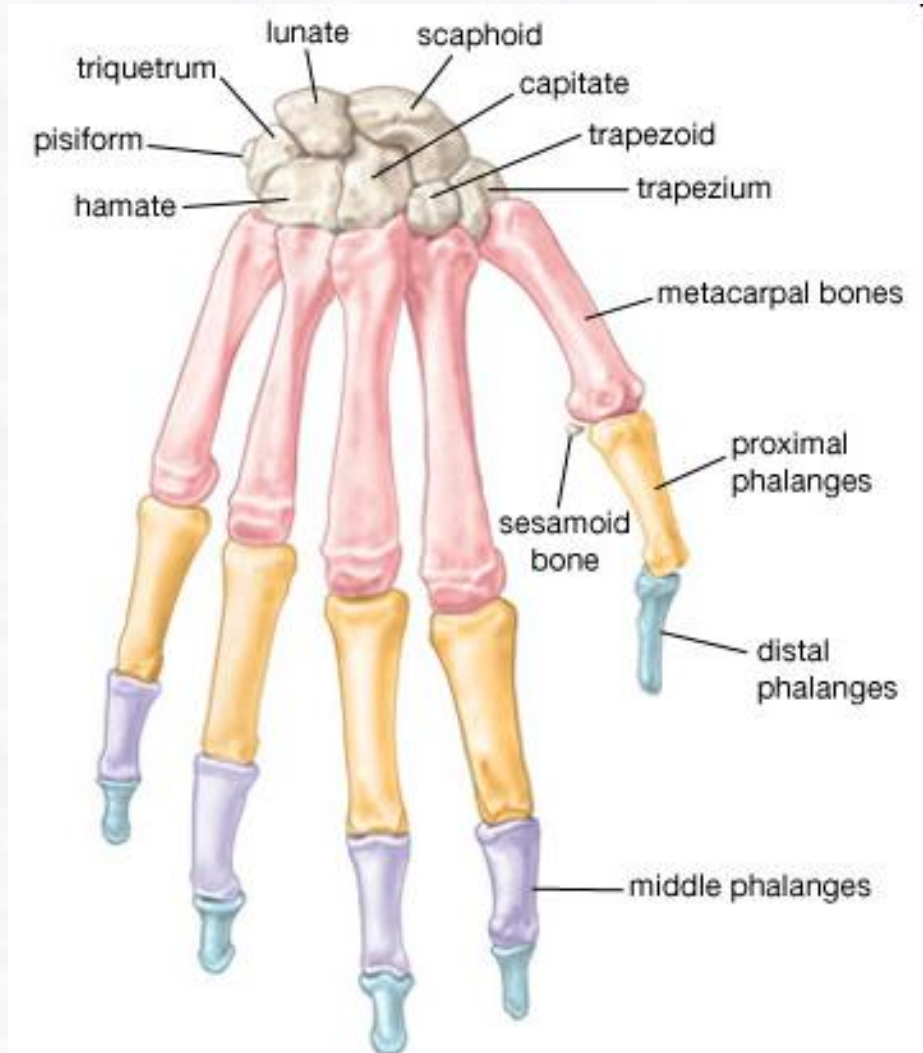
- SUPINATION

– turning the arm round so that palms face upwards

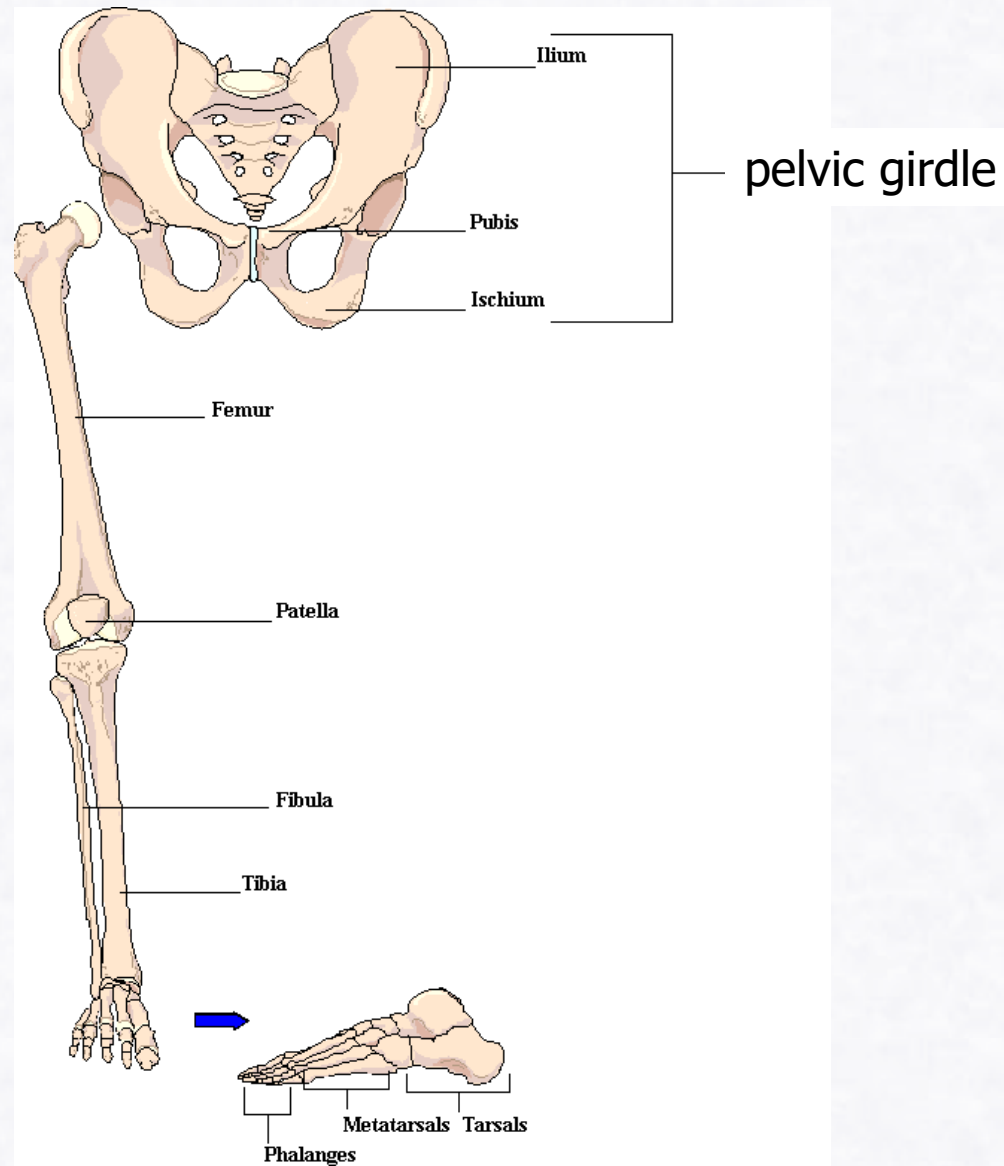


Hand bones (ossa manus)

right side, dorsal view



Skeleton of lower limb/extremity

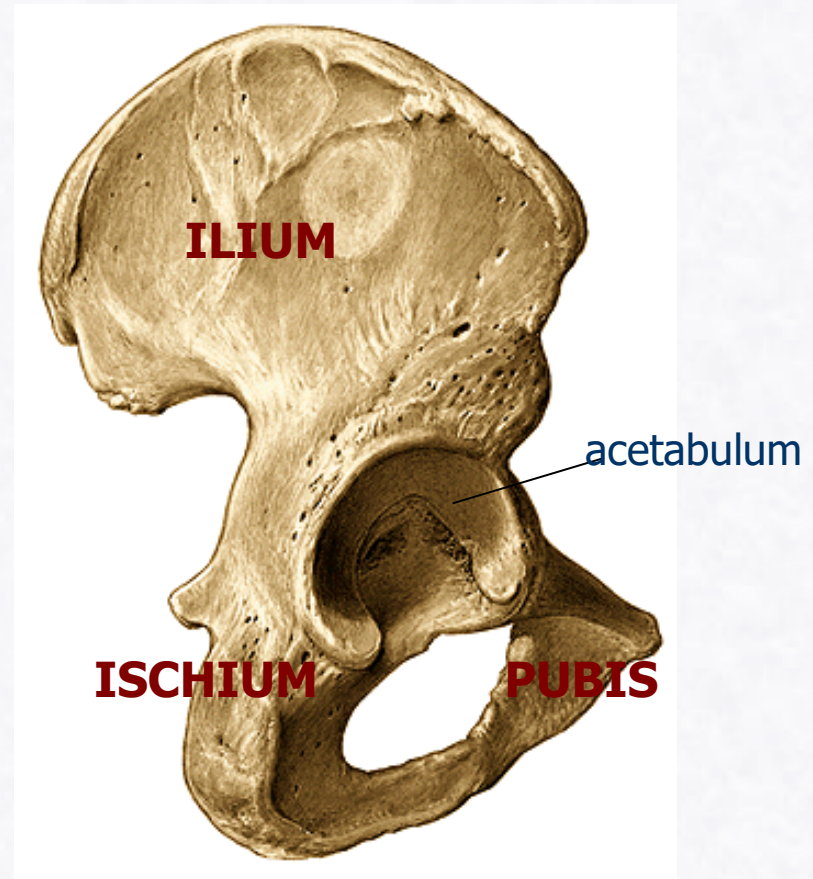
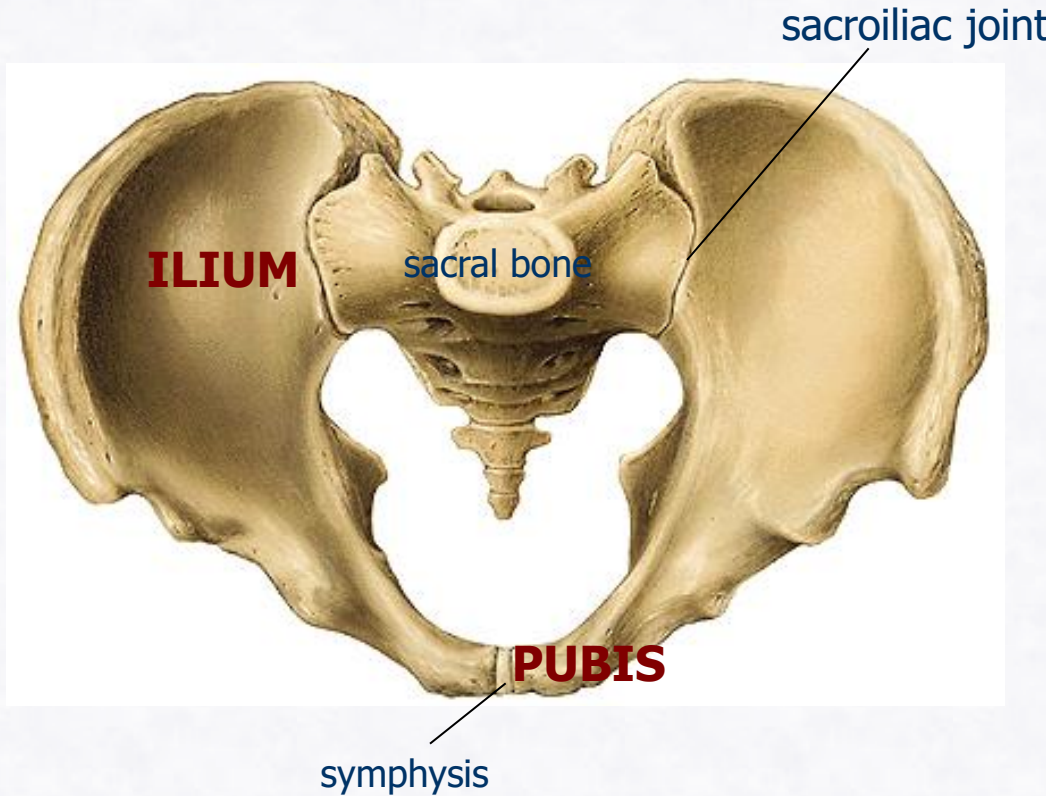


Pelvic girdle

HIP/PELVIC BONE (coxa)

- ilium (os ilium)
- ischium (os ischii)
- pubis (os pubis)

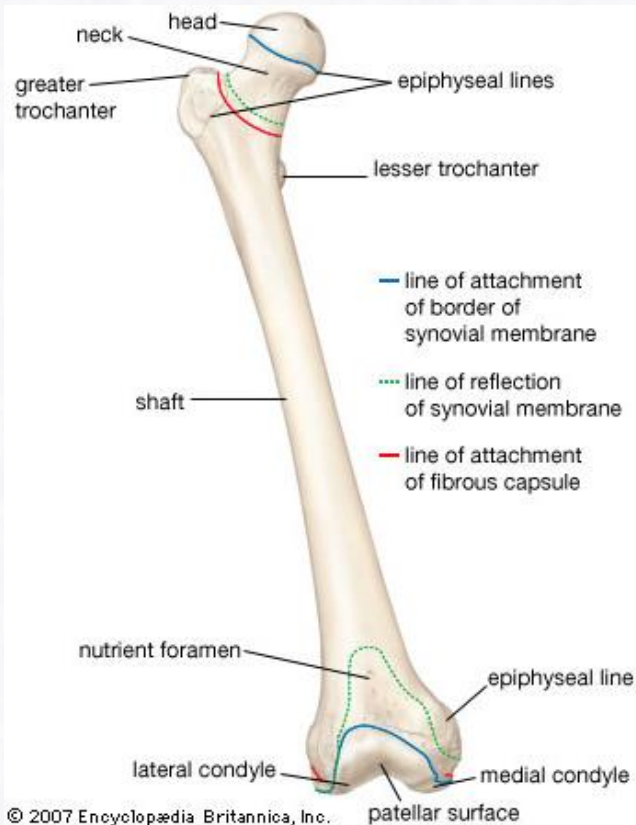
Hip/pelvic bone upper and dorsolateral view



Skeleton of lower limb/extremity

- 1) FEMUR (thigh bone)
- 2) PATELLA (knee cap)
- 3) TIBIA (shin bone)
- 4) FIBULA (leg bone)
- 5) TARSAL BONES (ossa tarsi)
 - lateral group: heel bone (calcaneus) ♦ cuboid bone
 - medial group: ankle bone (talus) ♦ navicular bone ♦ cuneiform bones
- 6) METATARSAL BONES (ossa metatarsalia)
- 7) PHALANGES

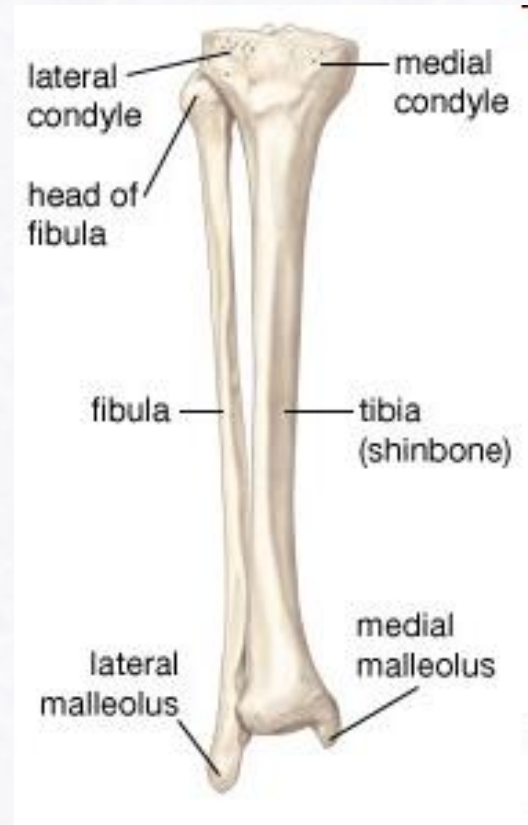
FEMUR (thigh)



PATELLA (knee cap)



TIBIA and FIBULA



Foot bones (ossa pedis)

