

THE SKELETAL SYSTEM



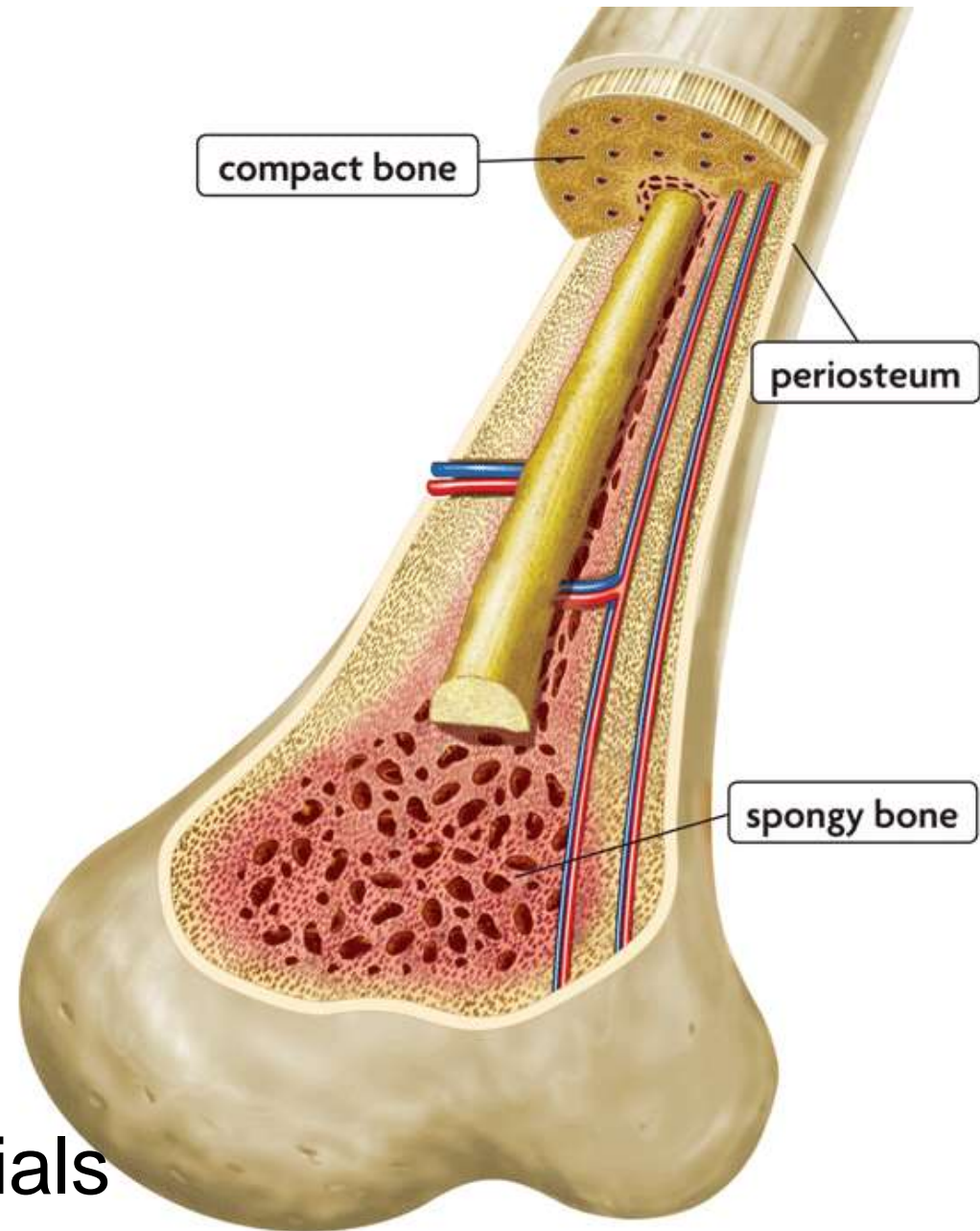
Functions of the Skeletal System

Support and protection

Body movement

Blood cell formation =
hemopoiesis
(occurs in bone marrow)

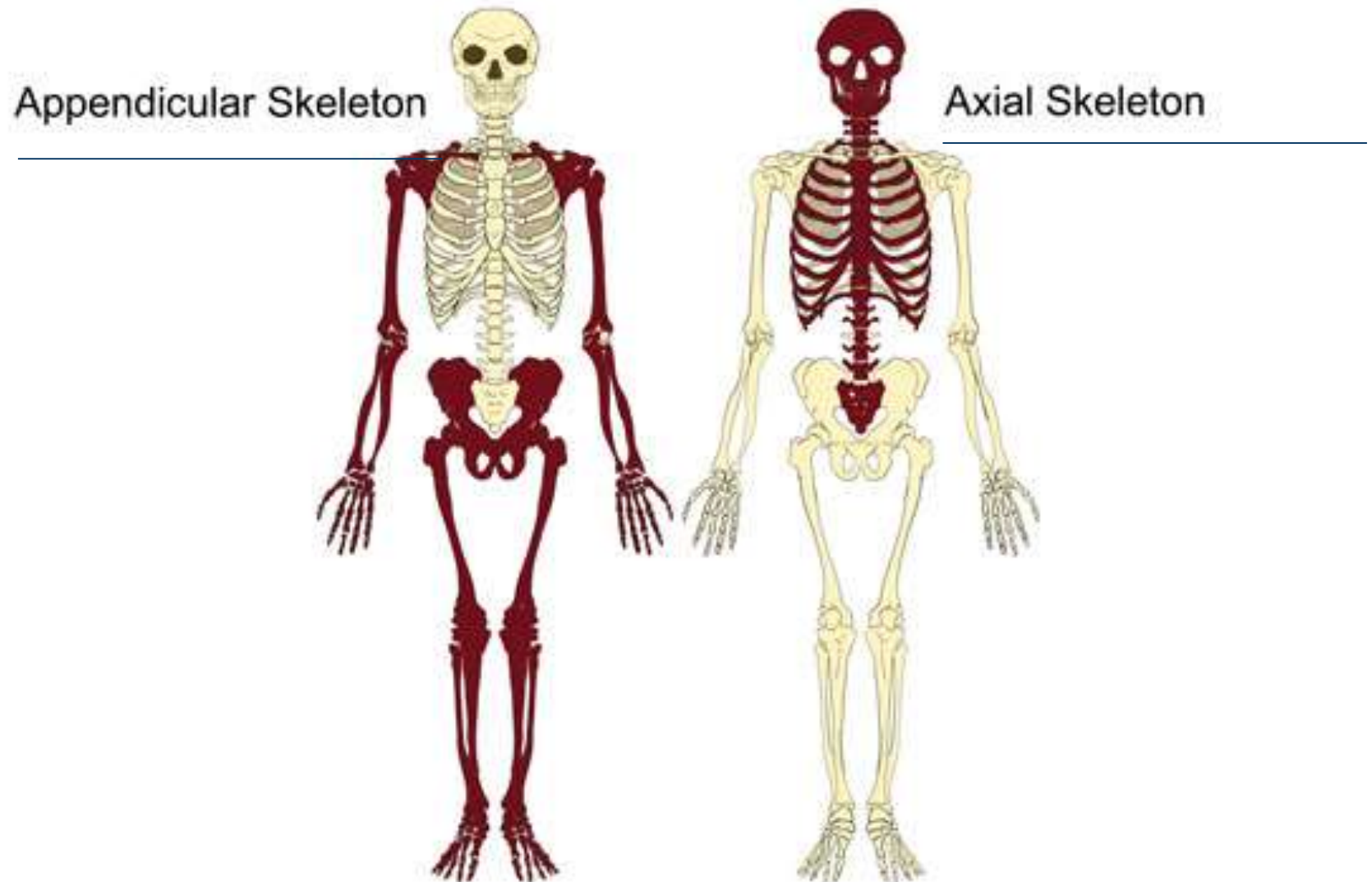
Storage of inorganic materials
(salt, calcium, potassium....)



ORGANIZATION

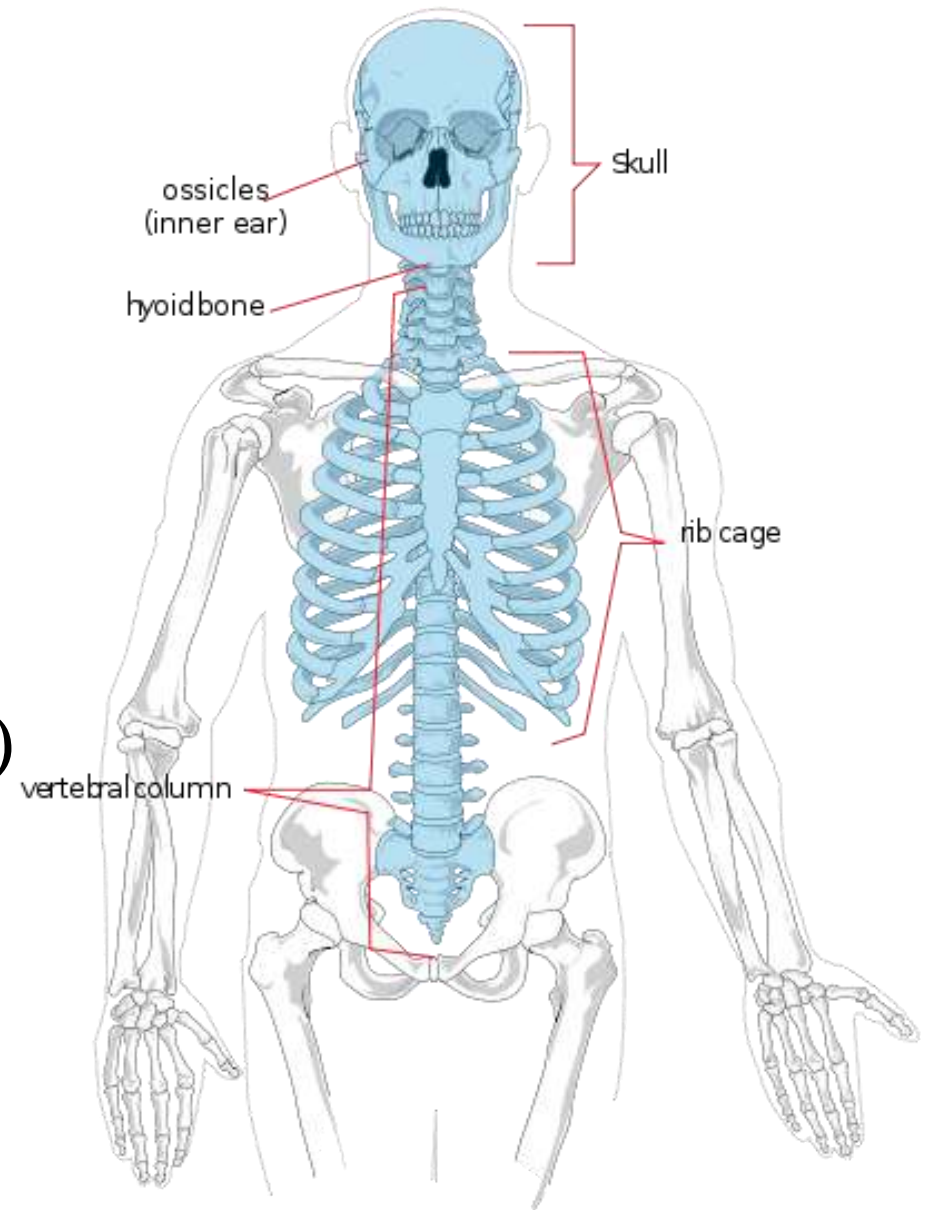
About 206 bones

2 Main Divisions



Axial Skeleton

- Head, neck, trunk
- Skull
- Hyoid Bone
- Vertebral Column
- Thoracic Cage (ribs, 12 pairs)
- Sternum



Hyoid Bone

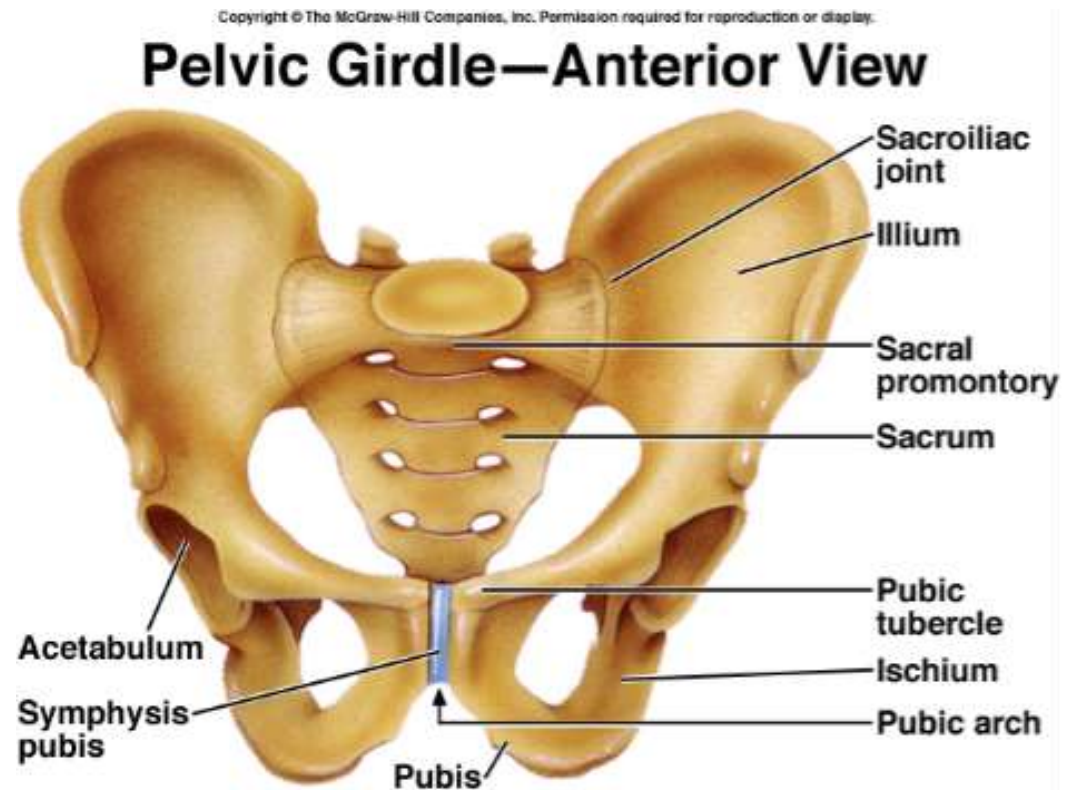
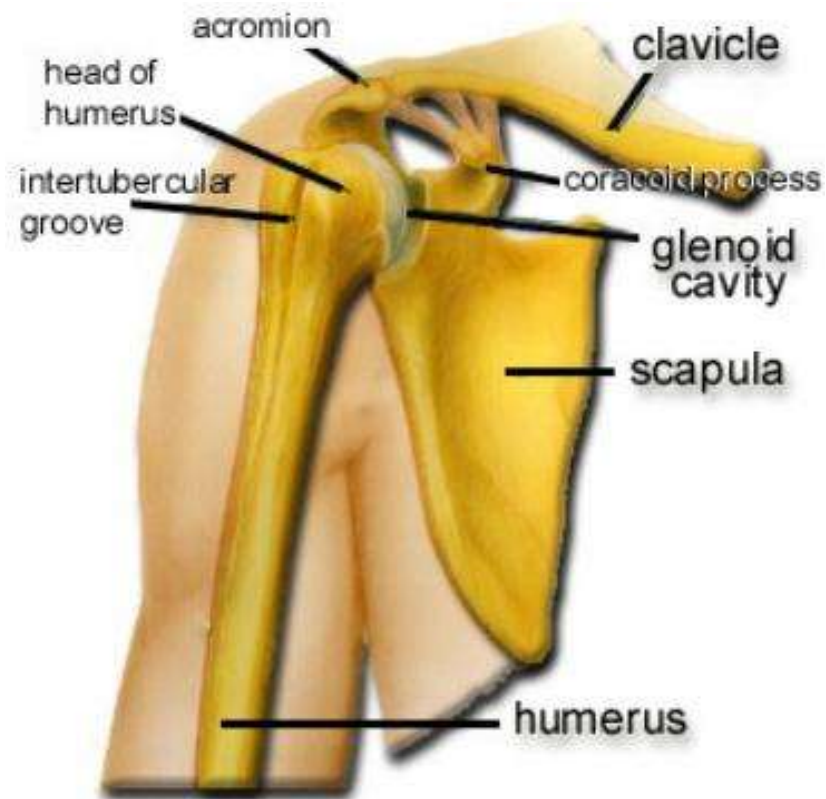


Appendicular Skeleton

Limbs & Bones that connect to the

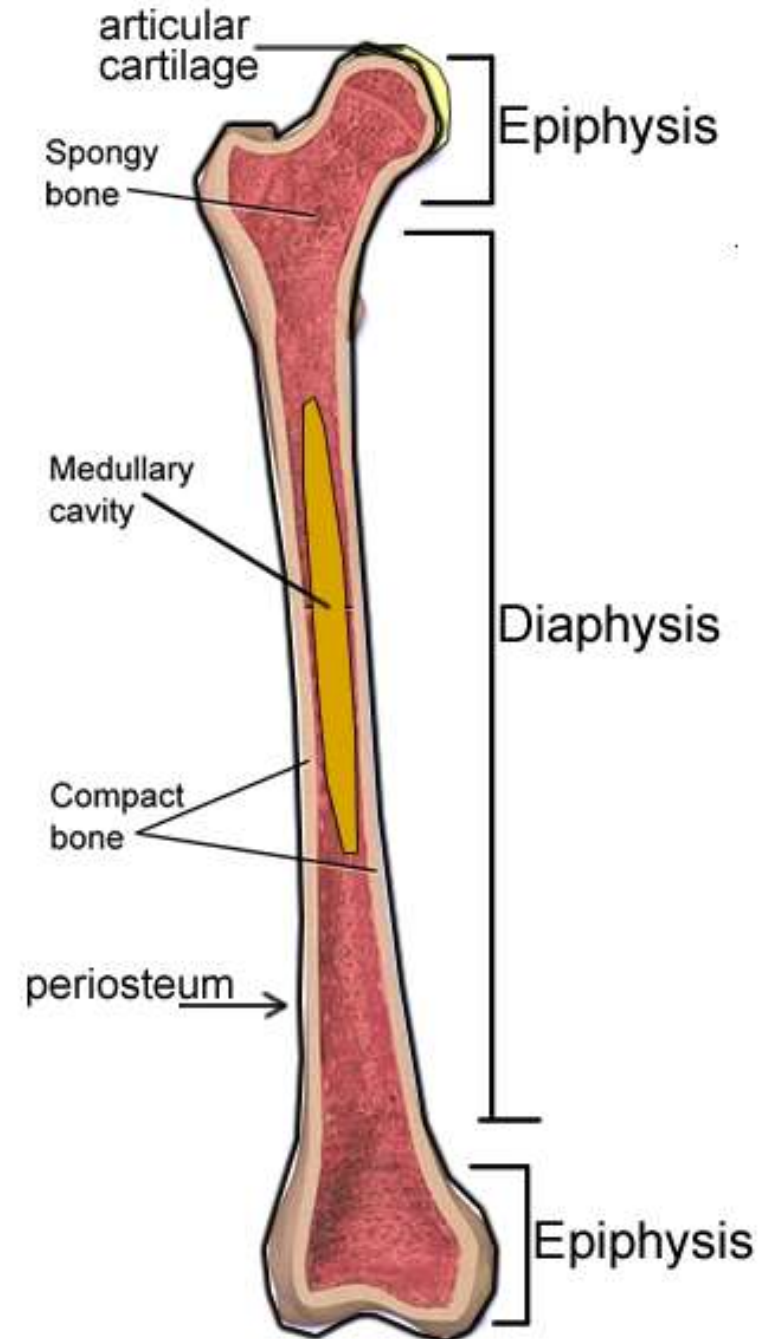
Pectoral Girdle (scapula, clavicle, arms)

Pelvic Girdle (coxal bones, legs)



BONE STRUCTURE - Long Bone

1. Epiphysis (end)
2. Diaphysis (shaft)
3. Articular Cartilage
(hyaline cartilage, padding)
4. Periosteum
(membrane that covers entire bone)



Inside the Long Bone

5. Medullary Cavity –
hollow chamber filled
with bone marrow

Red Marrow (blood)

Yellow Marrow (fat)



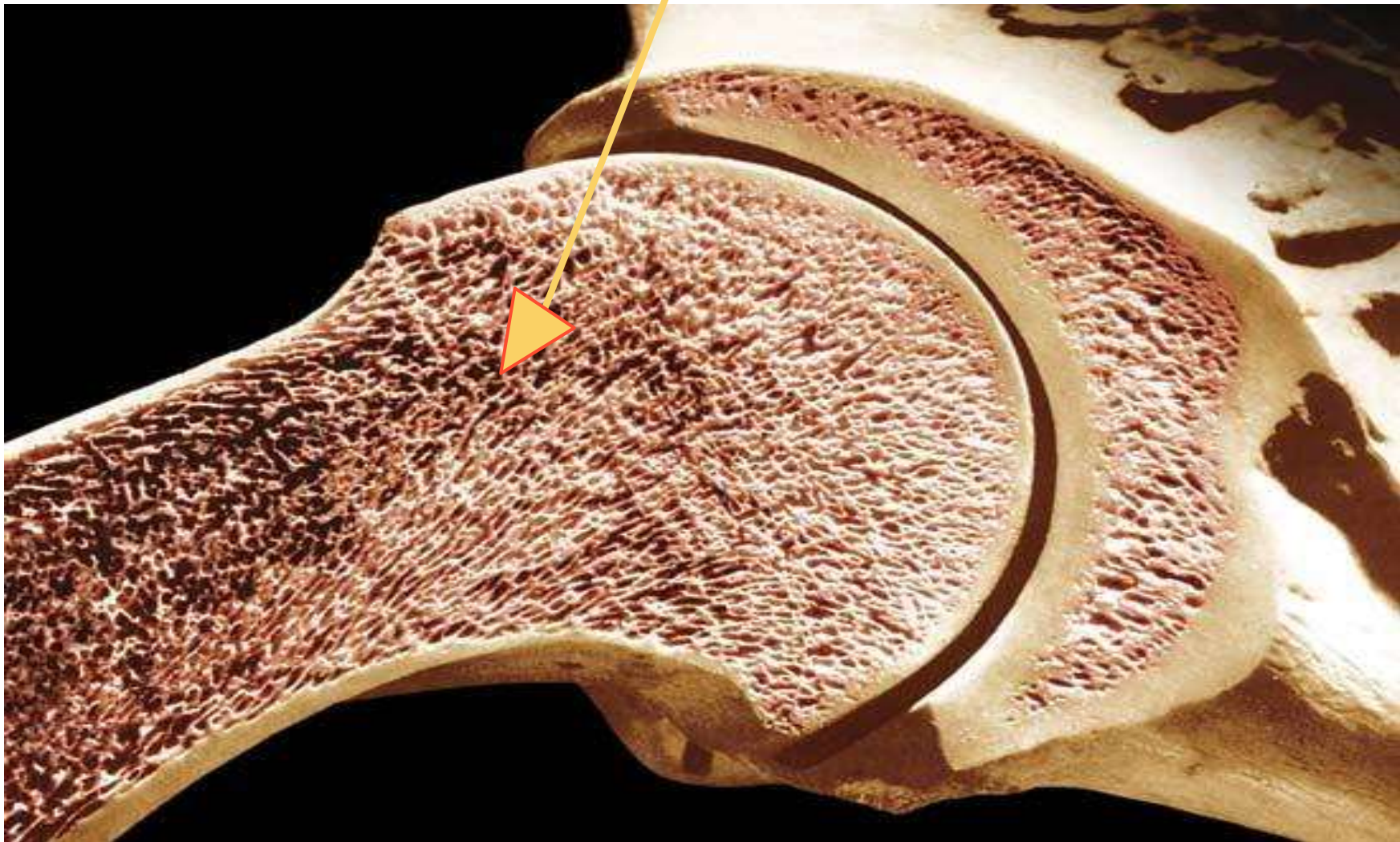
Endosteum

– lining of the medullary

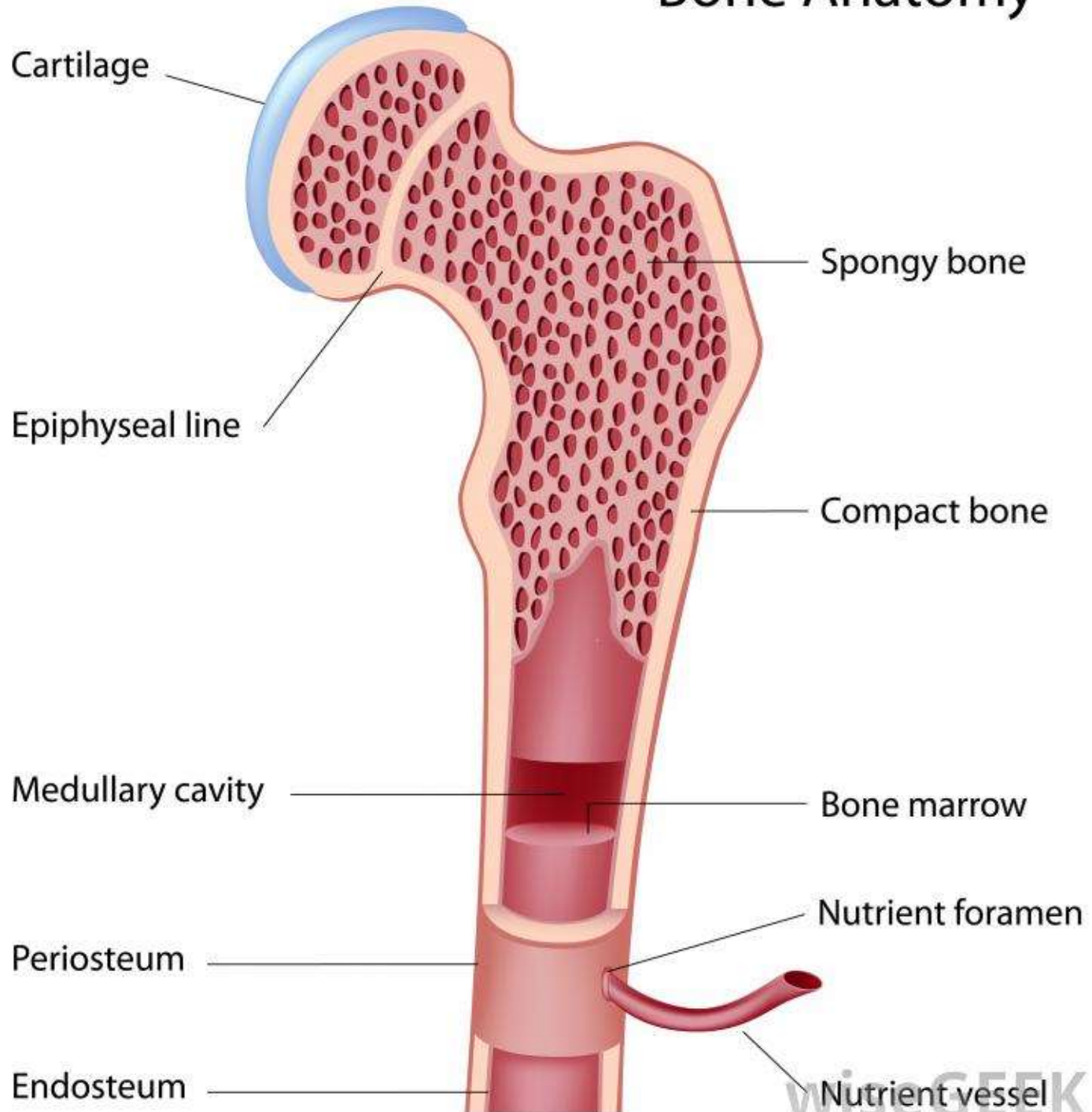
Types of Bone Tissue

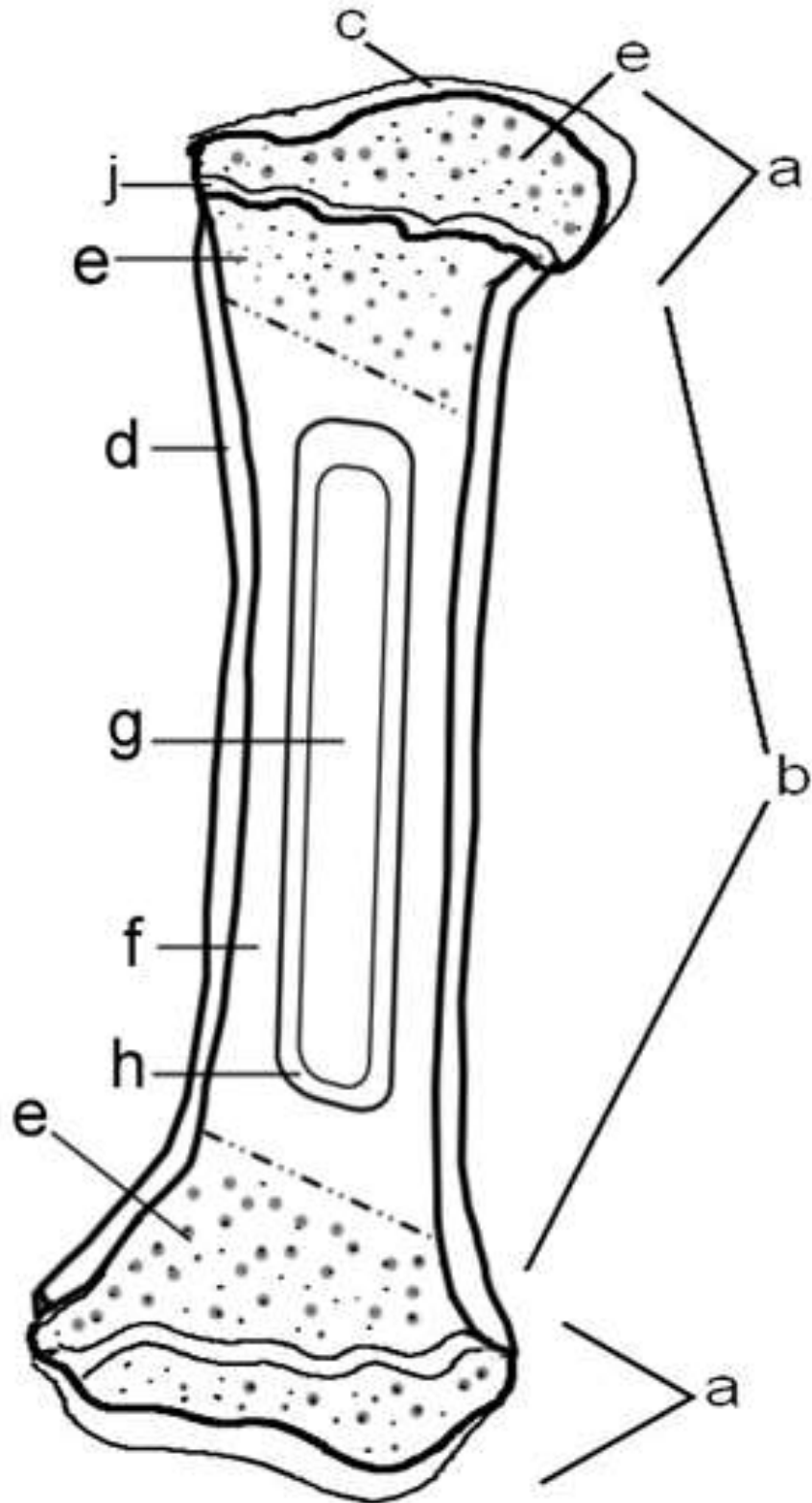
Compact (wall of the diaphysis)

Spongy (cancellous, epiphysis) - red marrow



Bone Anatomy





* Assignment

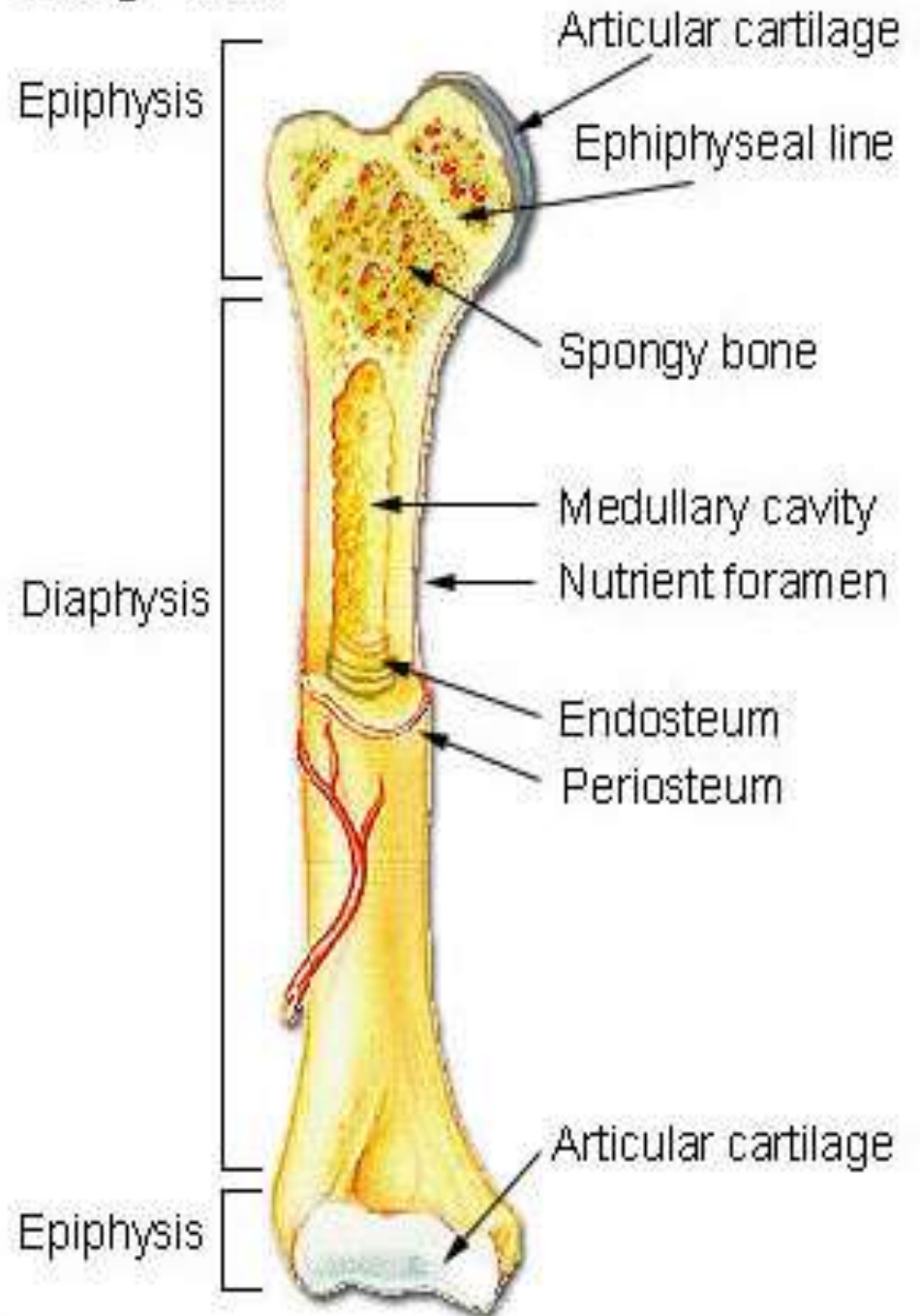
– Coloring of a Long Bone

Review the Structure of a Long Bone

Matching quiz at

<http://www.mhhe.com/biosci/a/p/holehaap/student/olc2/chap07matching01.html>

Long Bone



Microscopic Structure

Bone tissue is called OSSEOUS tissue

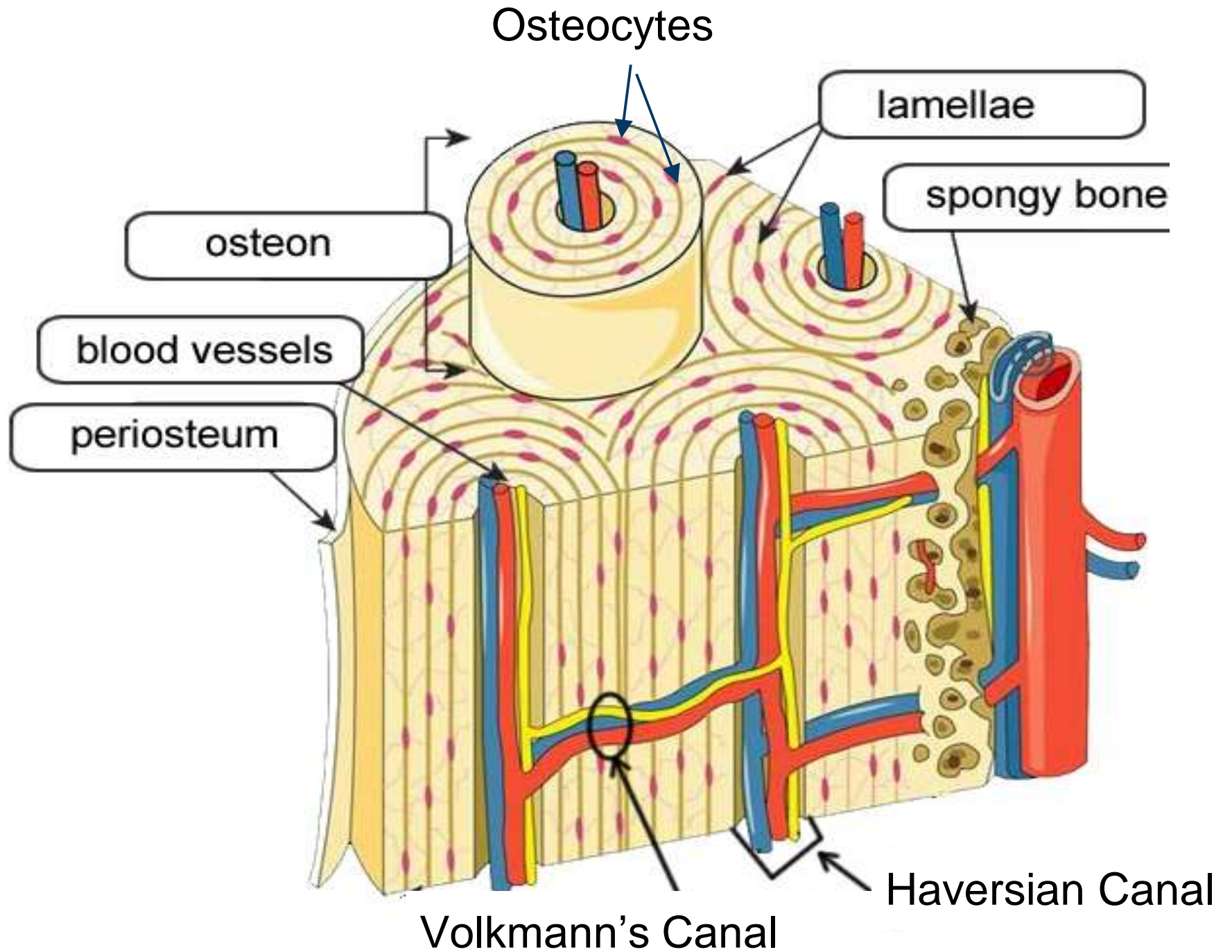
- the matrix is composed of collagen and inorganic salts

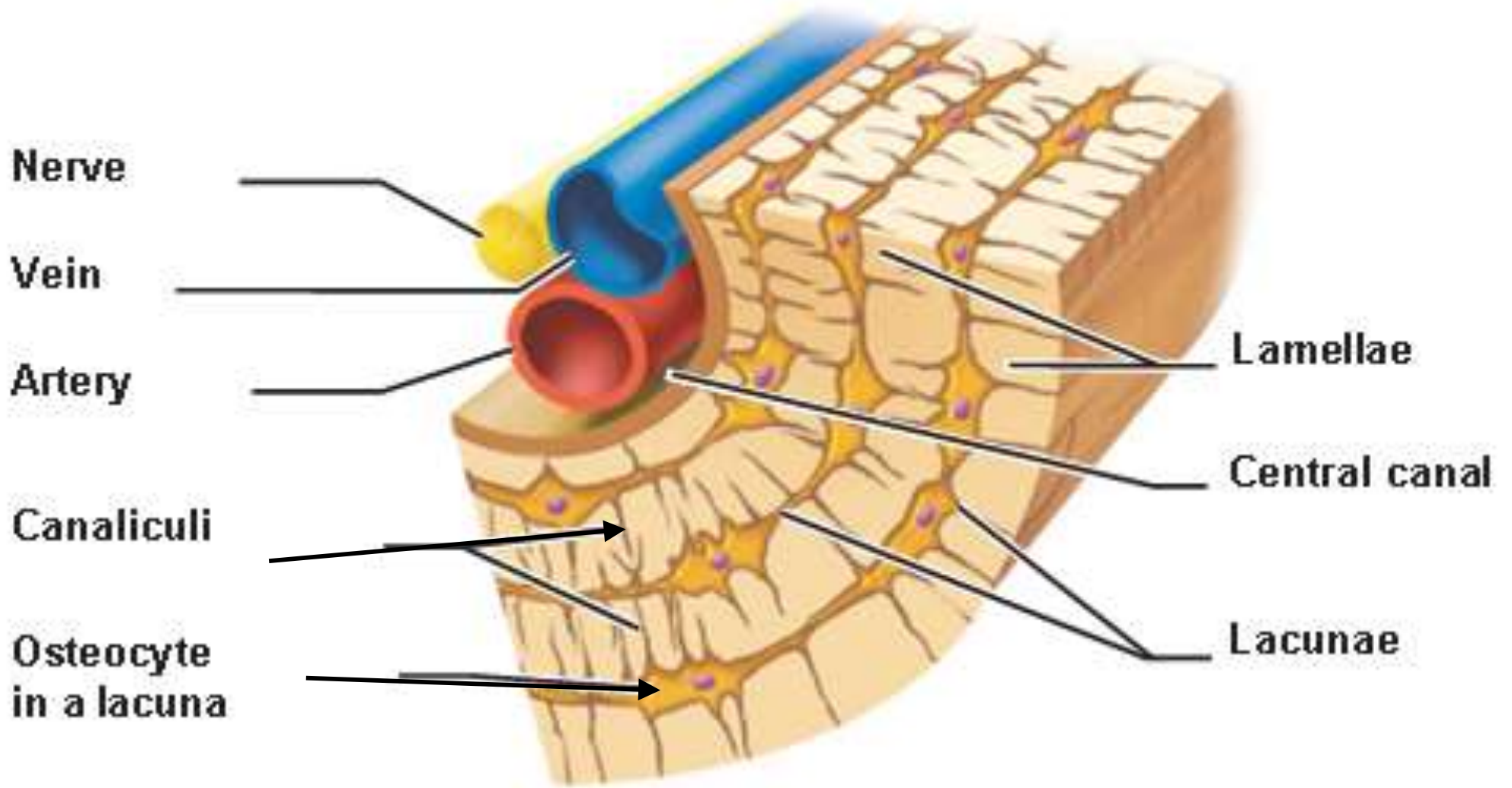
OSTEOCYTES - mature bone cells, enclosed in tiny chambers called LACUNAE

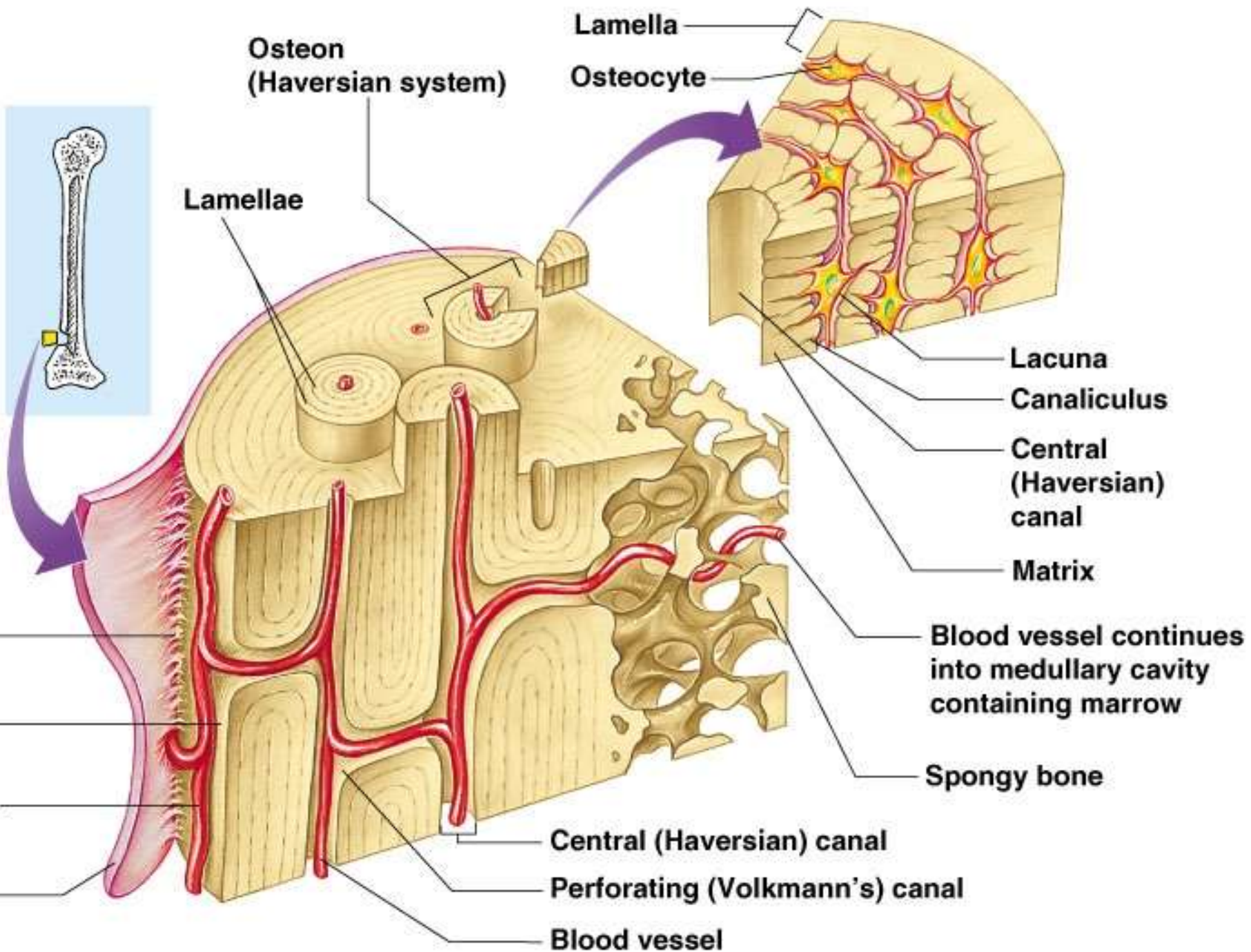
- these form rings called lamella around a HAVERSIAN CANAL which houses blood vessels

CANALICULI - tiny canals that link osteocytes

Haversian and Volkmann canals provide passageways for blood vessels







Test Yourself

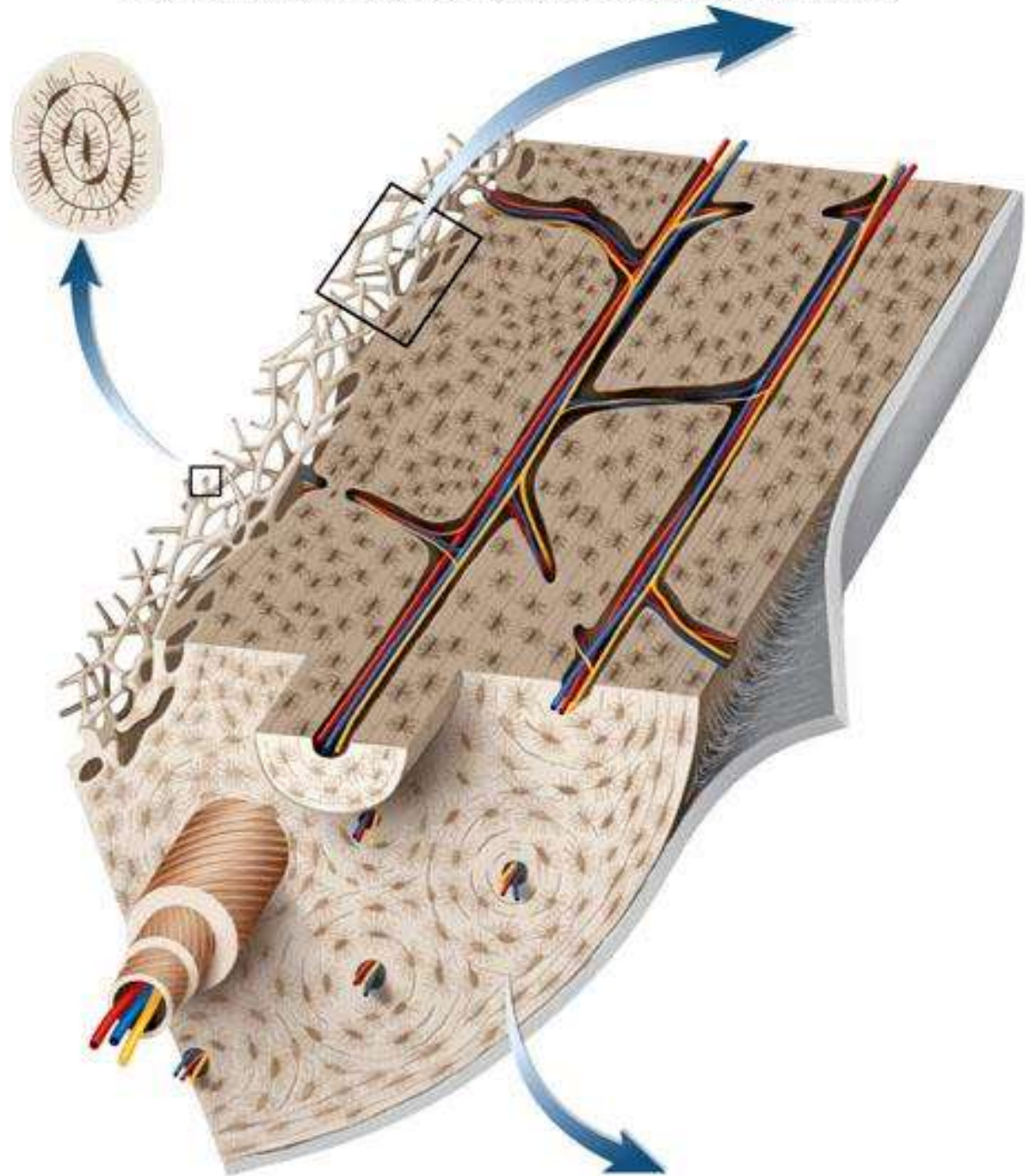
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Find the...

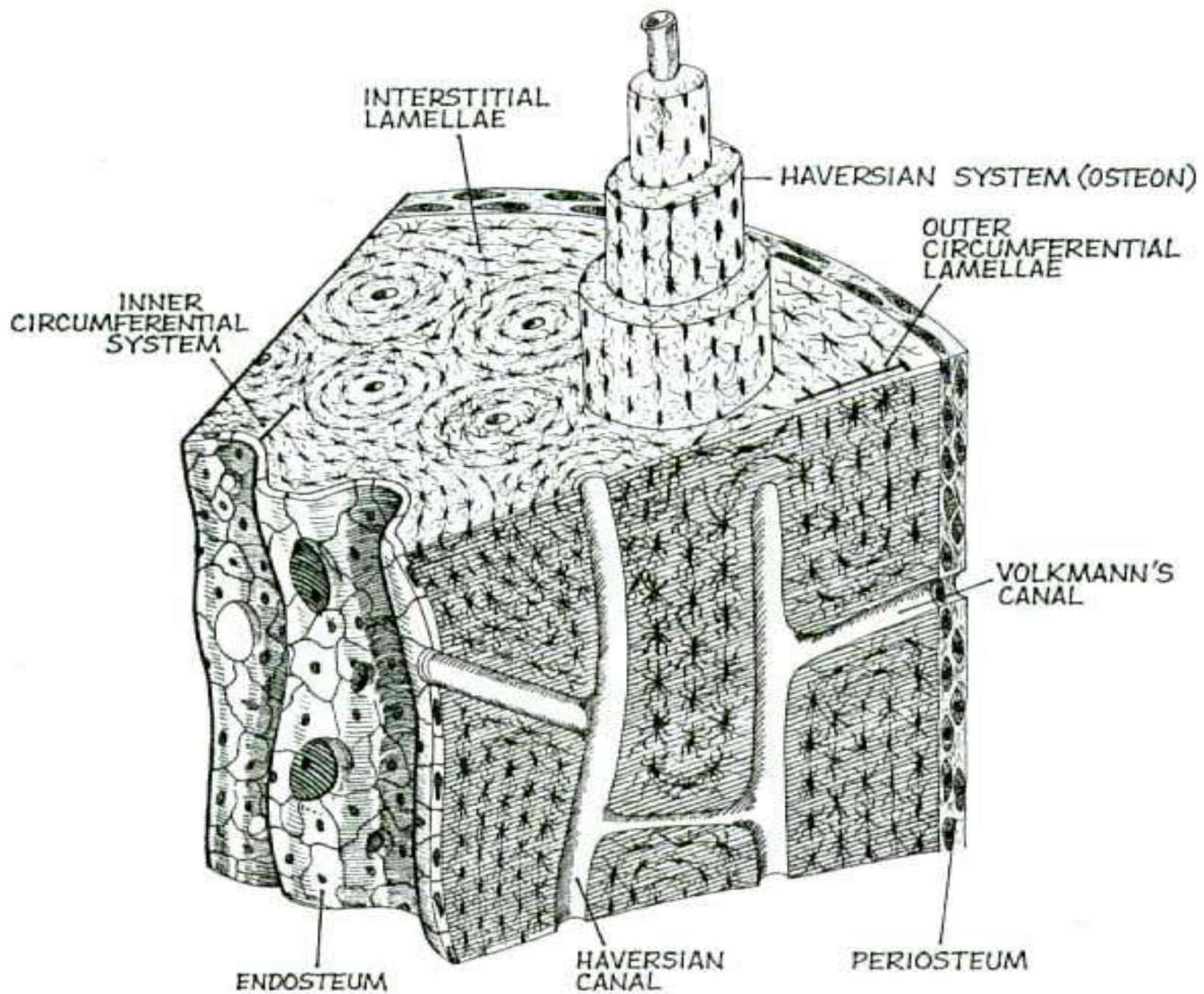
Haversian Canal
Volkman's Canal

Lamellae

Spongy Bone
Compact Bone



(b)



BONE DEVELOPMENT & GROWTH

1. Intramembranous bones – flat, skull
2. Endochondral bones – all other

Bones first form as hyaline cartilage. The cartilage then gradually changes into bone tissue - a process called OSSIFICATION

PRIMARY OSSIFICATION CENTER (shaft)

SECONDARY OSSIFICATION CENTER (ends)

Bone Development & Growth

EPIPHYSEAL DISK (growth plate) is a band of cartilage between the epiphysis and diaphysis

Growth Plate - open



Puppy

Growth Plate - Closed
(Epiphyseal Line)



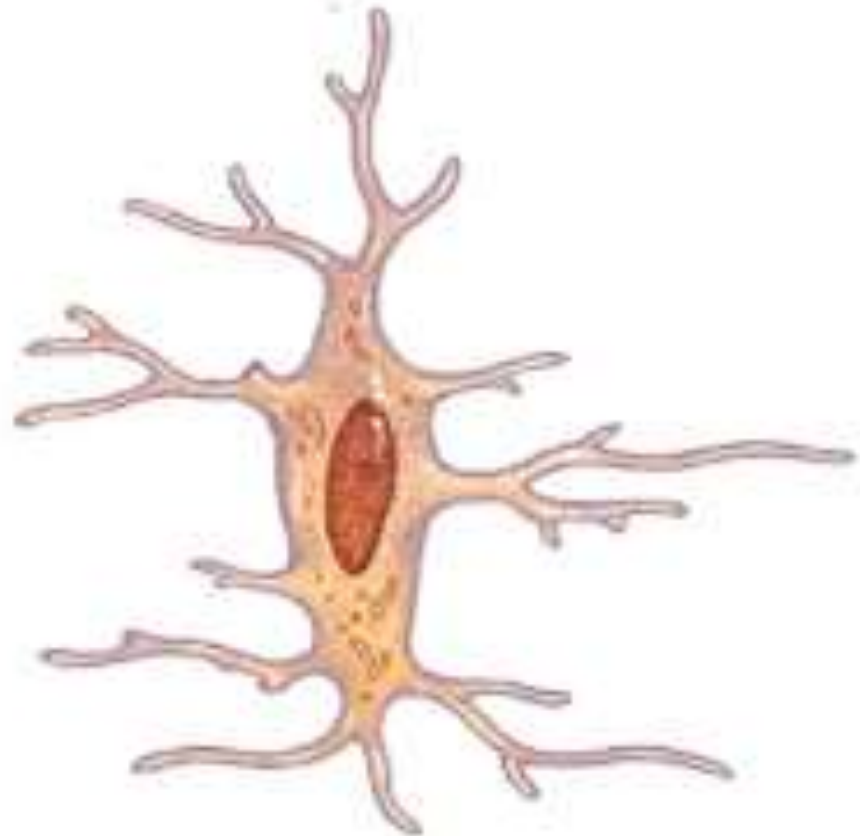
Adult

These areas increase bone length as the cells ossify

OSTEOBLASTS produce cells called osteocytes.



Osteoblast
(forms bone
matrix)



Osteocyte
(maintains
bone tissue)

RESORPTION

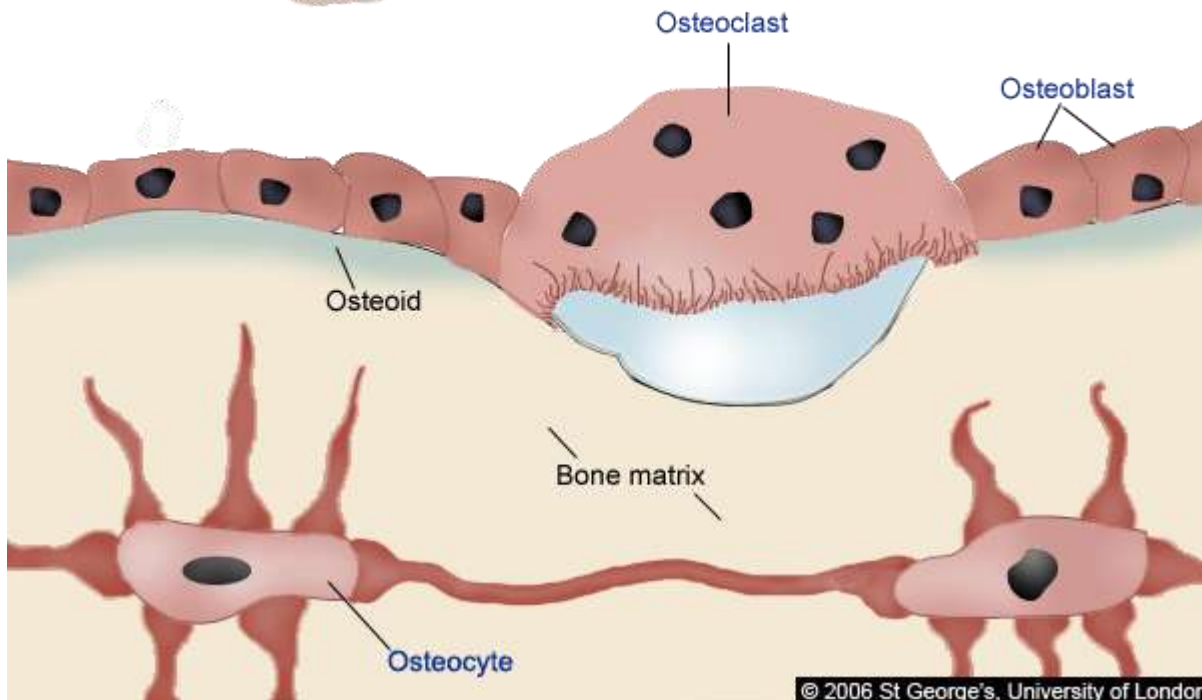
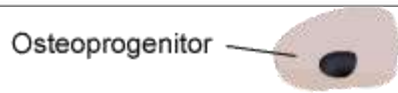
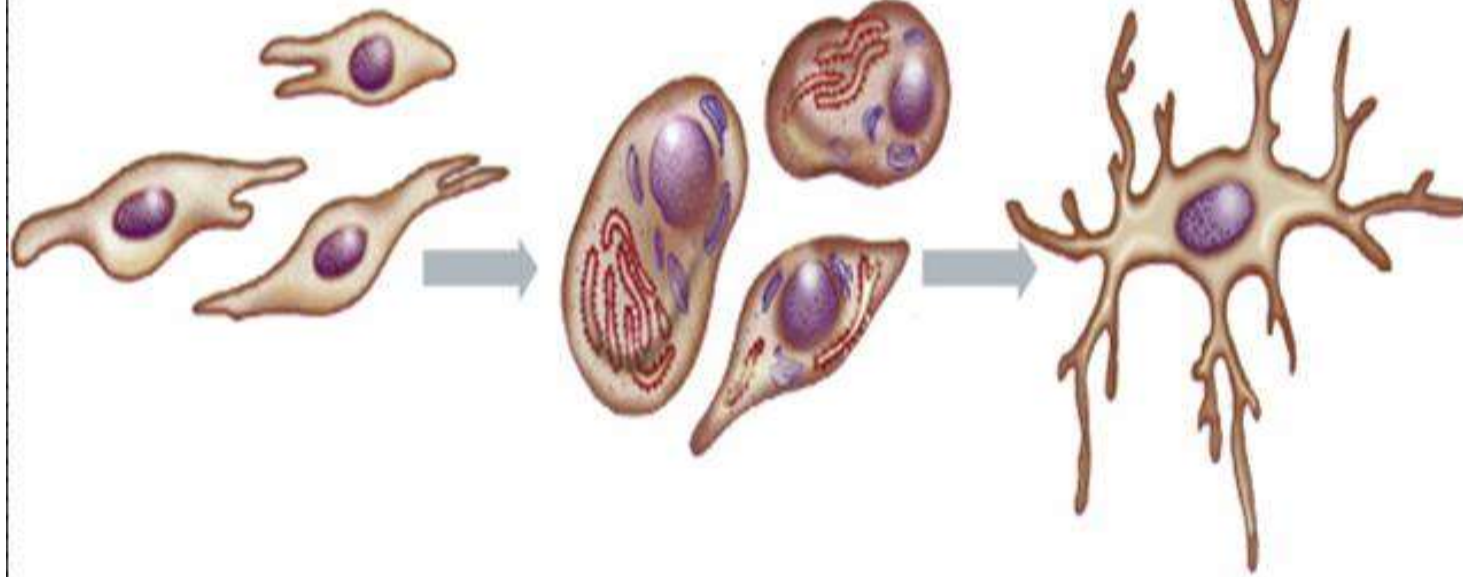
OSTEOCLASTS -
dissolve bone tissue
to release
minerals, process is
called RESORPTION



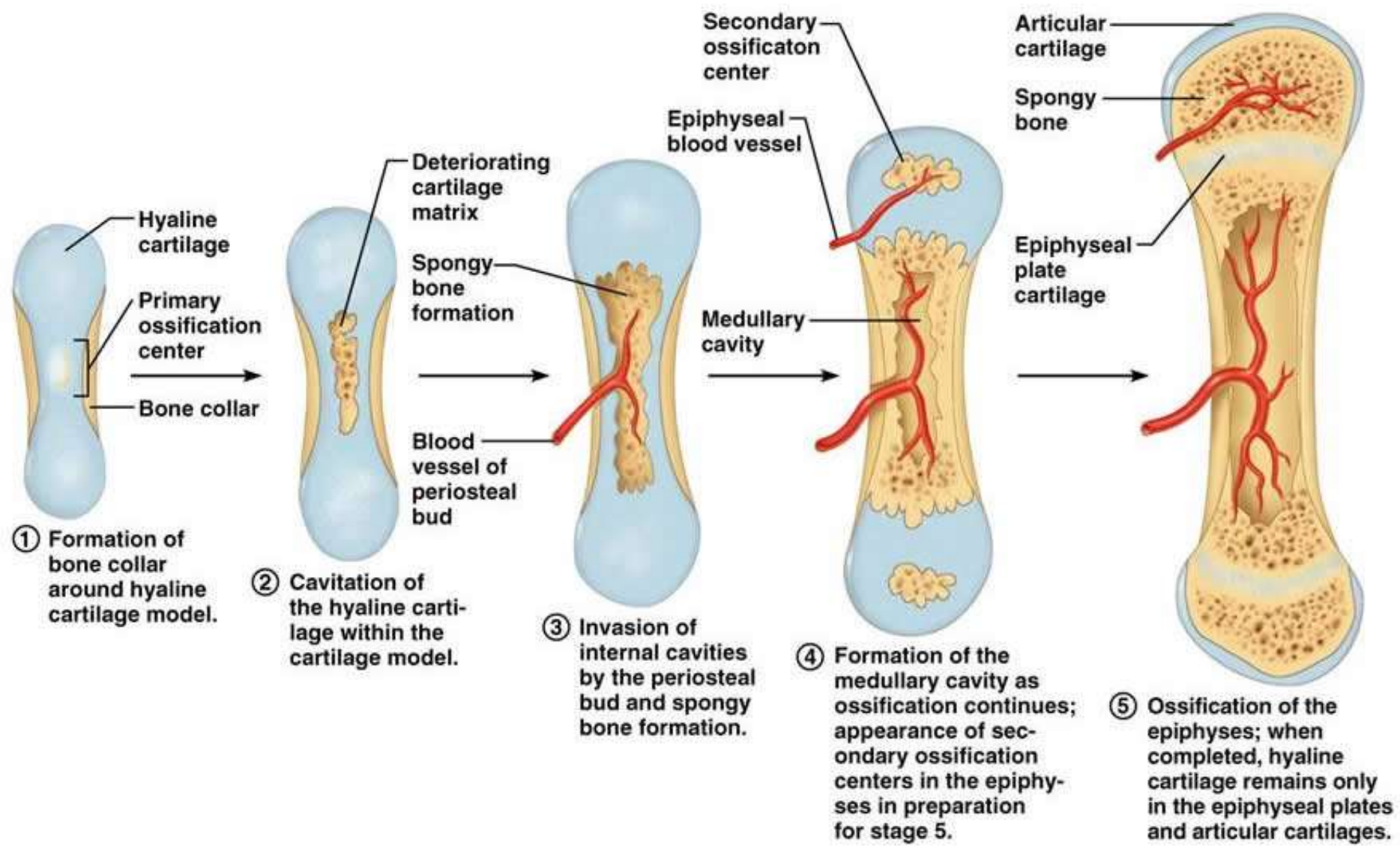
Osteogenic cells

Osteoblasts

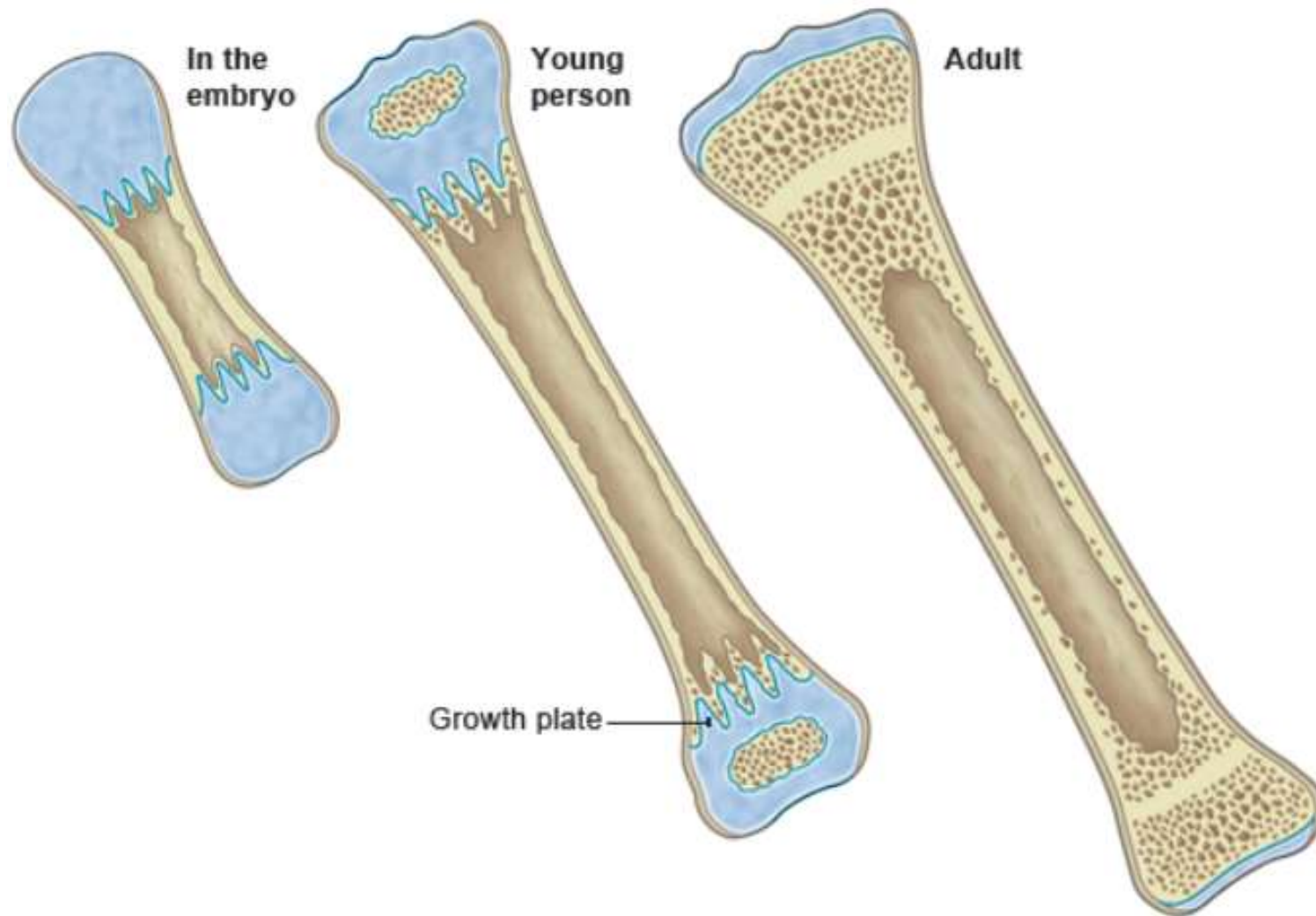
Osteocyte



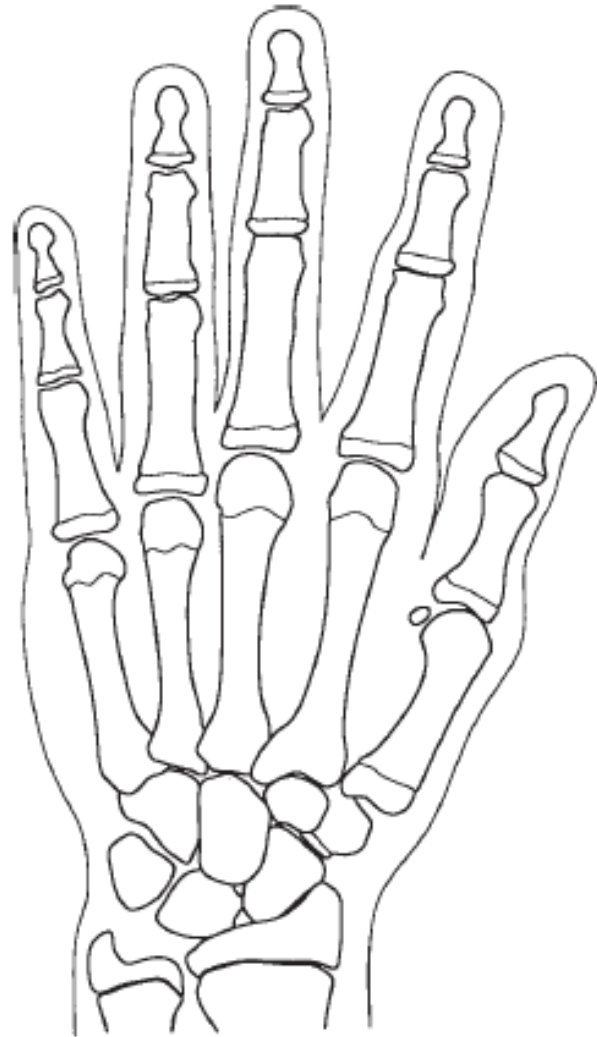
Bone Growth



Bone Growth



* Assignment - Coloring of the Aging Hand



Types of Joints (articulations)

Synarthrotic (not moveable, aka sutures)

*skull

Amphiarthrotic (slightly movable)

*vertebrae

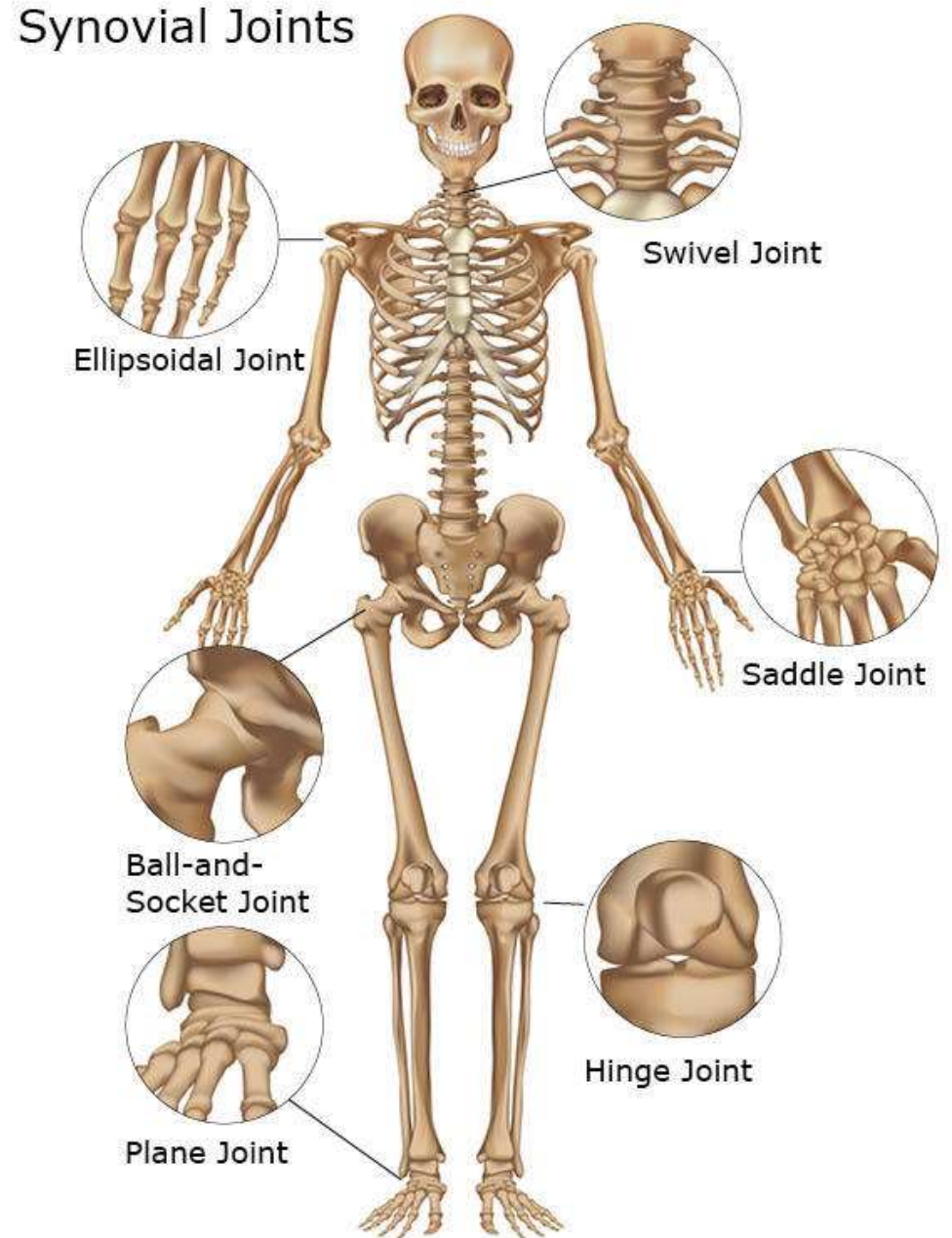
Diarthrotic (moveable joint)

*knees, elbows, wrist, shoulder..etc

*synovial fluid for lubrication

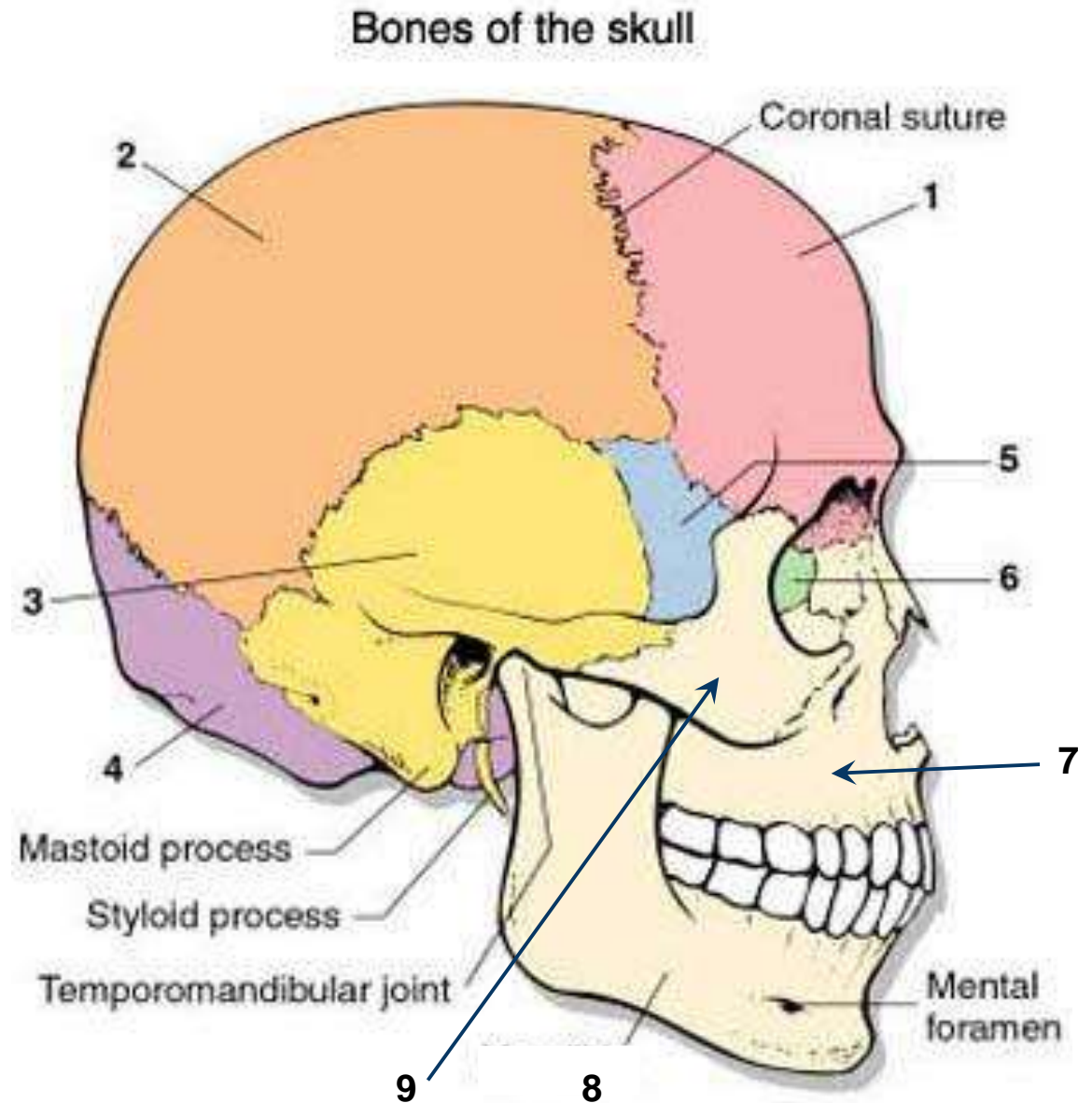
Types of Synovial Joints

1. Ball and Socket
(shoulder / hip)
2. Hinge (elbow, knee)
3. Pivot (lower arm)
4. Saddle (thumb)



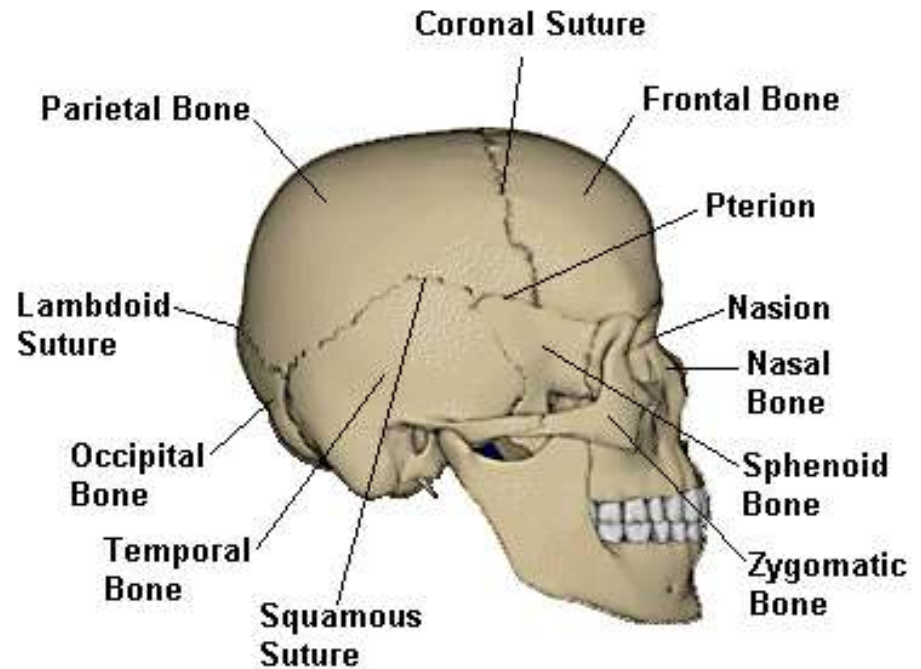
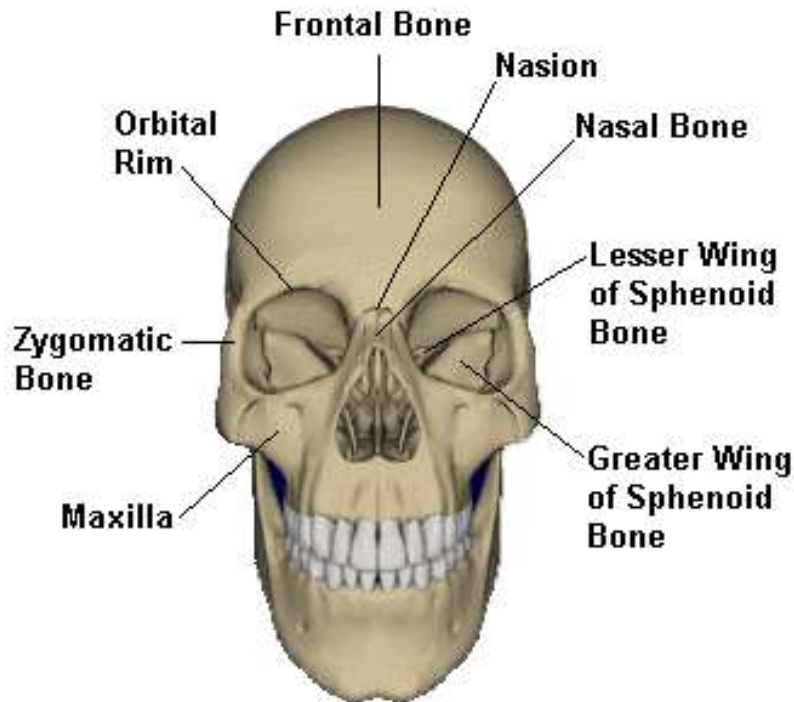
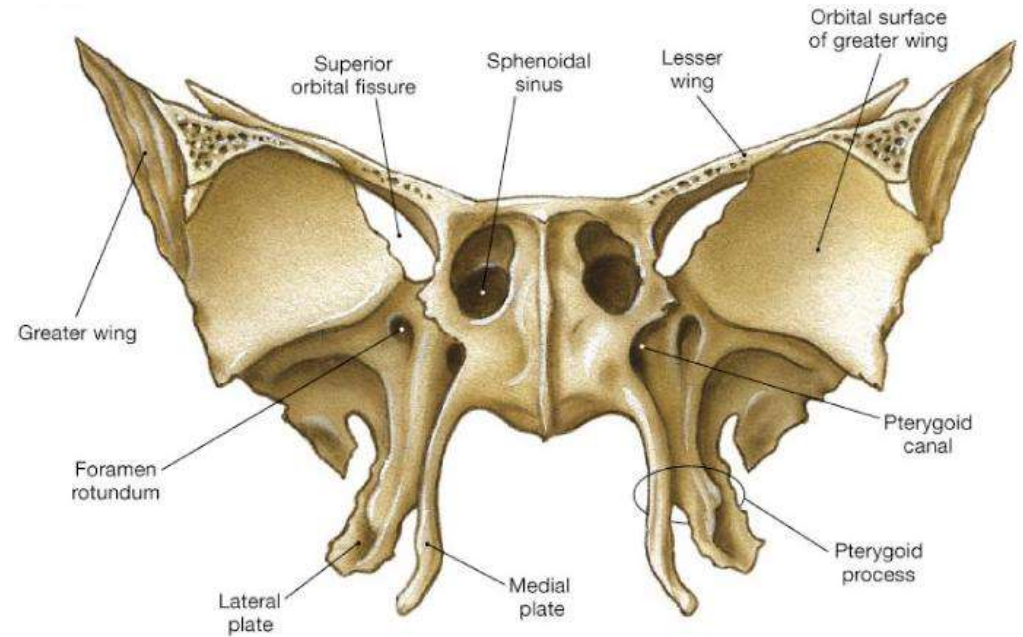
BONES OF THE SKULL

1. Frontal -
2. Parietal -
3. Temporal -
4. Occipital -
5. Sphenoid -
6. Ethmoid -
7. Maxilla -
8. Mandible -
9. Zygomatic -



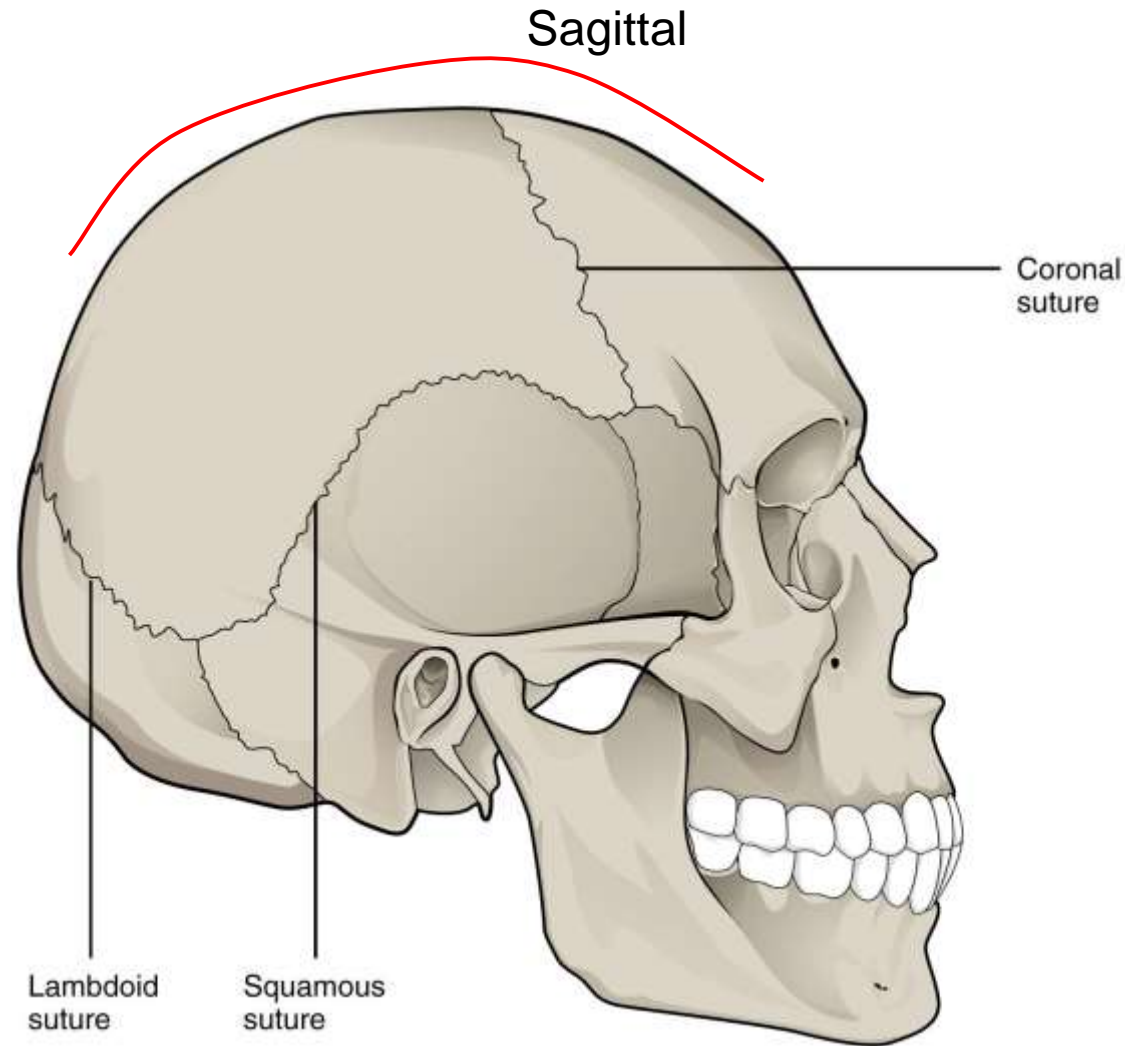
Sphenoid Bone

Names for its shape
- a butterfly!



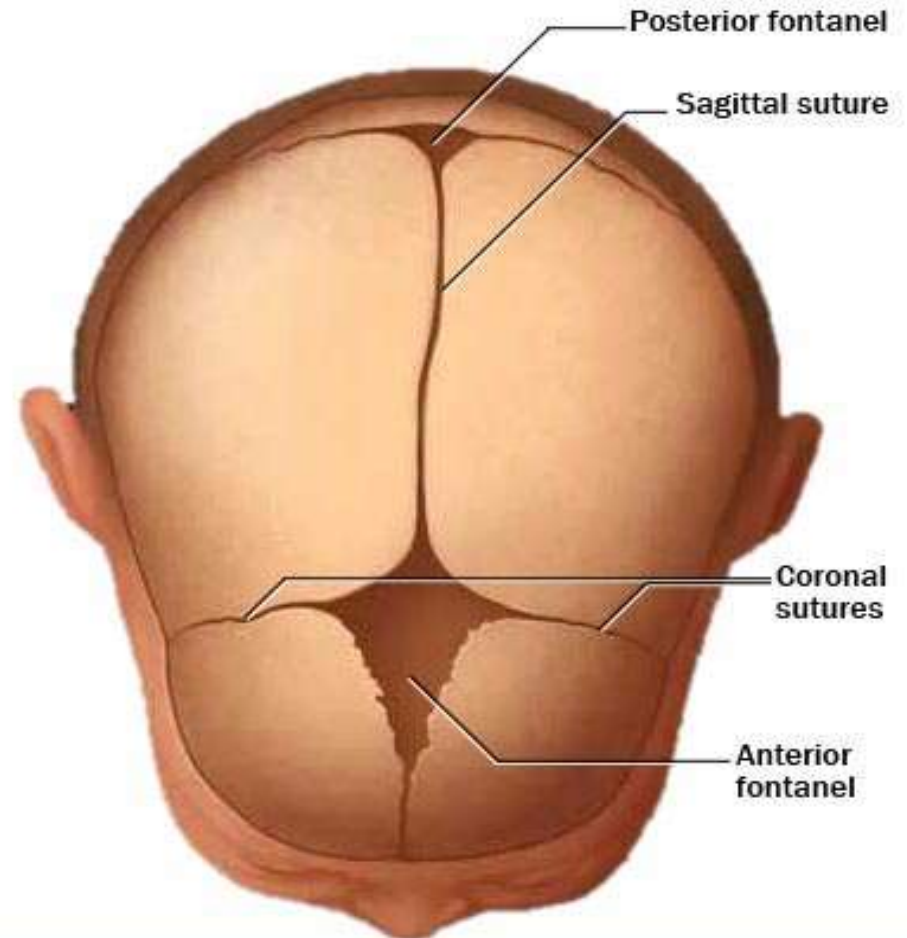
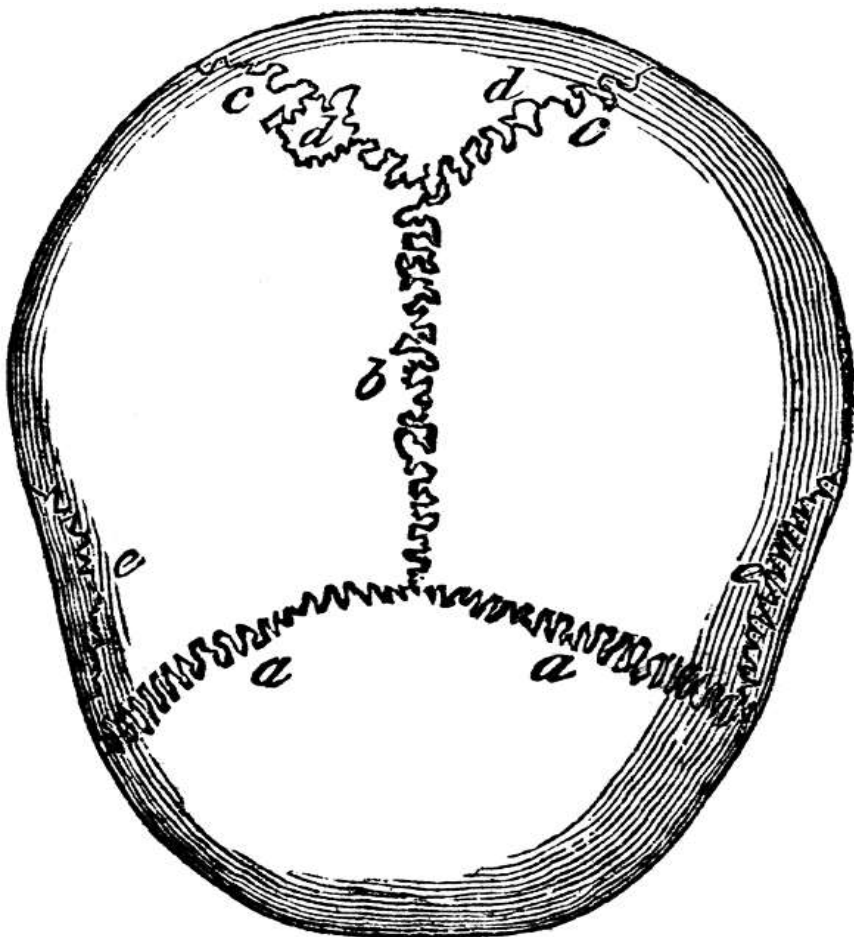
Sutures - connection points

1. Coronal - between frontal and parietal bones
2. Lambdoidal - between occipital and parietal bones
3. Squamosal - between temporal and parietal bones
4. Sagittal - between parietal bones



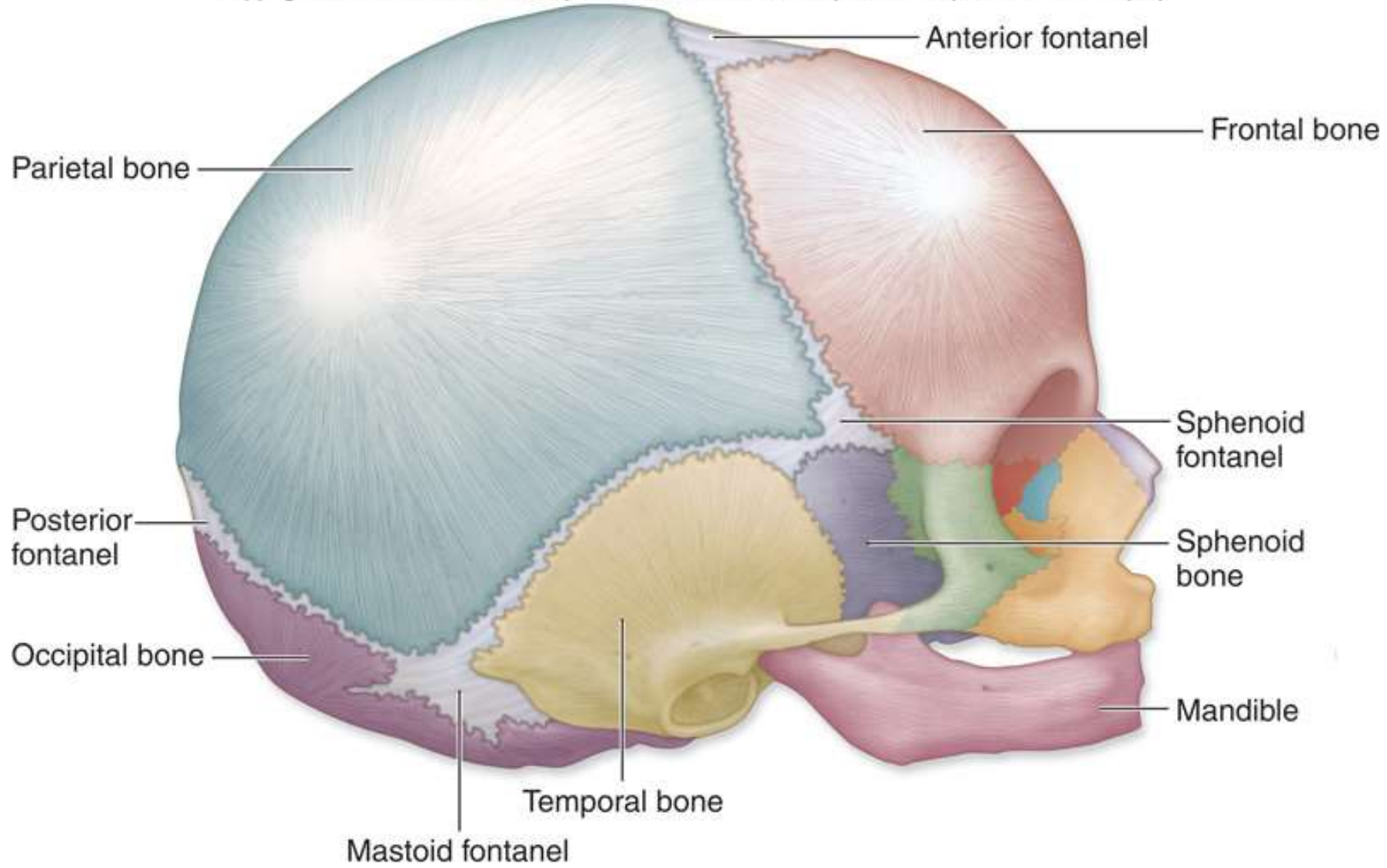
Suture - refers to any connection between large bones (in fetal skulls, these are called fontanel)

Fissure - any wide gap between bones



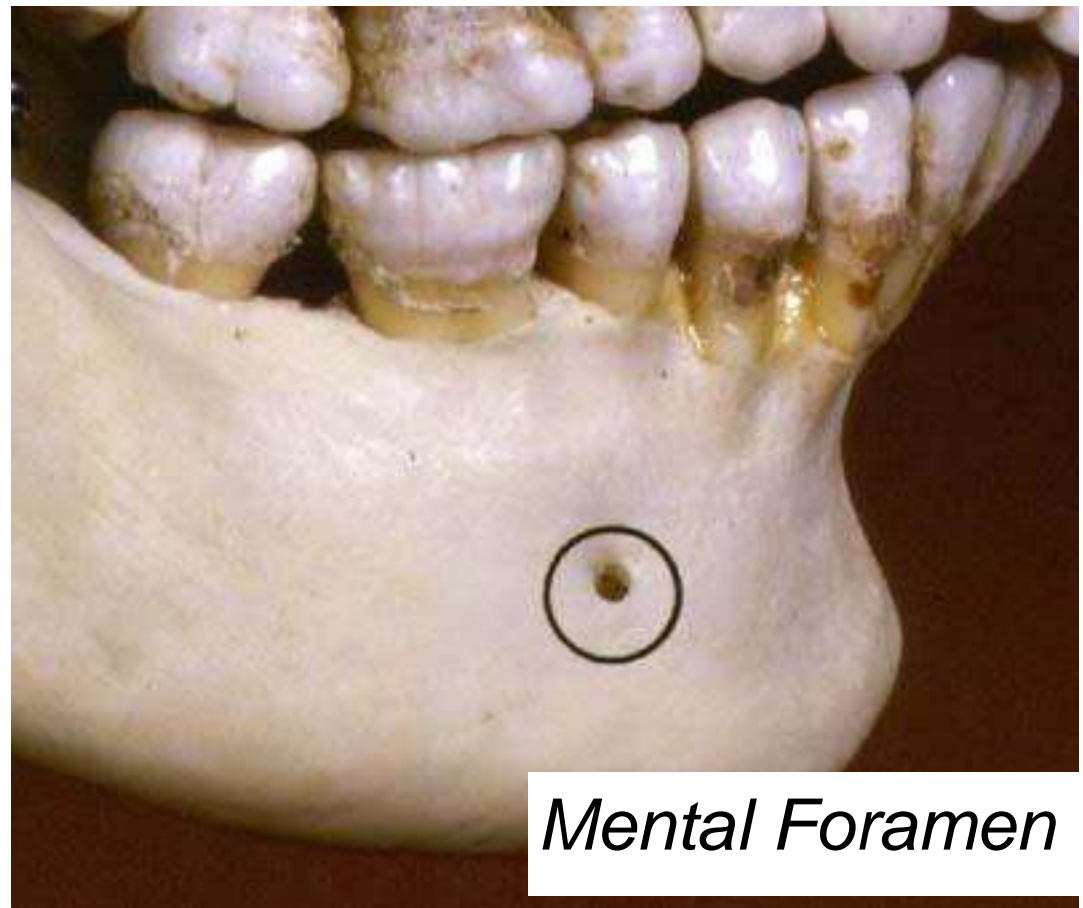
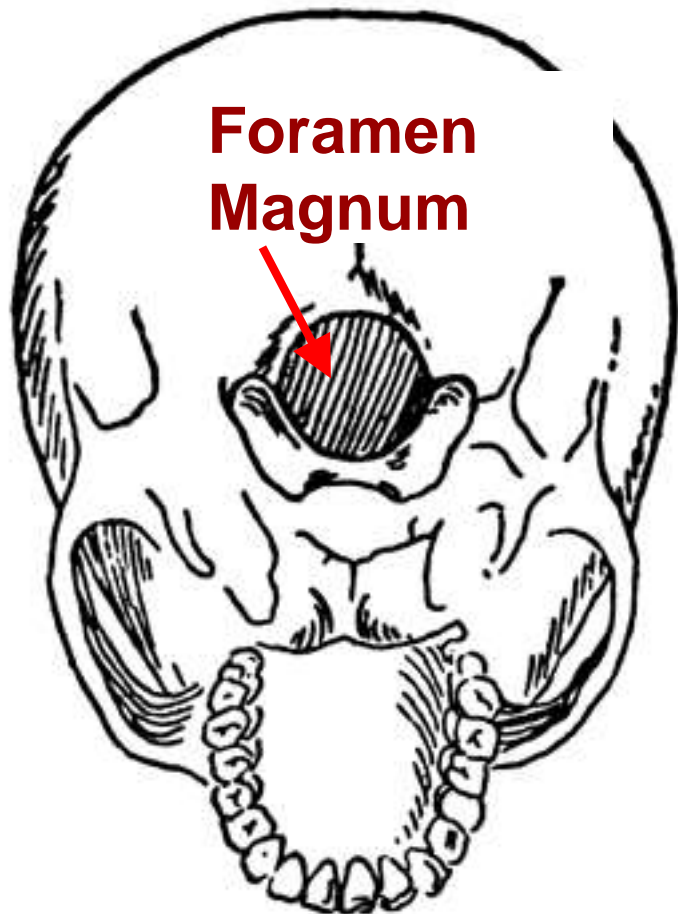
Fontanelles are “soft spots” on an infant’s skull

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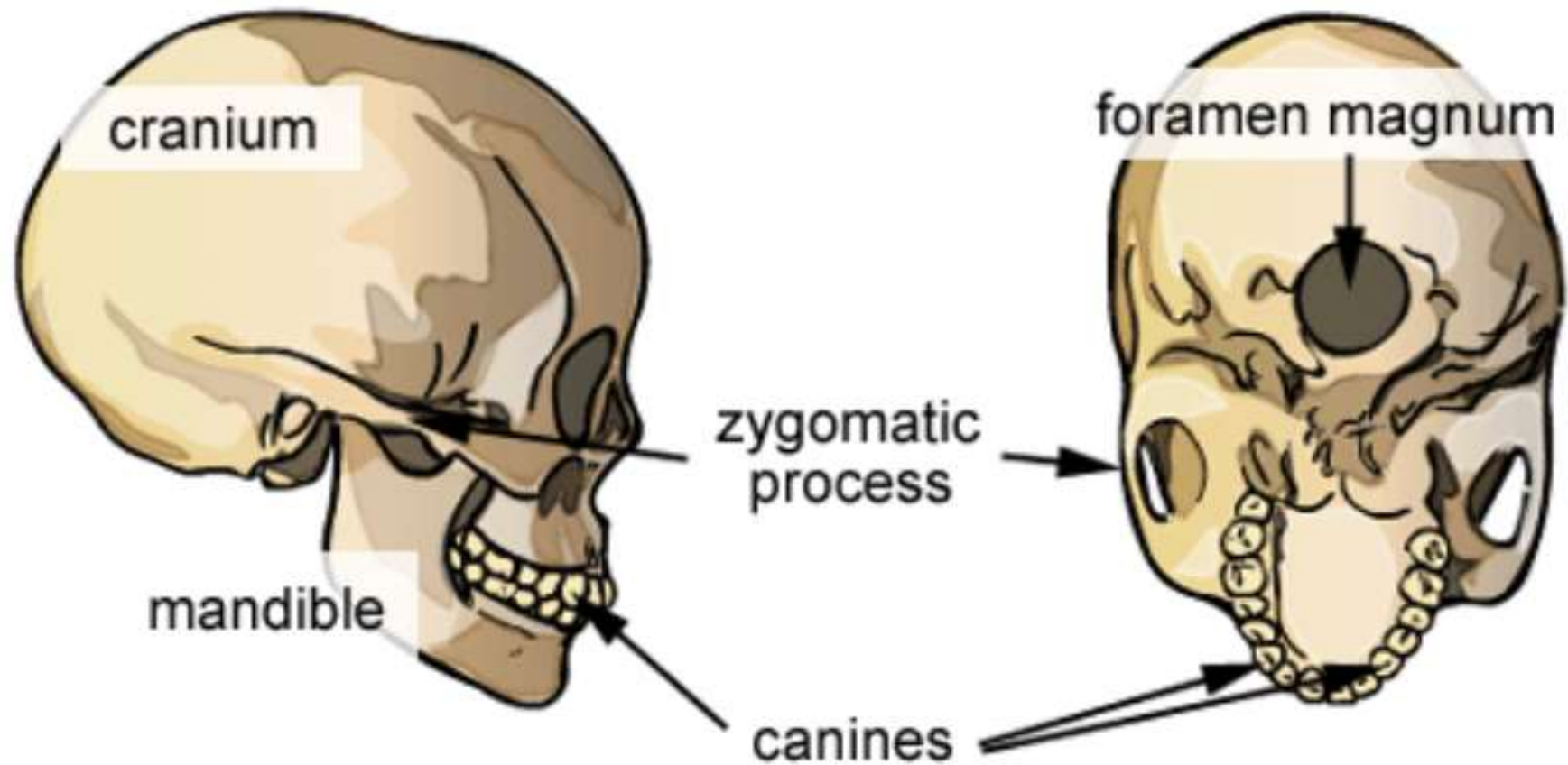


TOPOGRAPHY OF THE SKULL

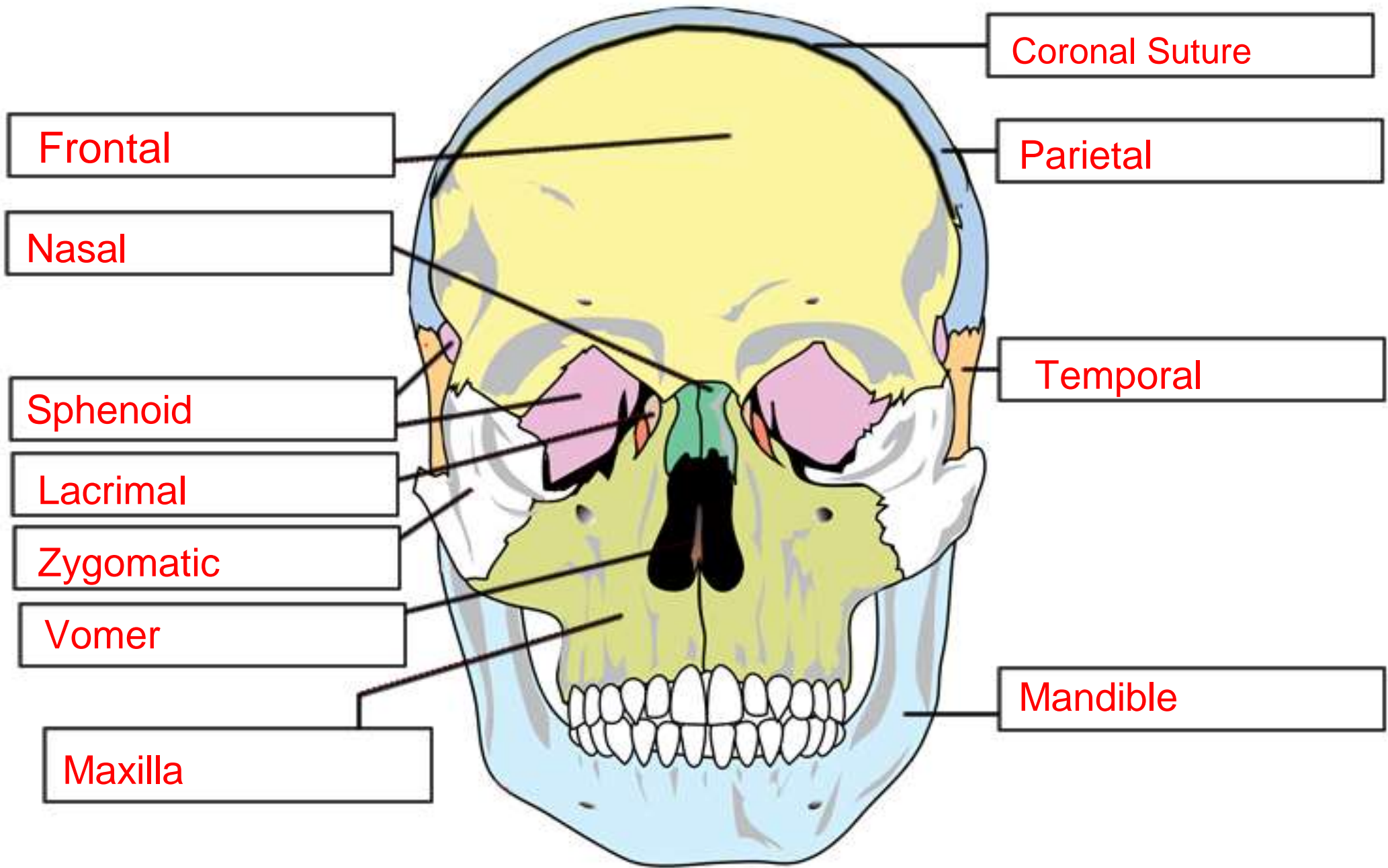
Foramen - refers to any opening in the skull, nerves and blood vessels leave this opening to supply the face

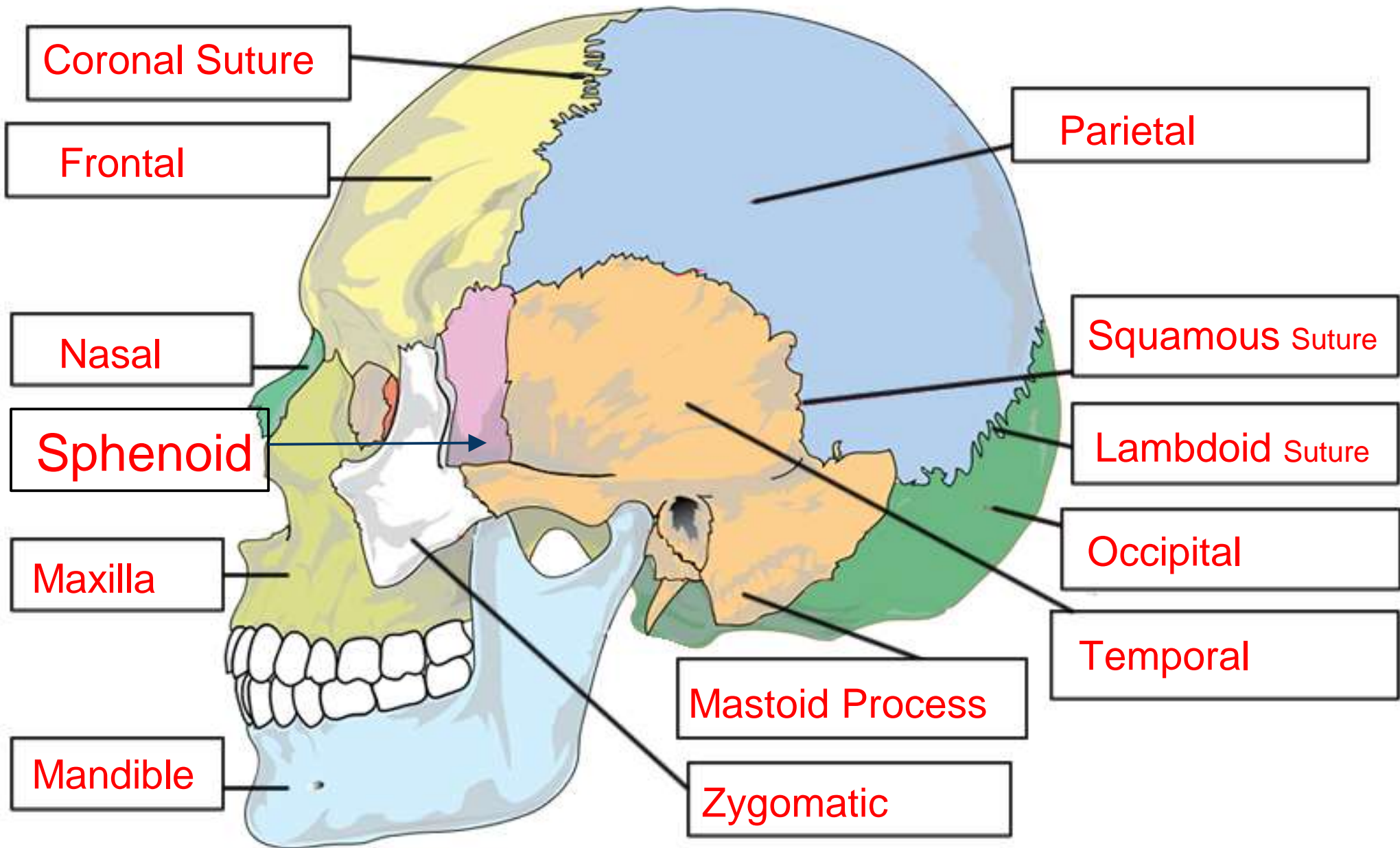


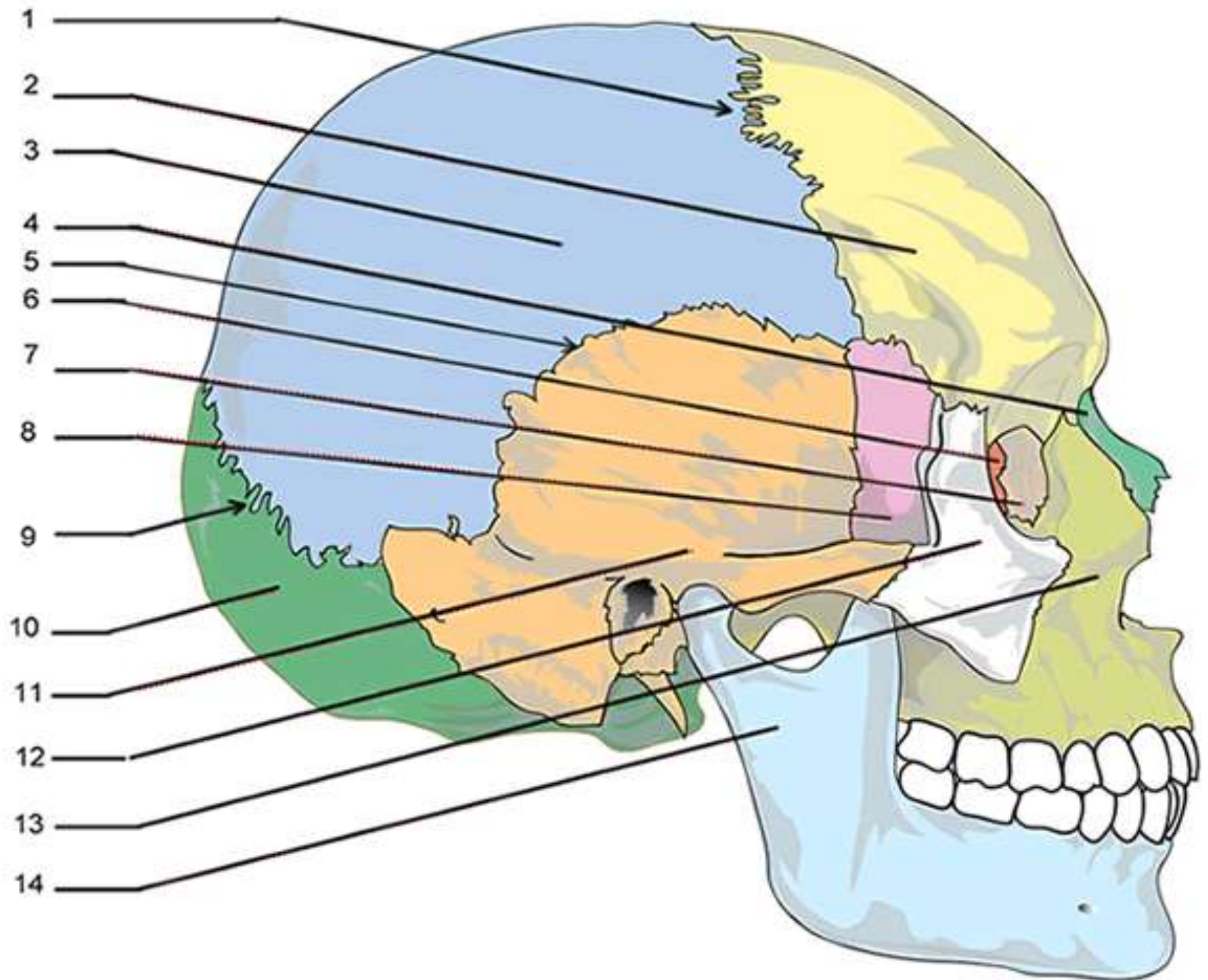
Foramen Magnum



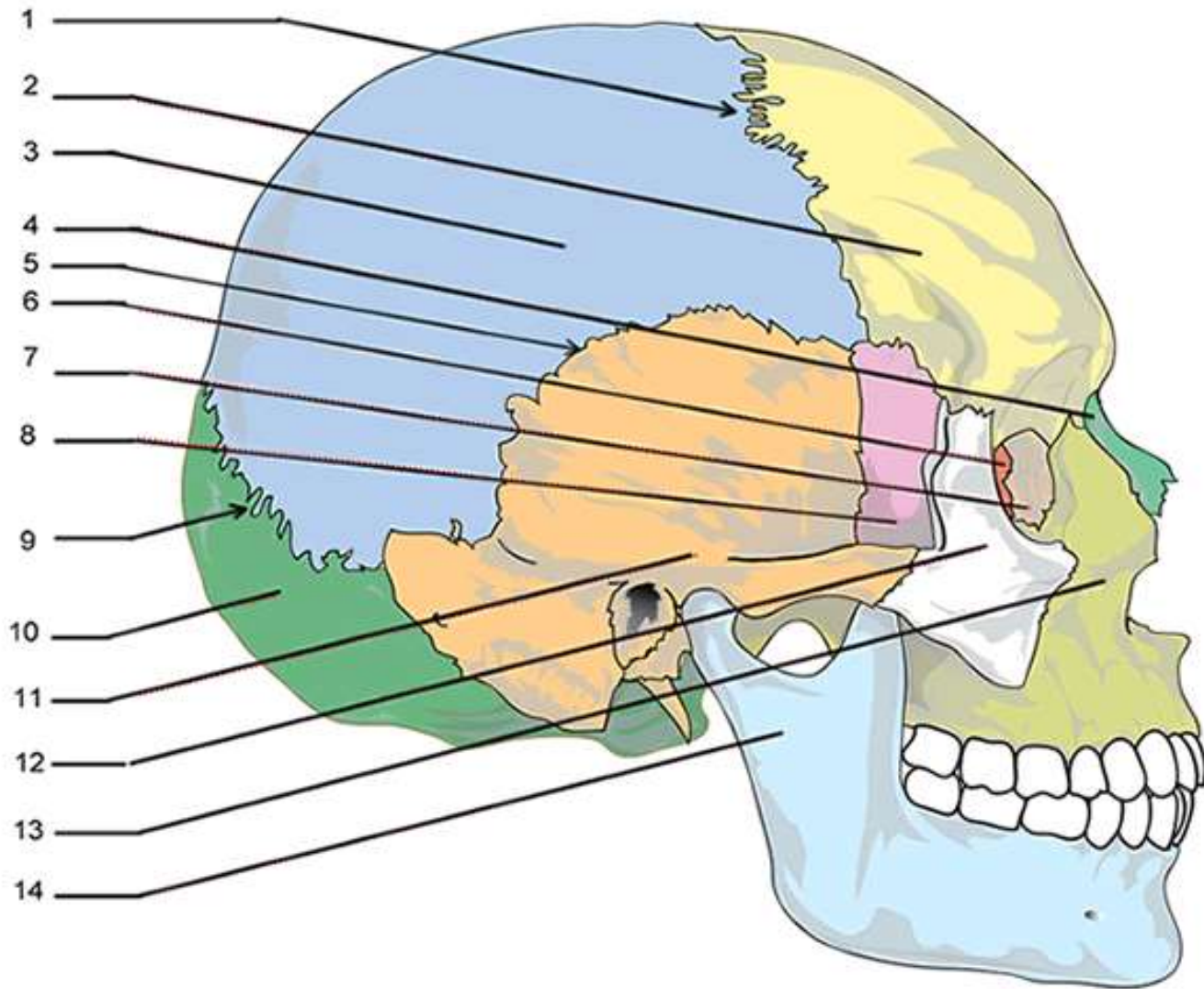
* Assignment: Skull Labeling

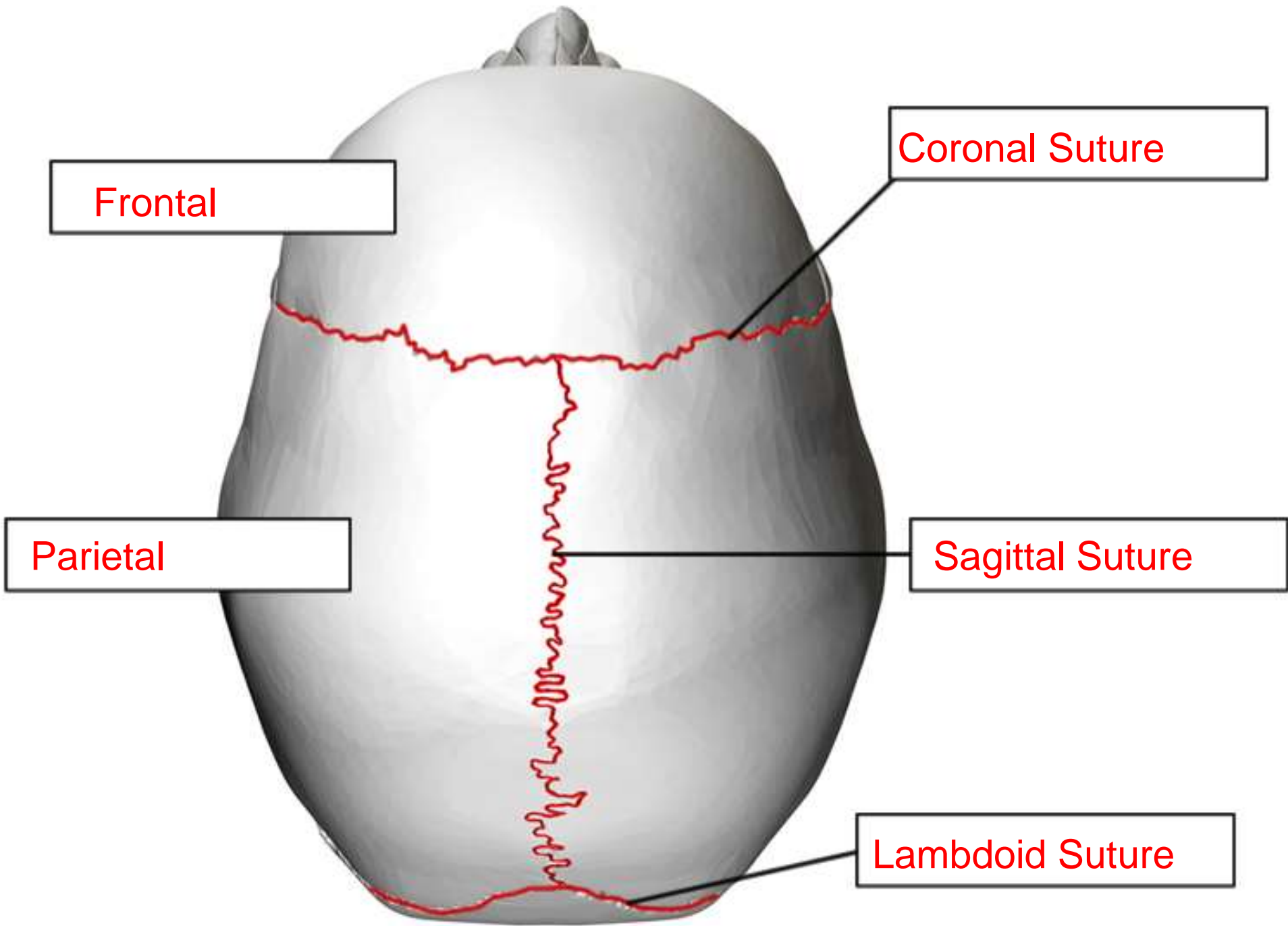




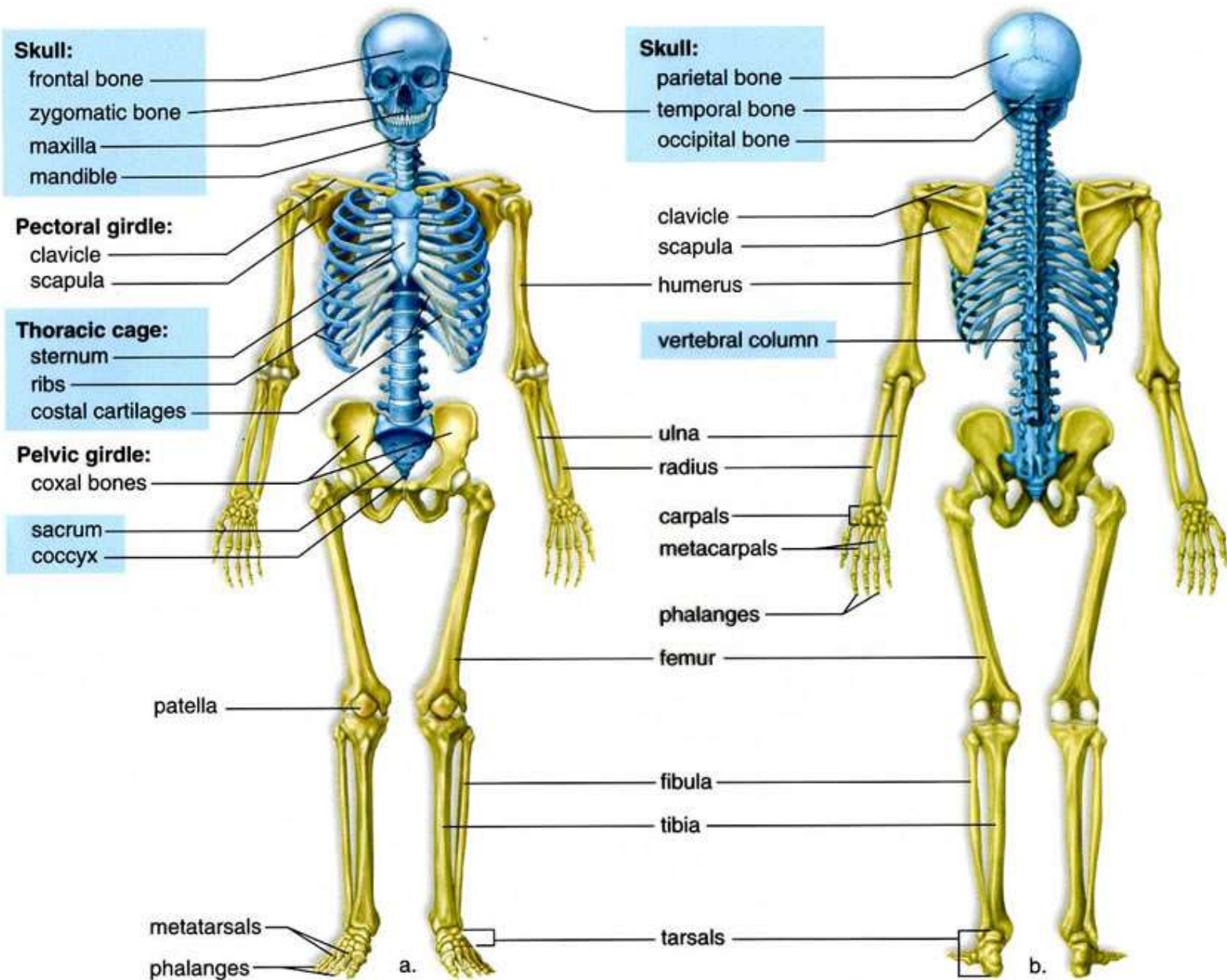


1. Coronal Suture
2. Frontal
3. Parietal
4. Nasal
5. Squamosal Suture
6. Ethmoid
7. Lacrimal
8. Sphenoid
9. Lamdoidal Suture
10. Occipital
11. Temporal
12. Zygomatic
13. Maxilla
14. Mandible





The Rest of the Bones



715 The human skeleton
 Figure 41.5

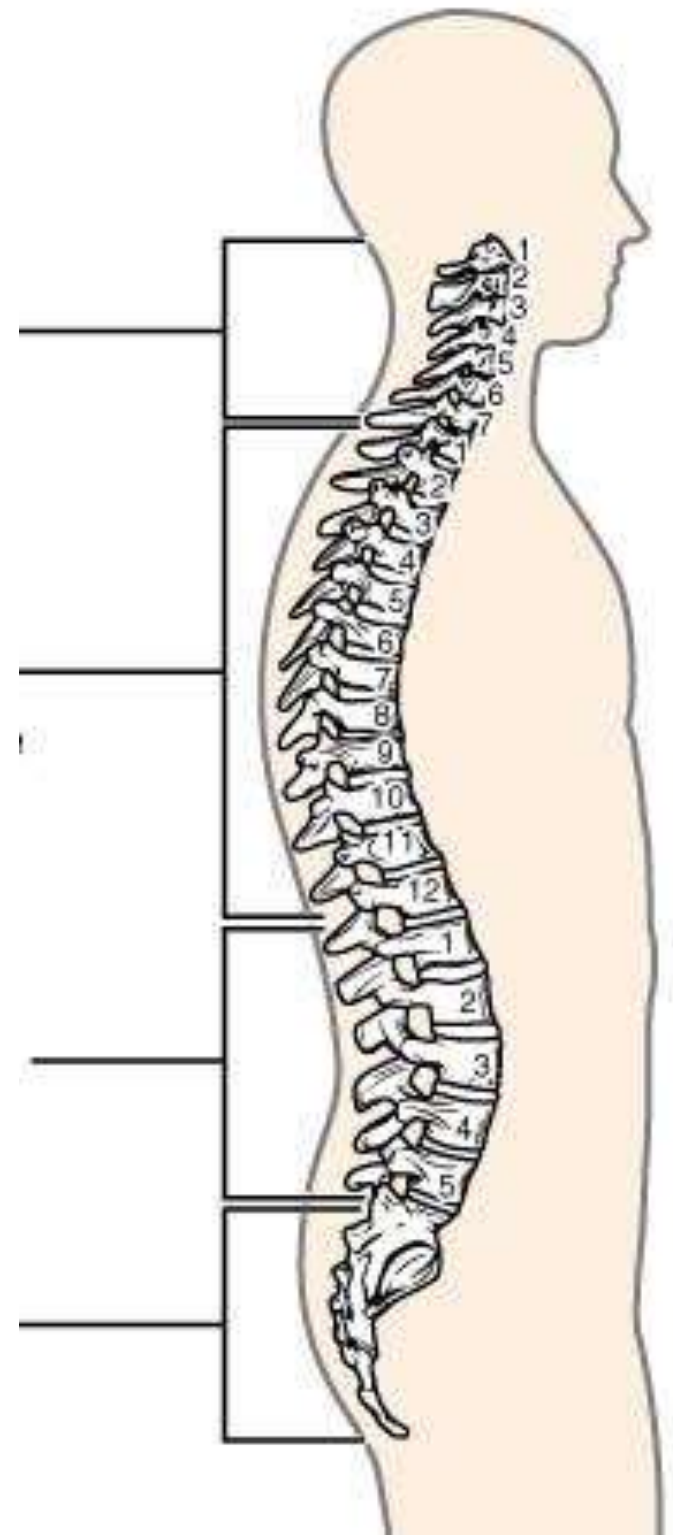
Vertebral Column

Cervical (C1-C7)

Thoracic (T1-T12)

Lumbar (L1-L5)

Sacrum and Coccyx



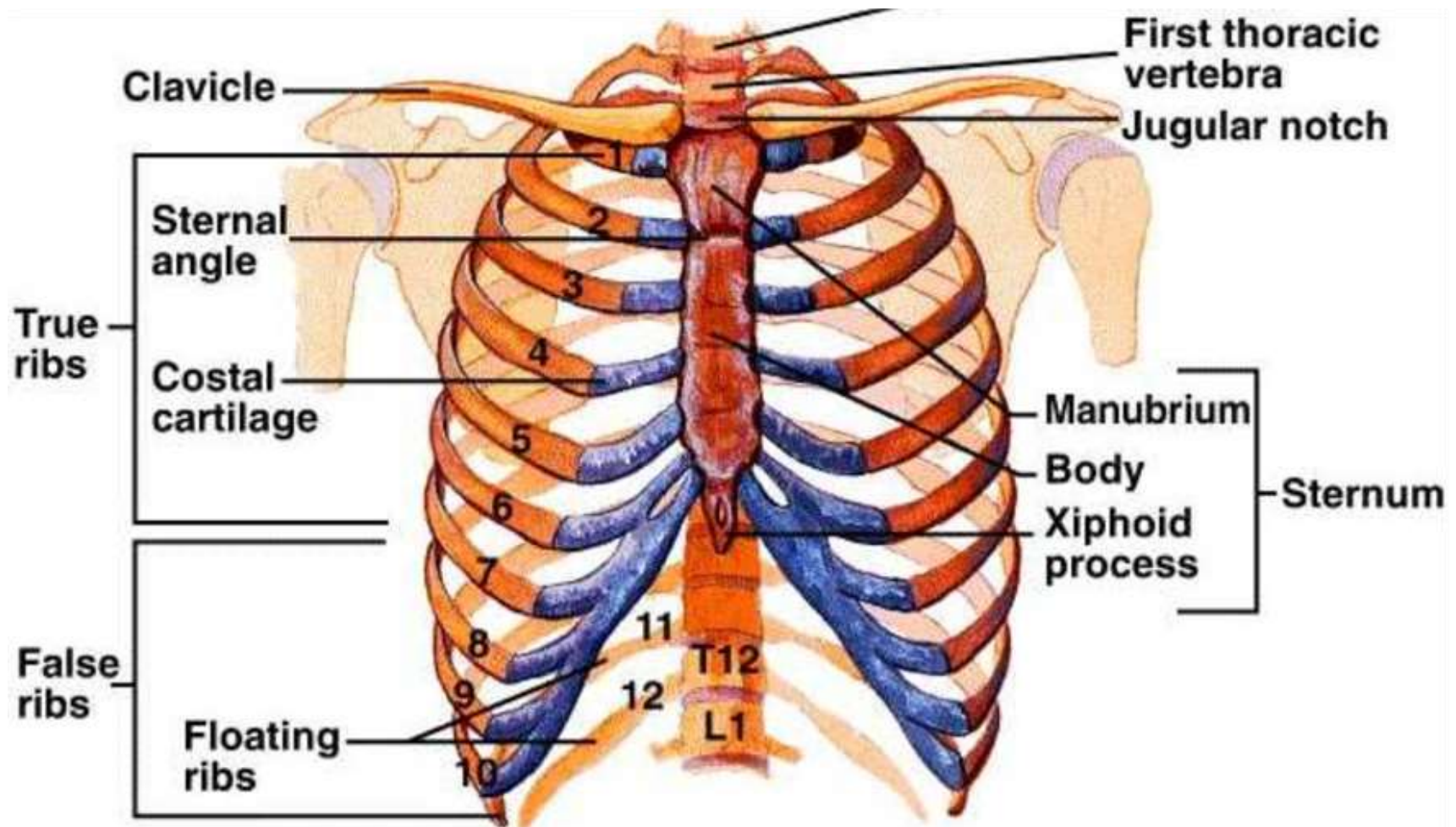
The picture can't be displayed.

Thoracic Cage → 12 pairs of ribs

True Ribs = First seven

False Ribs = Next 3 pairs

Floating Ribs = Last two pairs



Pectoral Girdle

CLAVICLES (collarbones)

1 clavicle.

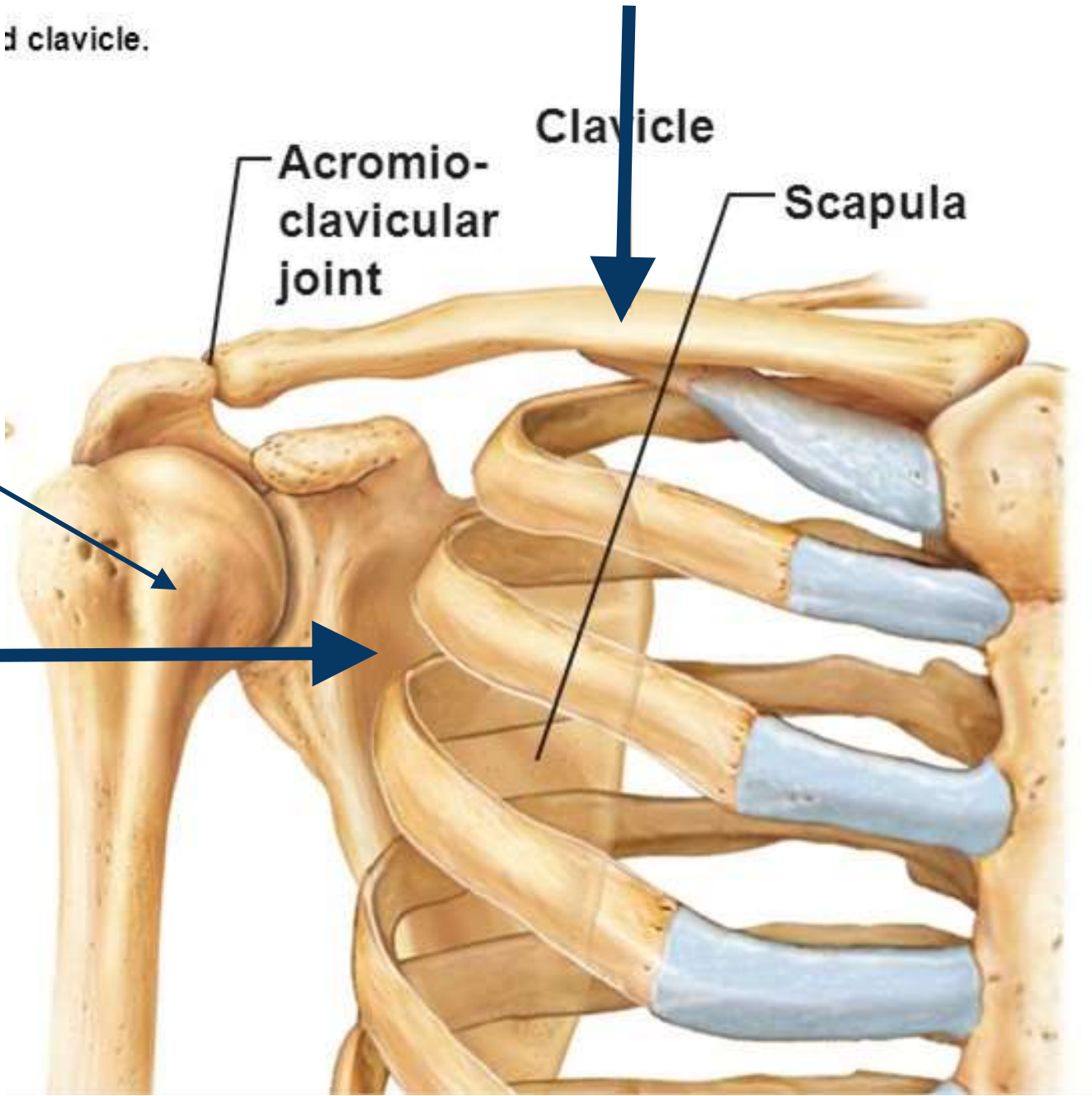
Clavicle

Acromio-
clavicular
joint

Scapula

HUMERUS
(arm)

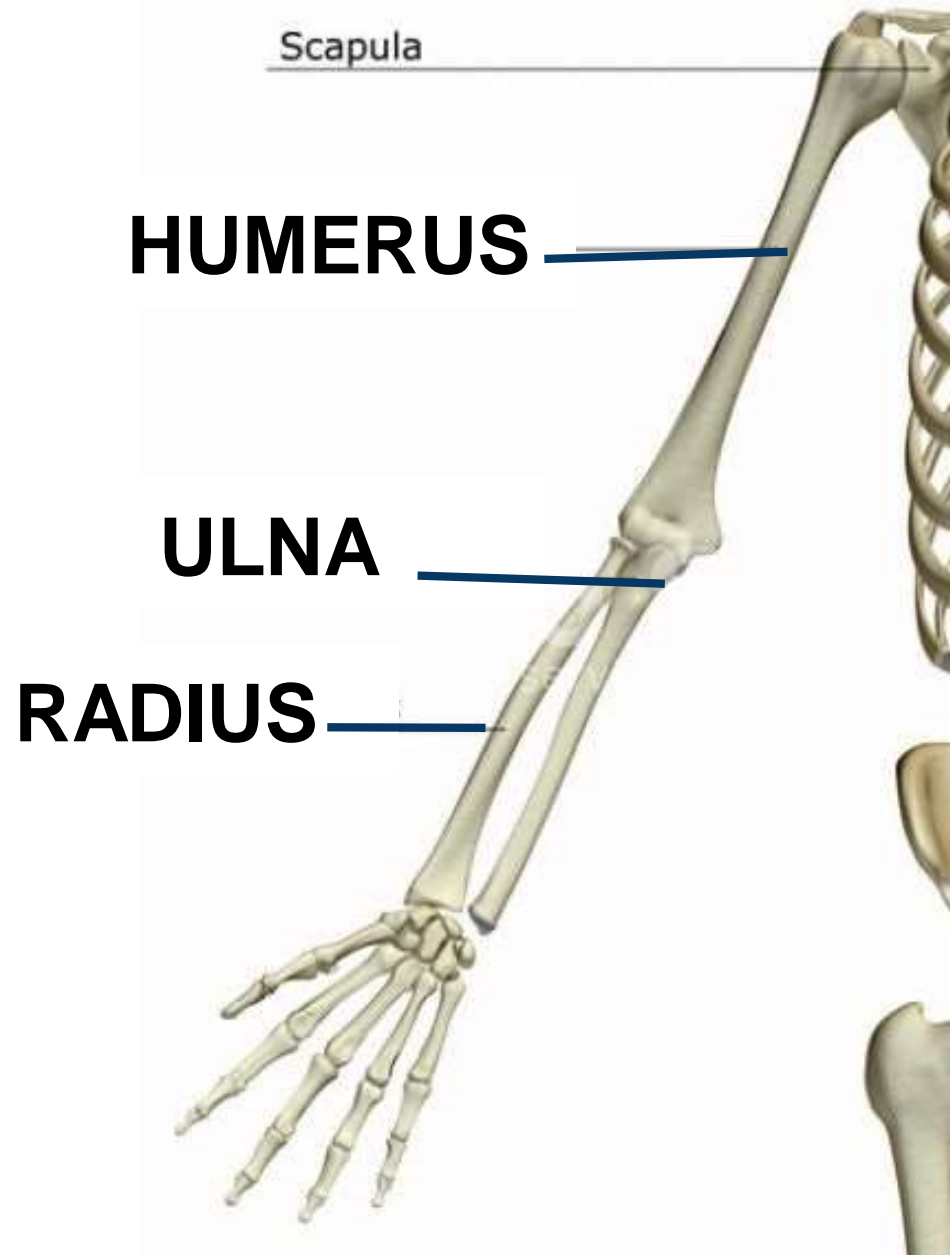
SCAPULAS
(shoulderblade)



Bones of the Arm

Ulna goes to
pinky (P-U)

Radius goes
to thumb

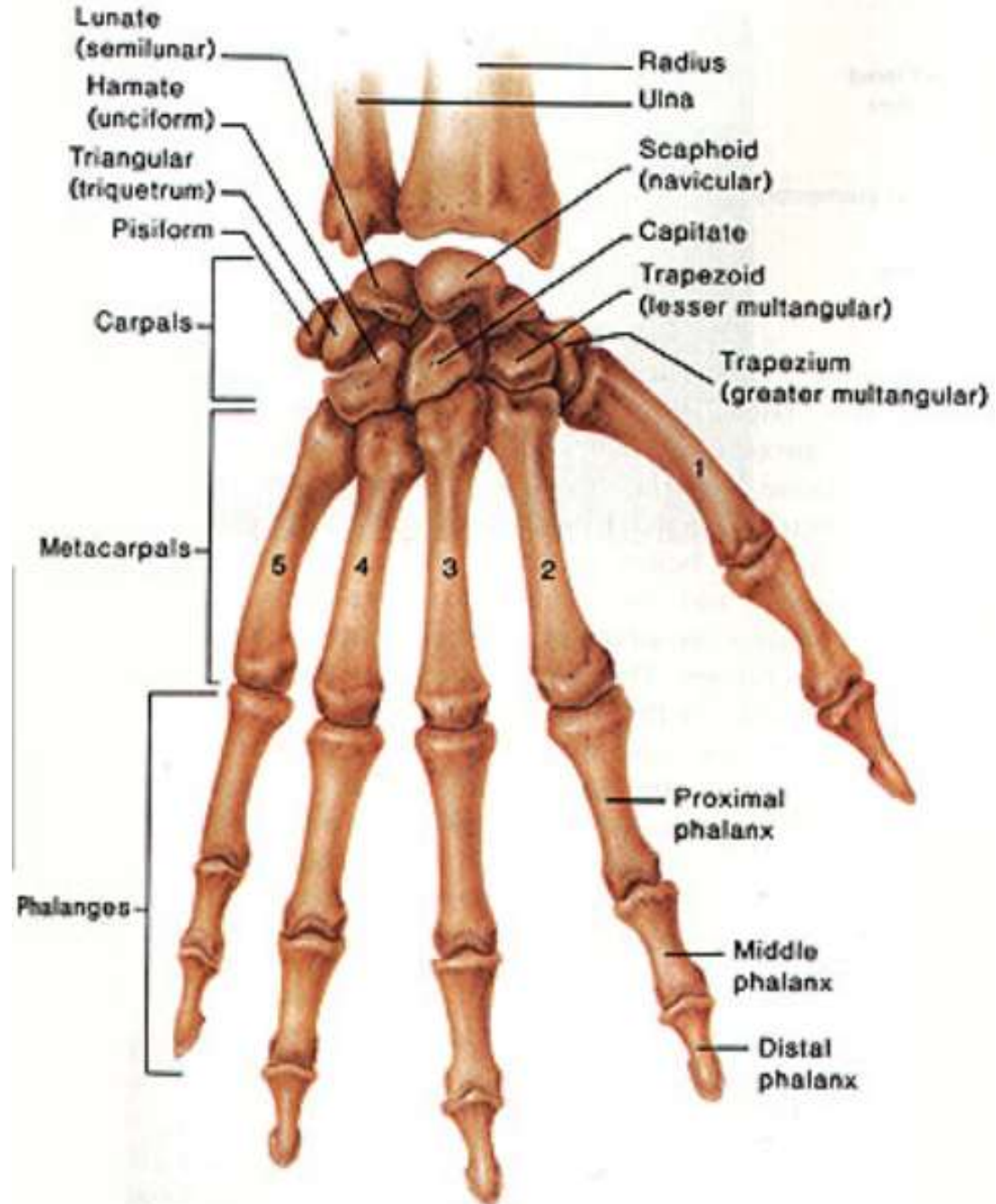


Wrist Bones

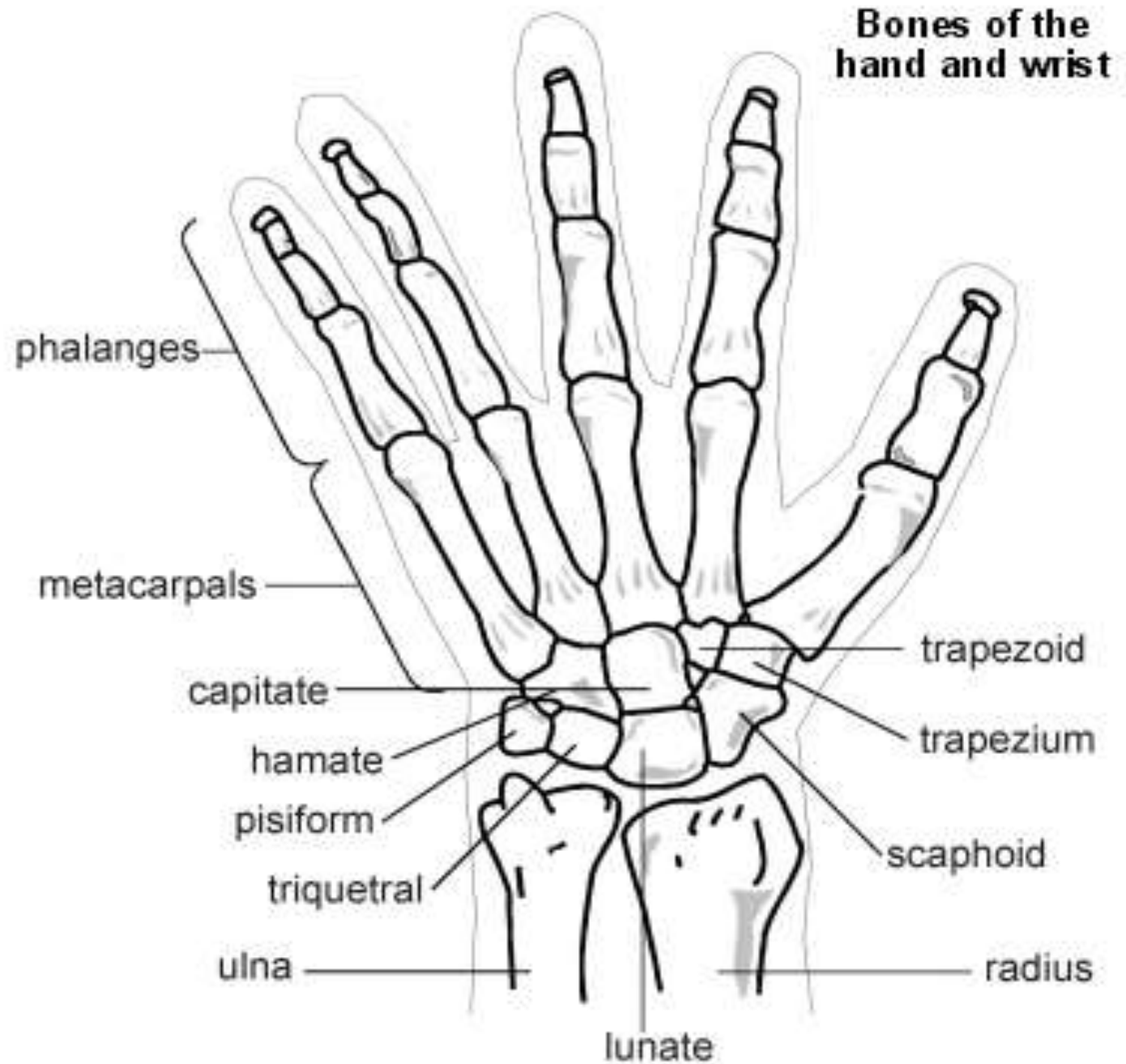
Wrist - 8 small bones called carpels

Metacarpals
(hand)

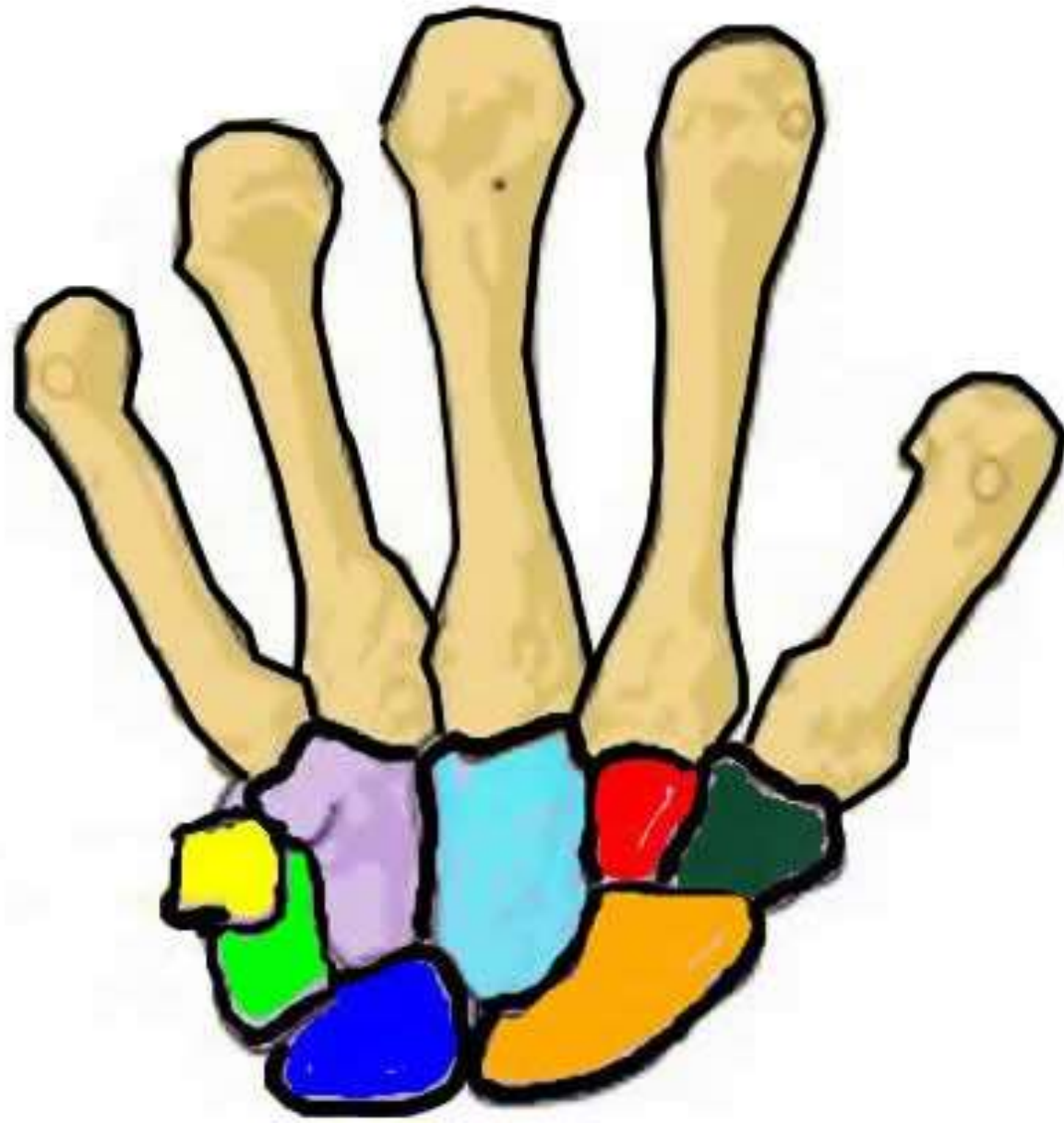
Fingers:
Phalanges



Name the
carpals for
*extra credit
on test.



How to learn the carpals?



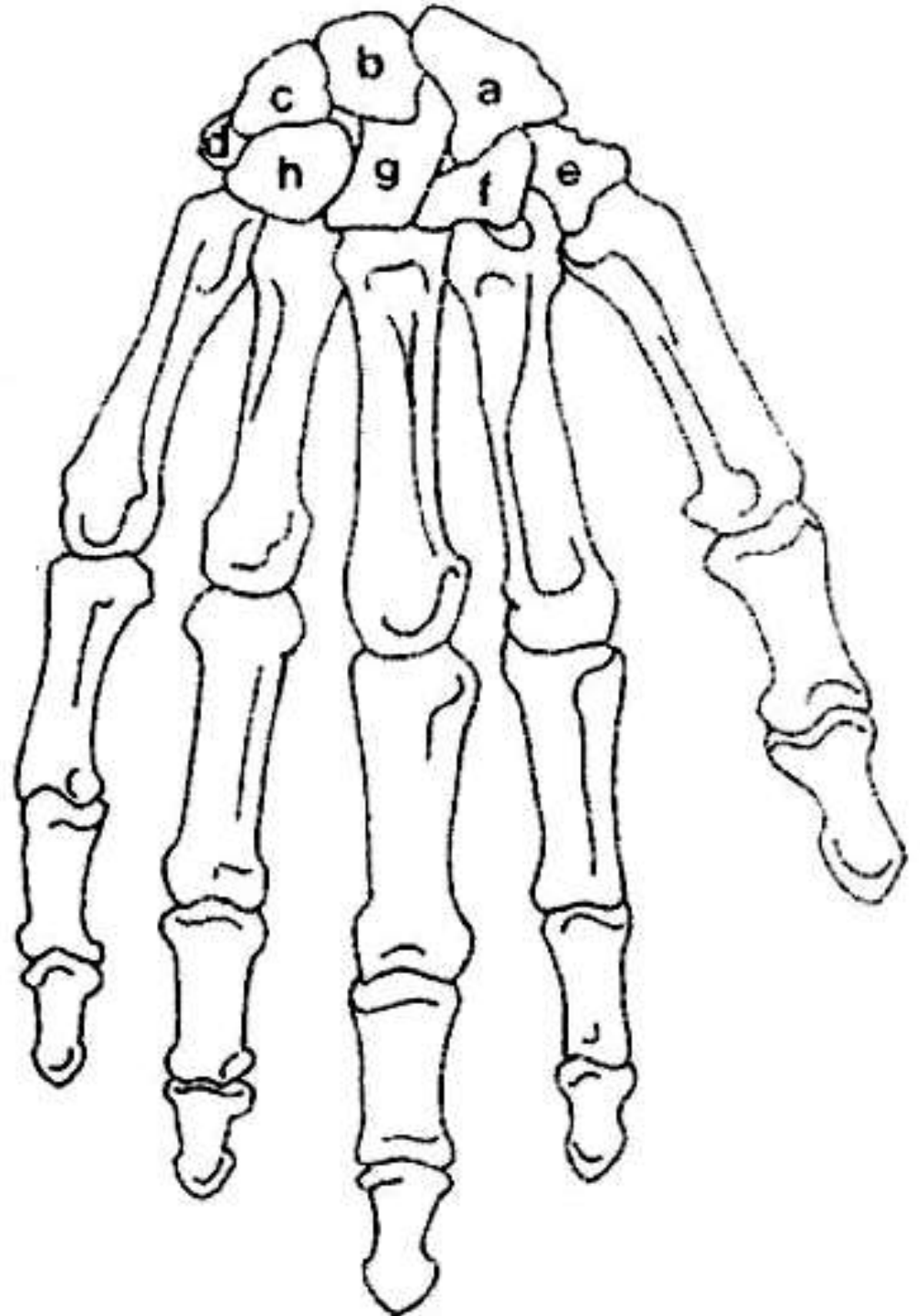
- Scaphoid
- Lunate
- Triquetrum
- Pisiform
- Hamate
- Capitate
- Trapezoid
- Trapezium

anatomycorner.com

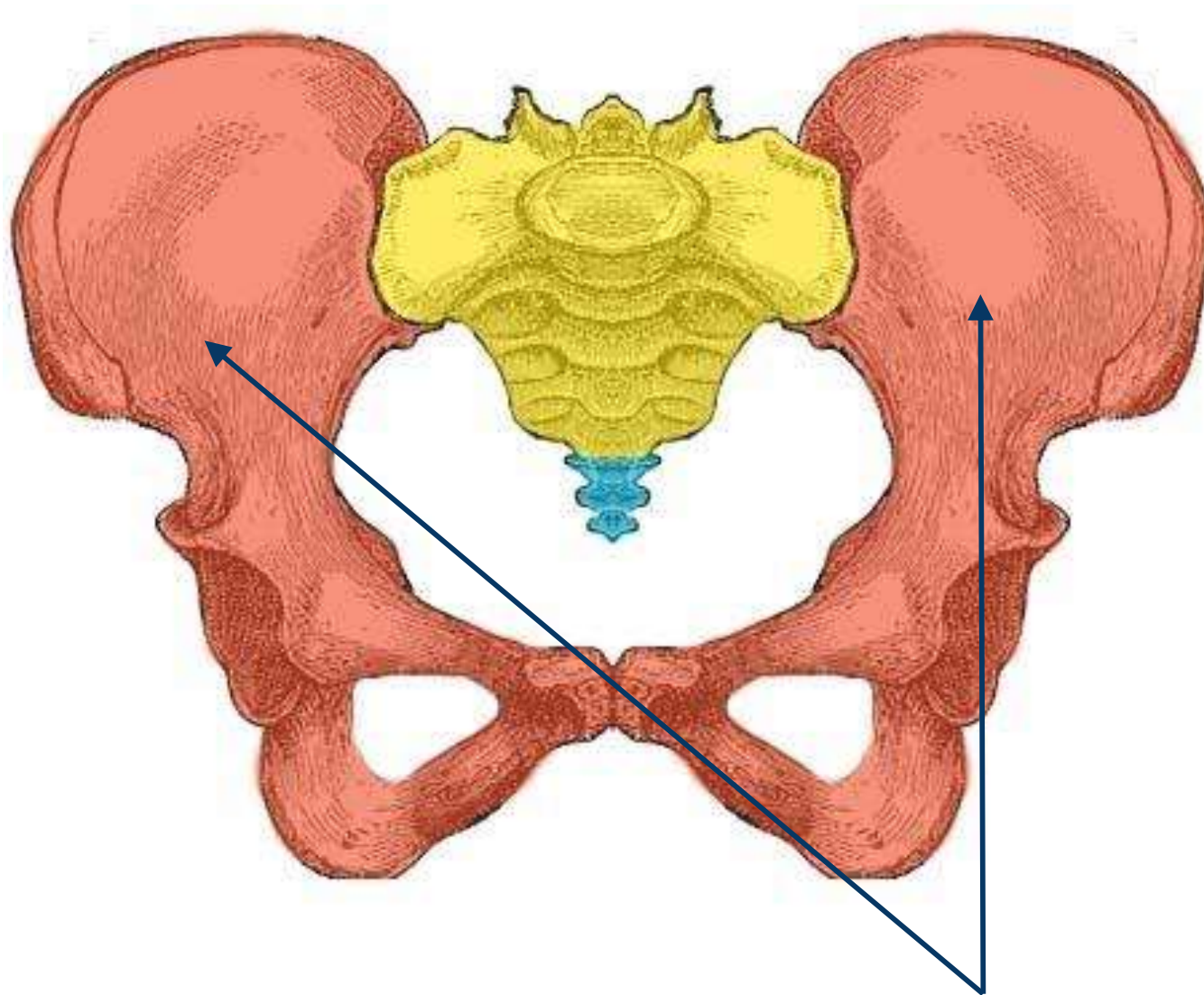
Some Lemurs Try Peanuts That They Can't Handle


ANSWERS...

- a. Scaphoid
- b. Lunate
- c. Triquetrum
- d. Pisiform
- e. Trapezium
- f. Trapezoid
- g. Capitate
- h. Hamate



Pelvic Girdle



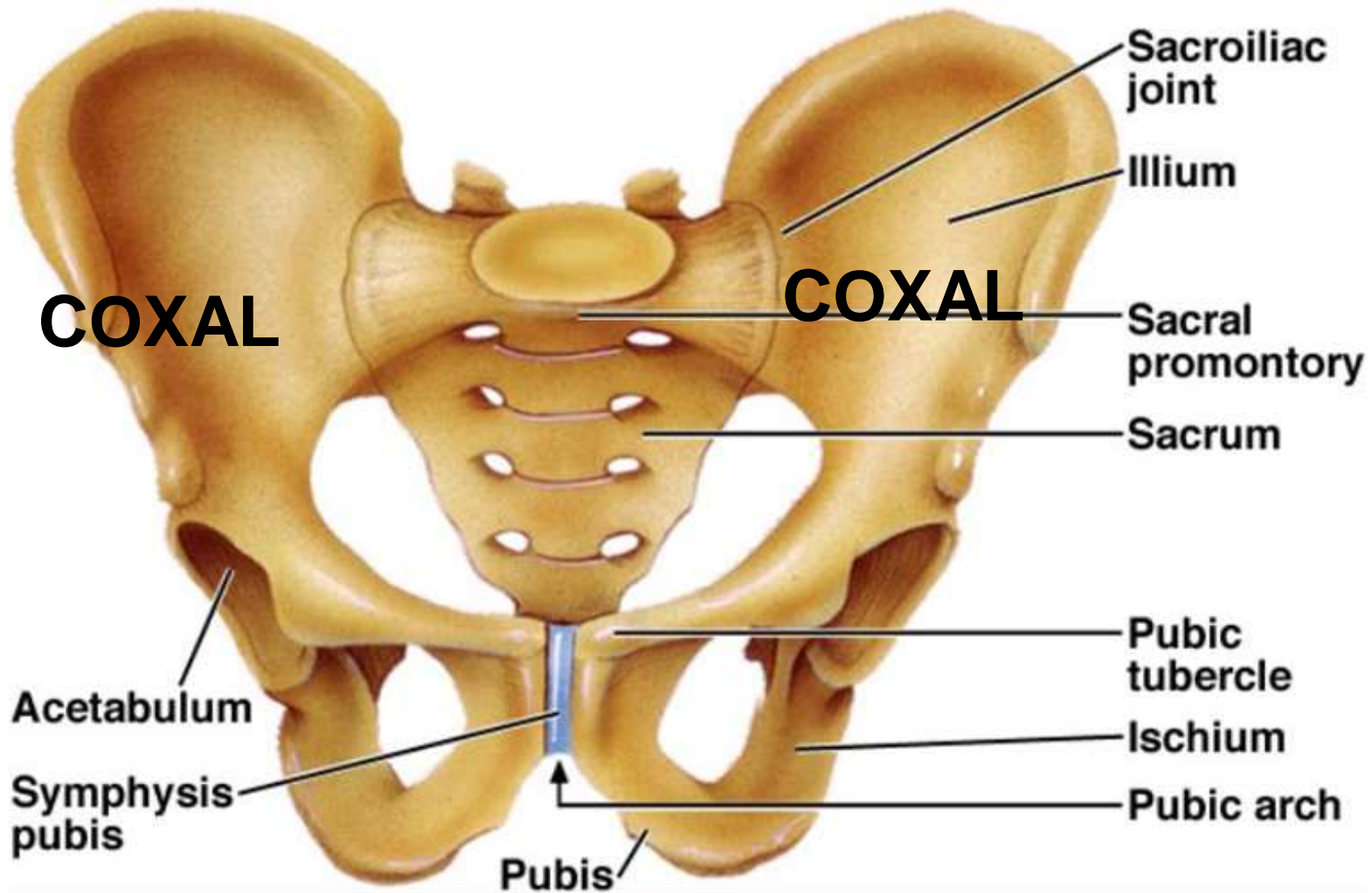
 Hip bones

 Sacrum

 Coccyx

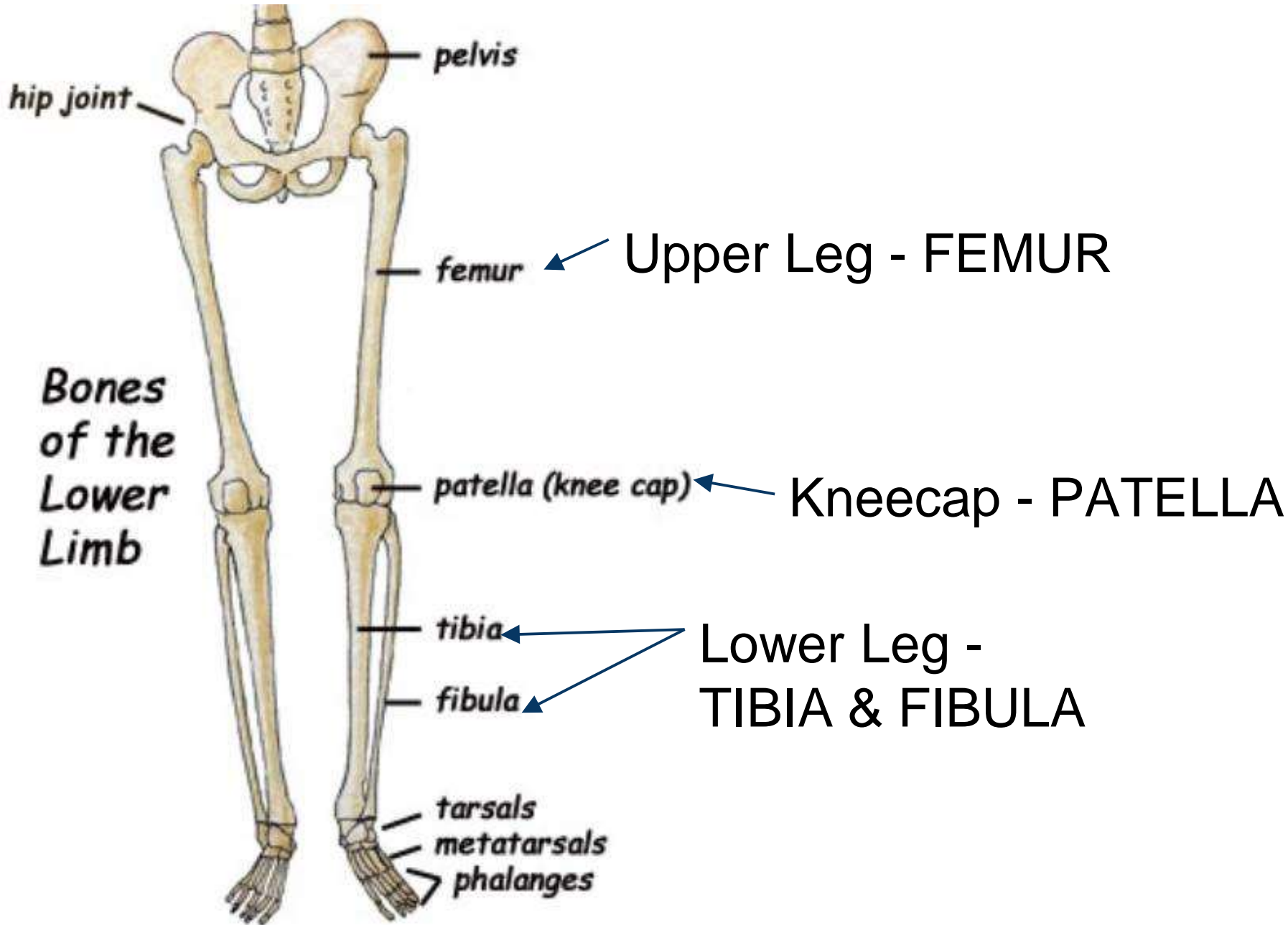
two large COXAL BONES

Pelvic Girdle



The **SACRUM** is between coxal bones,
COCCYX is the tailbone

Bones of the Leg



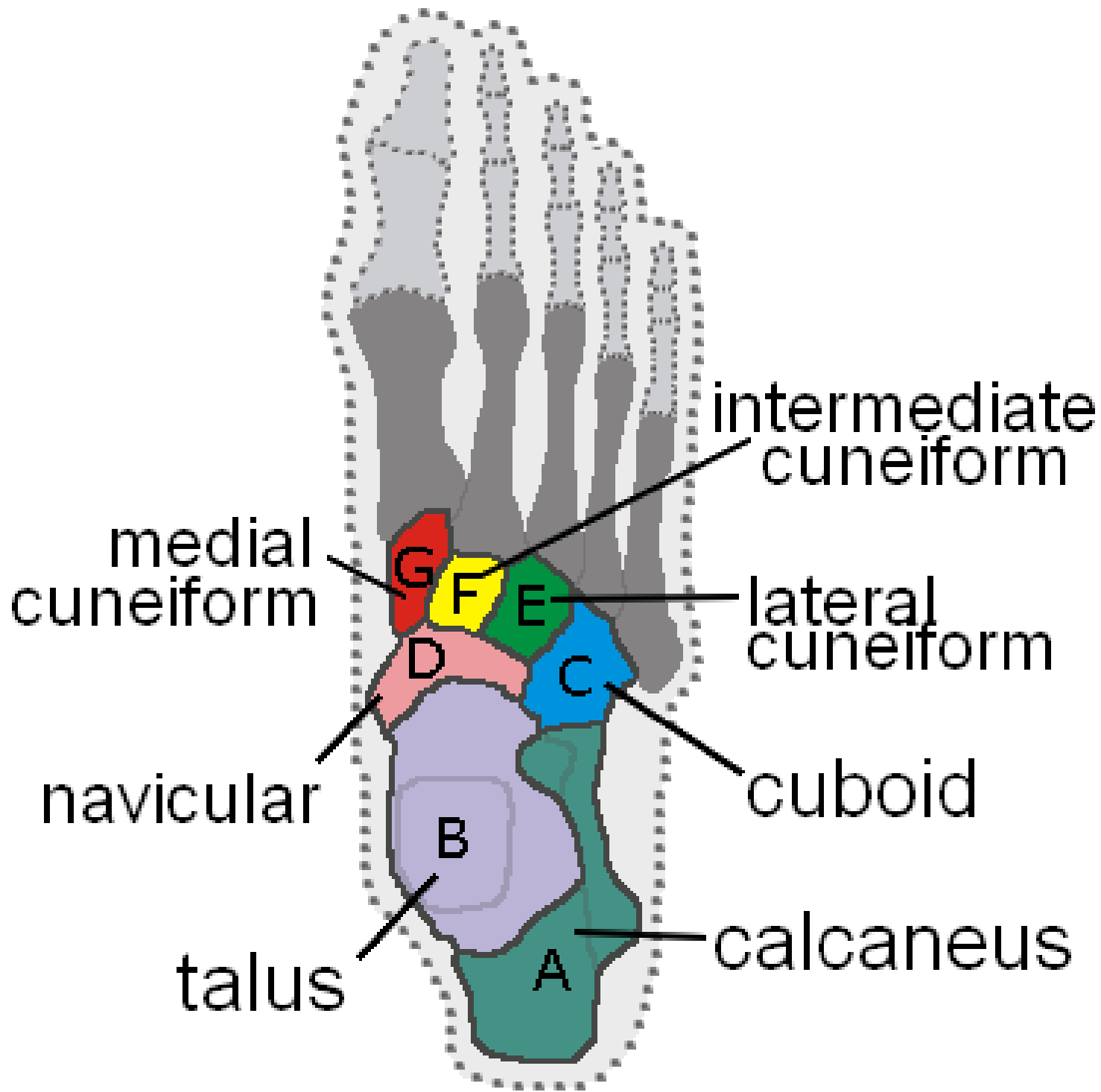
Bones of the Ankle



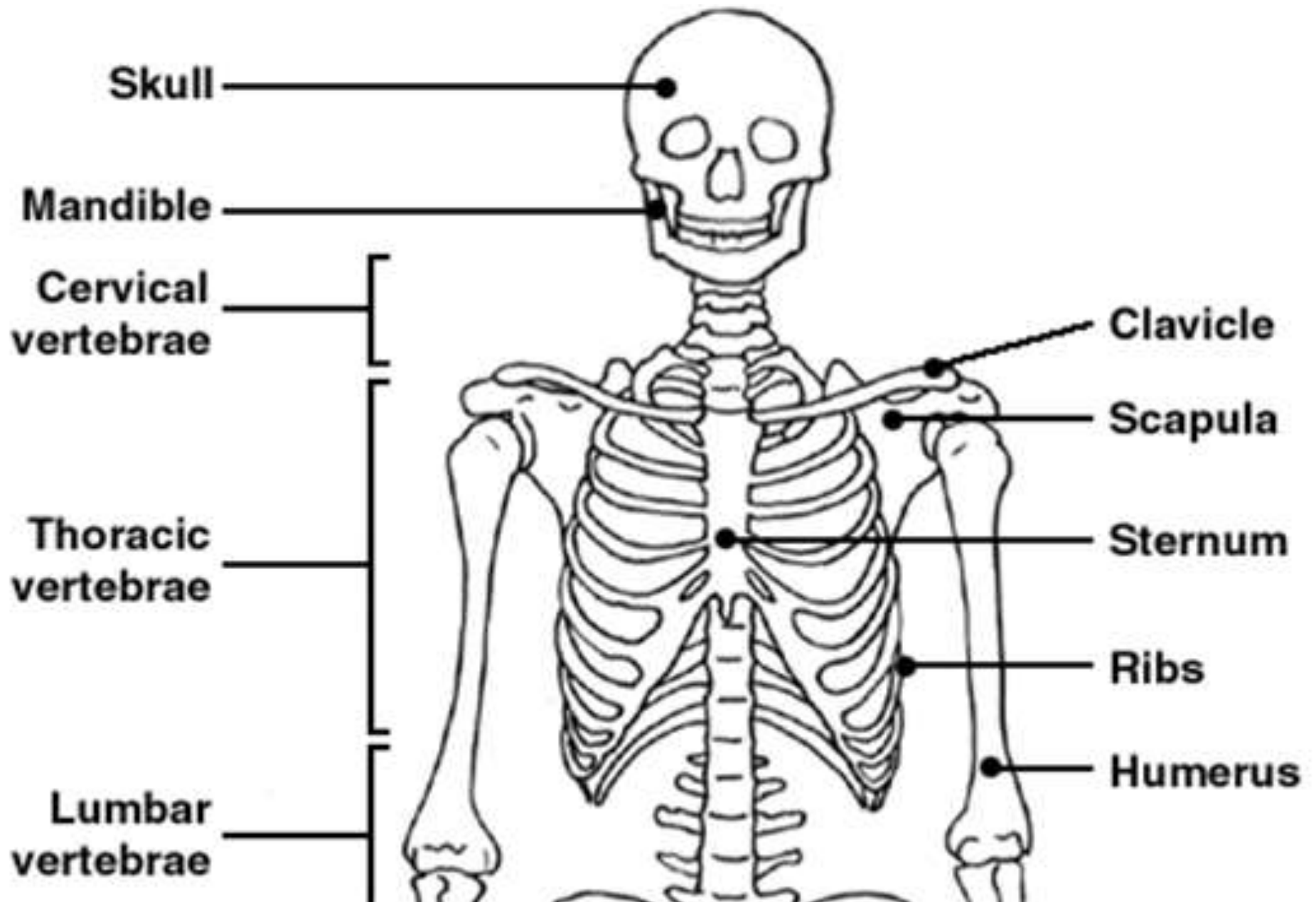
Ankle and Upper foot - 7 bones called Tarsals

Large heel bone is the calcaneous

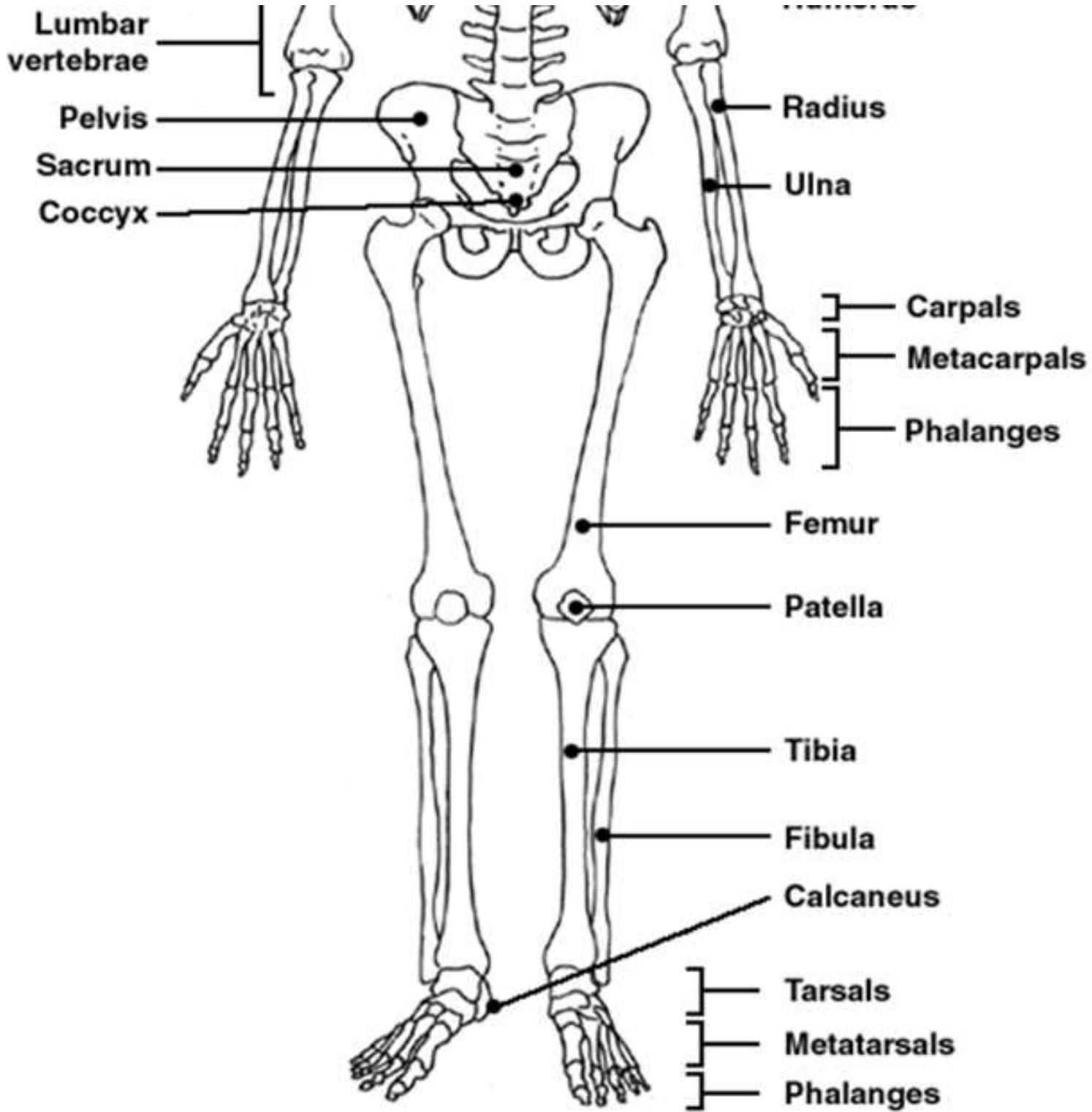
Foot = metatarsals
Toes = phalanges

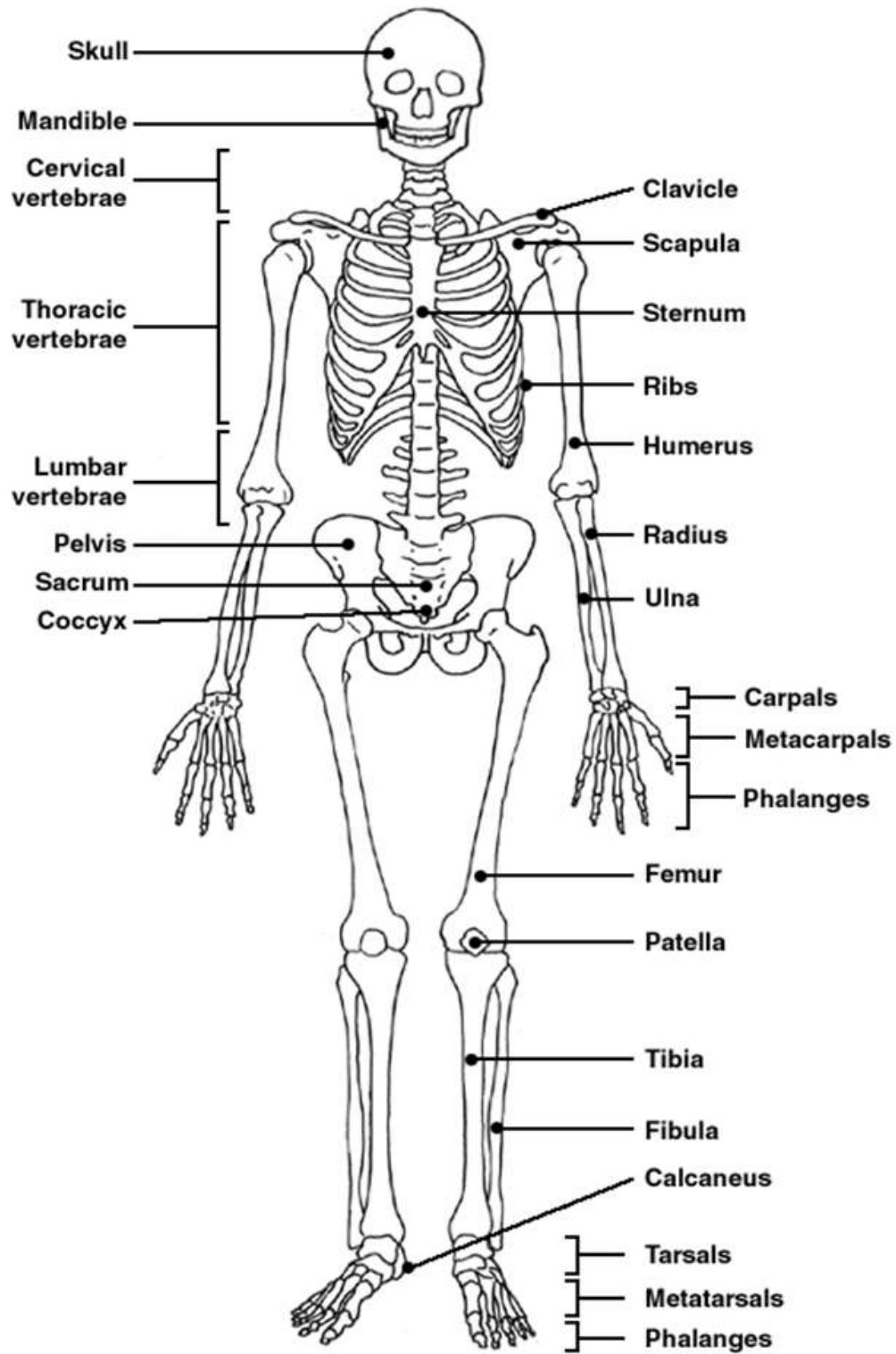


Assignment – Foot
Coloring

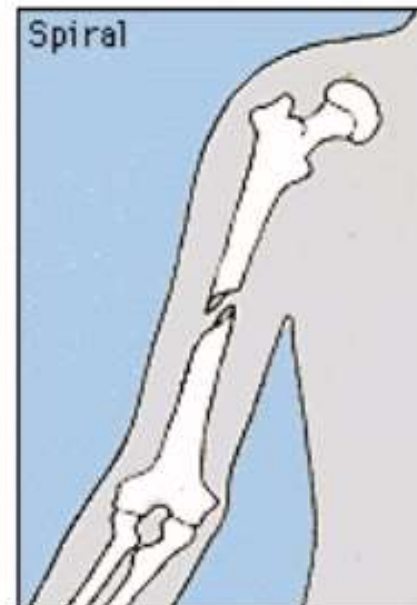
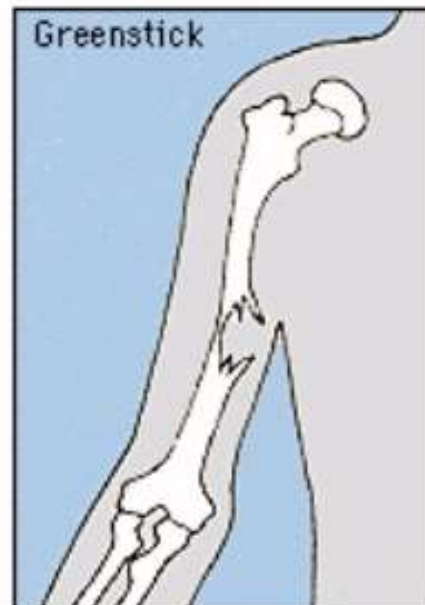
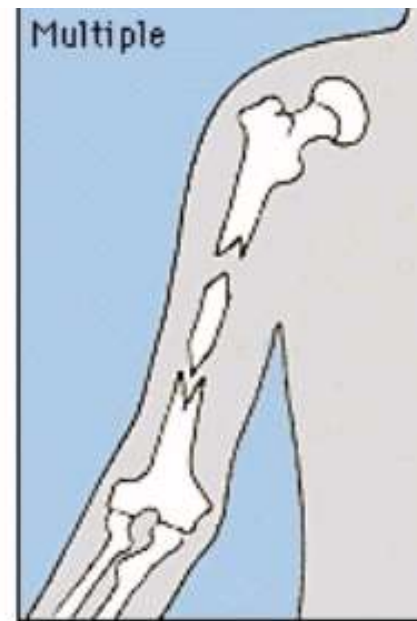
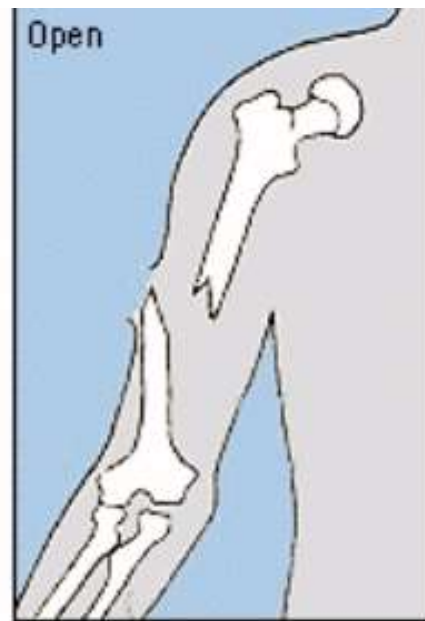
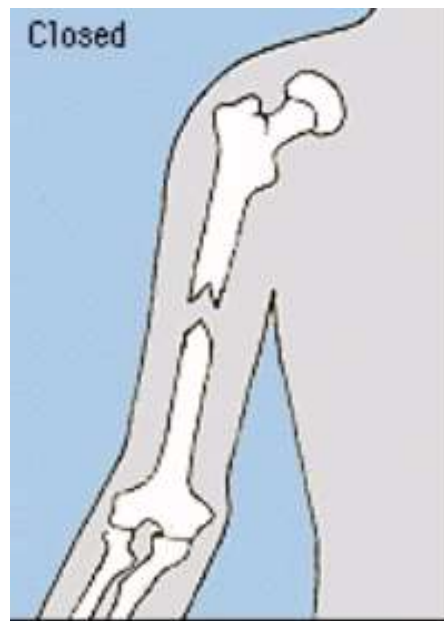


Assignment –
Skeleton Labeling





Broken Bones



Bone Fracture Types (1)



A *greenstick* fracture is incomplete, and the break occurs on the convex surface of the bend in the bone.



A *fissured* fracture involves an incomplete longitudinal break.



A *comminuted* fracture is complete and fragments the bone.

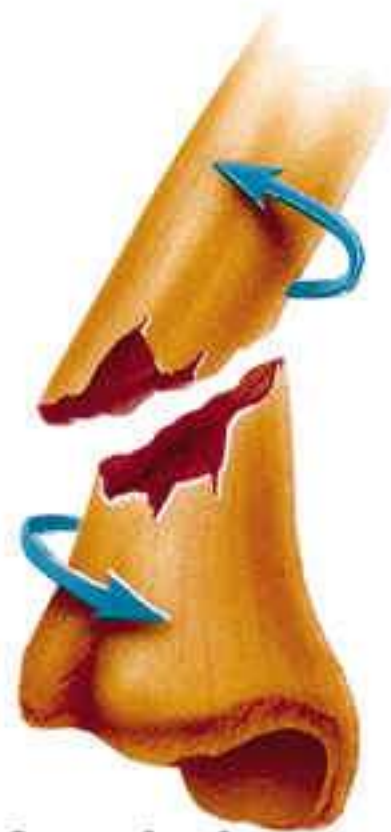
Bone Fracture Types (2)



A transverse fracture is complete, and the break occurs at a right angle to the axis of the bone.



An oblique fracture occurs at an angle other than a right angle to the axis of the bone.



A spiral fracture is caused by twisting a bone excessively.

Warning: Next slide is graphic!



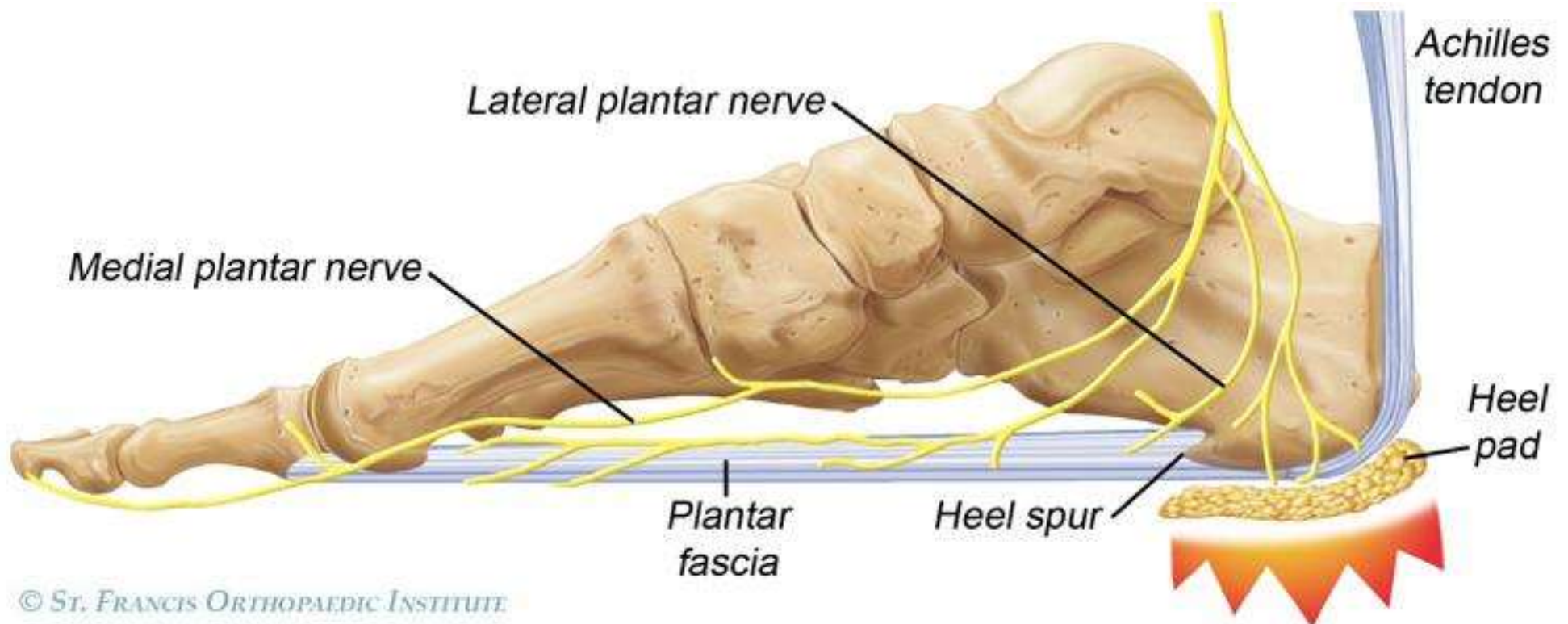
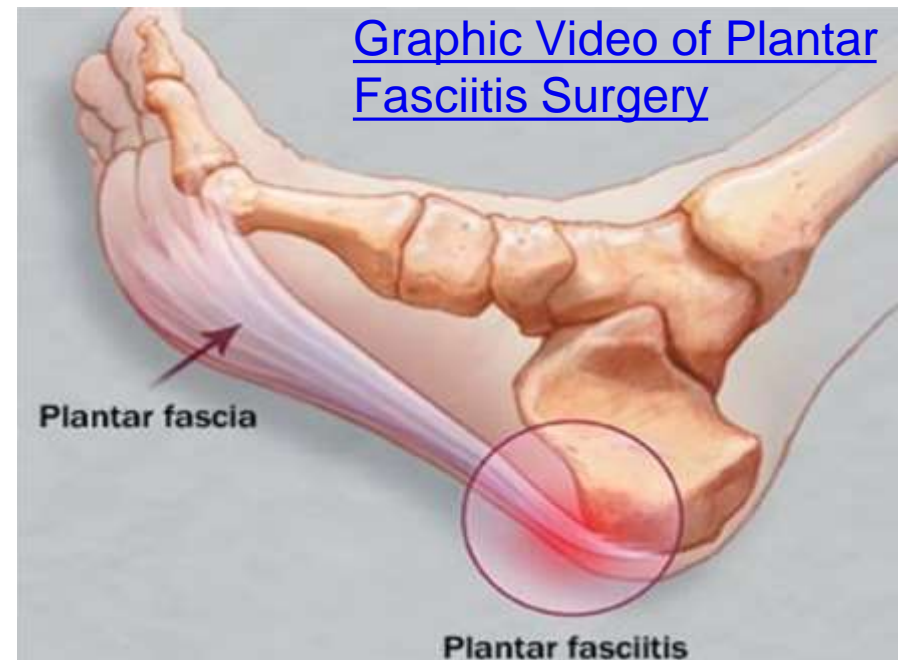
Bone Disorders

1. **BONE SPURS**, also known as osteophytes, occur when the body grows small projections on the edges of bones



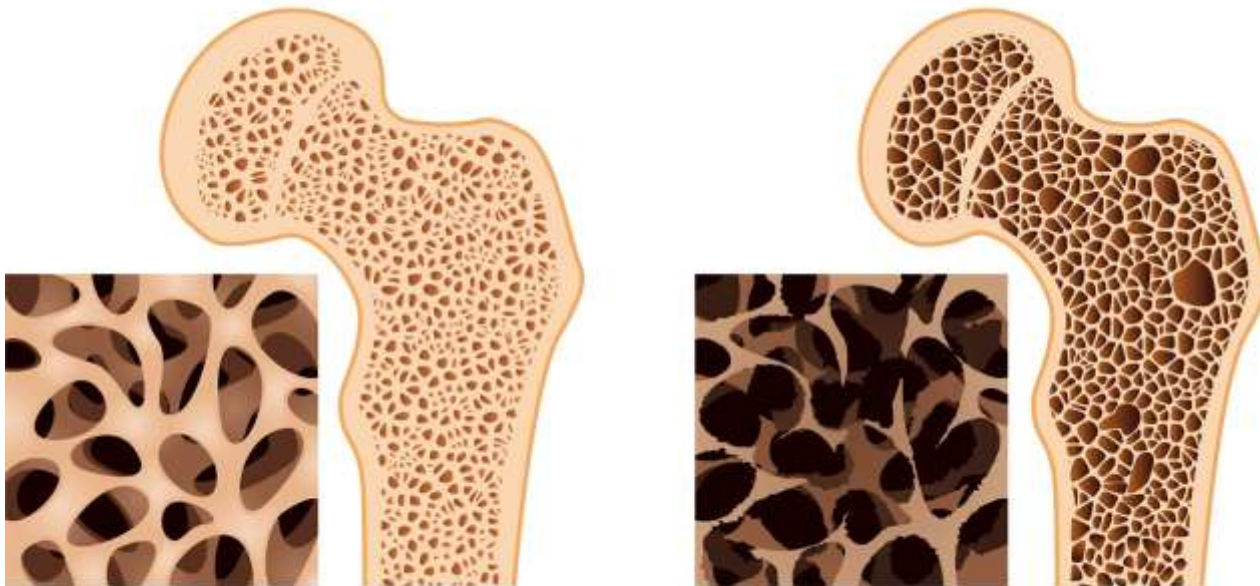
2. Plantar fasciitis

- common cause of heel pain.
- inflammation of the plantar fascia
- walking can be painful



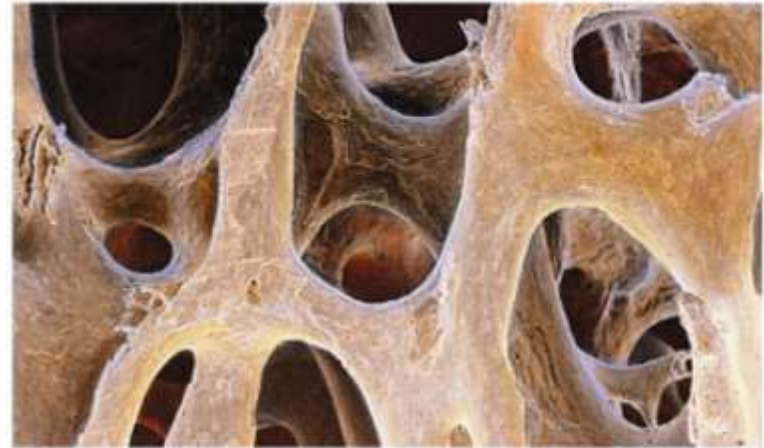
3. OSTEOPOROSIS: Increased activity of osteoclasts cause a break down bone, bones become more fragile

The spongy bone especially becomes more porous.

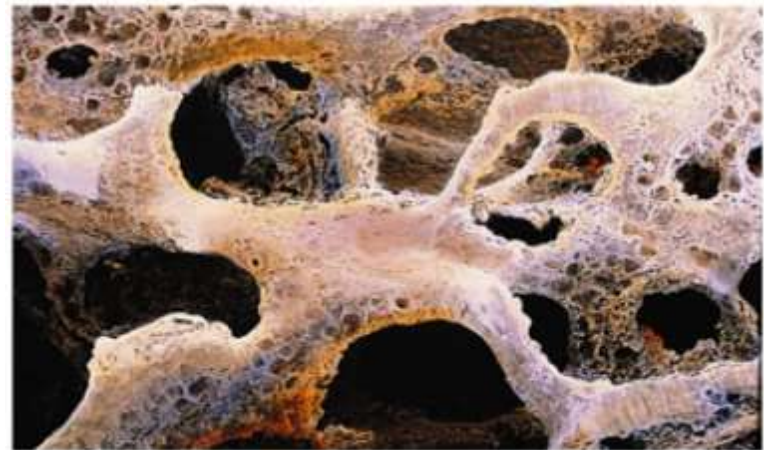


Healthy bone

Osteoporosis



(a)

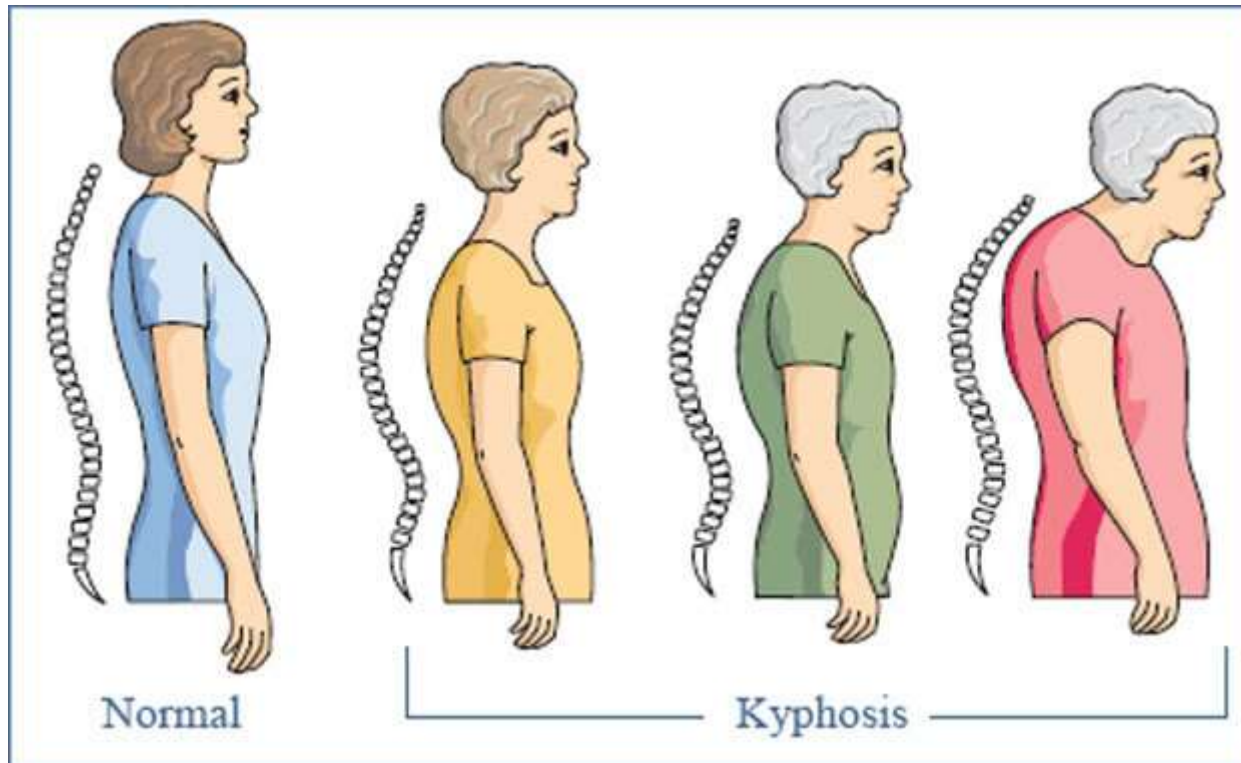


(b)



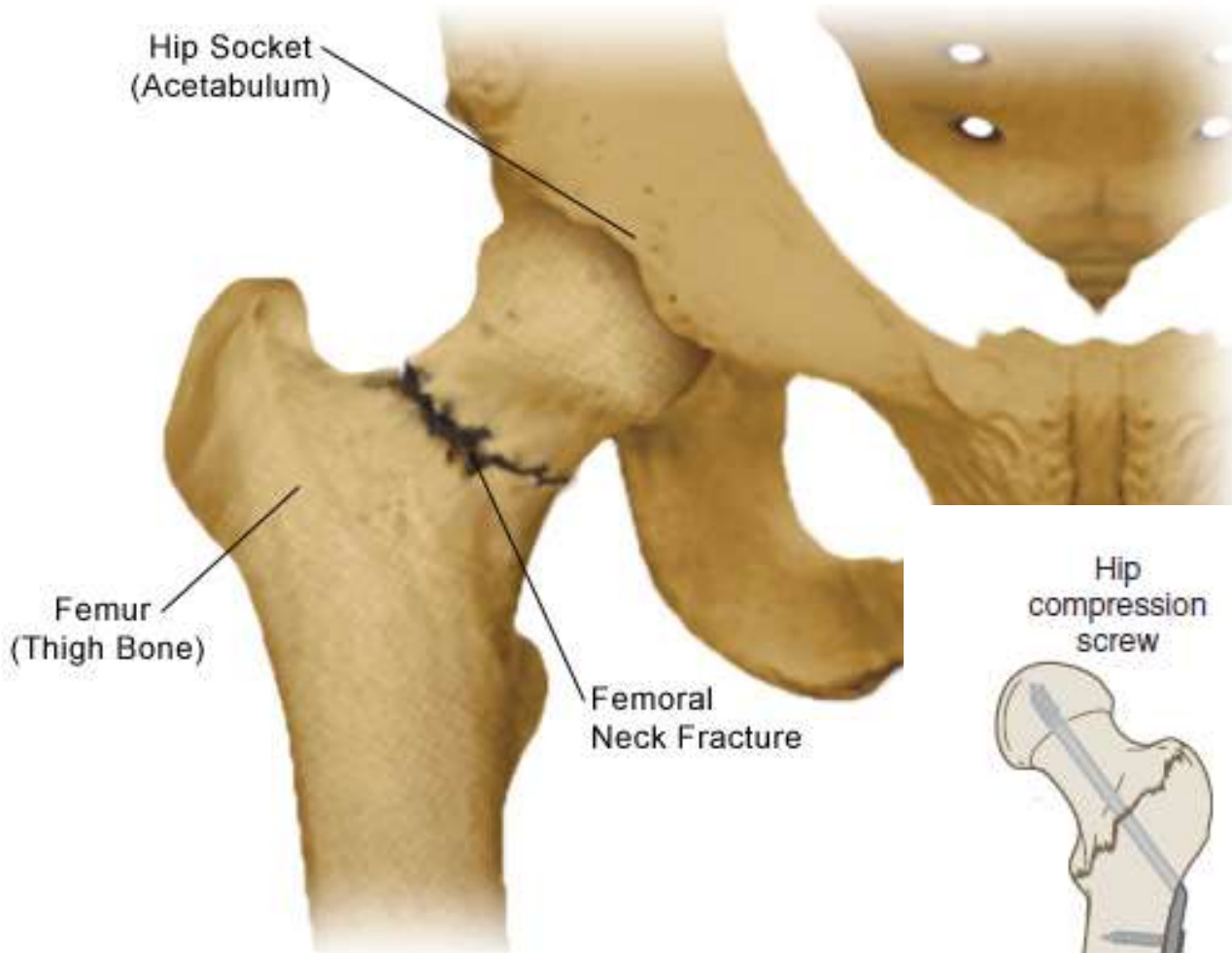
Causes of Osteoporosis:

1. Lack of exercise
2. Poor diet
3. Genetics
4. Ethnicity
5. Gender

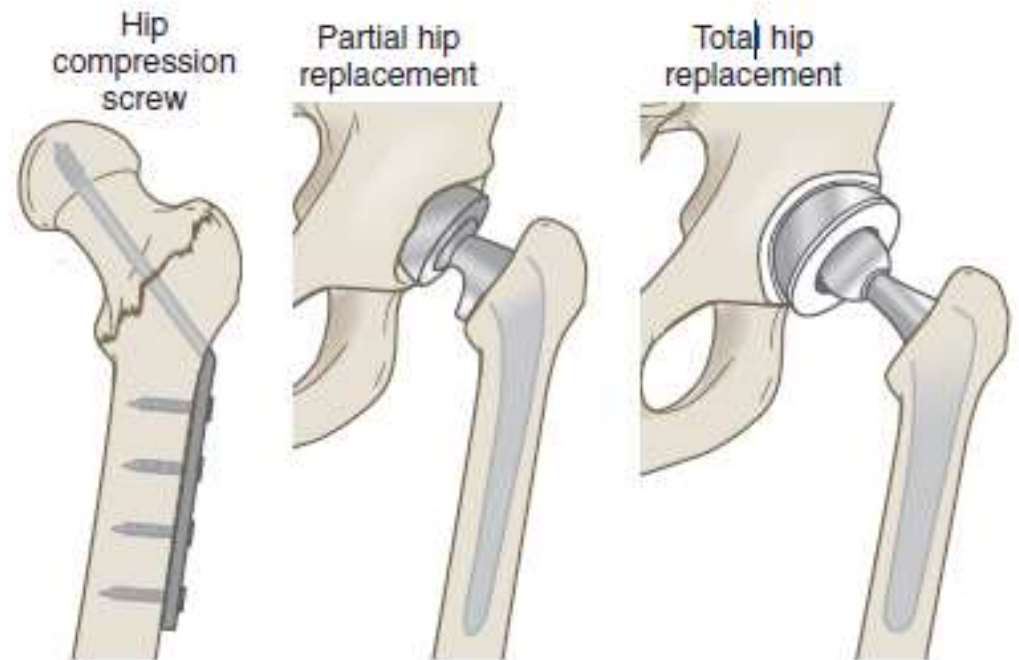


Why do older people break their hips?

Femoral Neck Fracture



A femoral neck fracture is common among older adults and can be related to osteoporosis. This type of fracture may cause a complication because the break usually cuts off the blood supply to the head of the femur.



4. **Rheumatoid arthritis** is an autoimmune disease which causes joint stiffness and bone deformity



Source: <http://www.thetimes.co.uk/tto/public/article3233439.ece>

5. Rickets

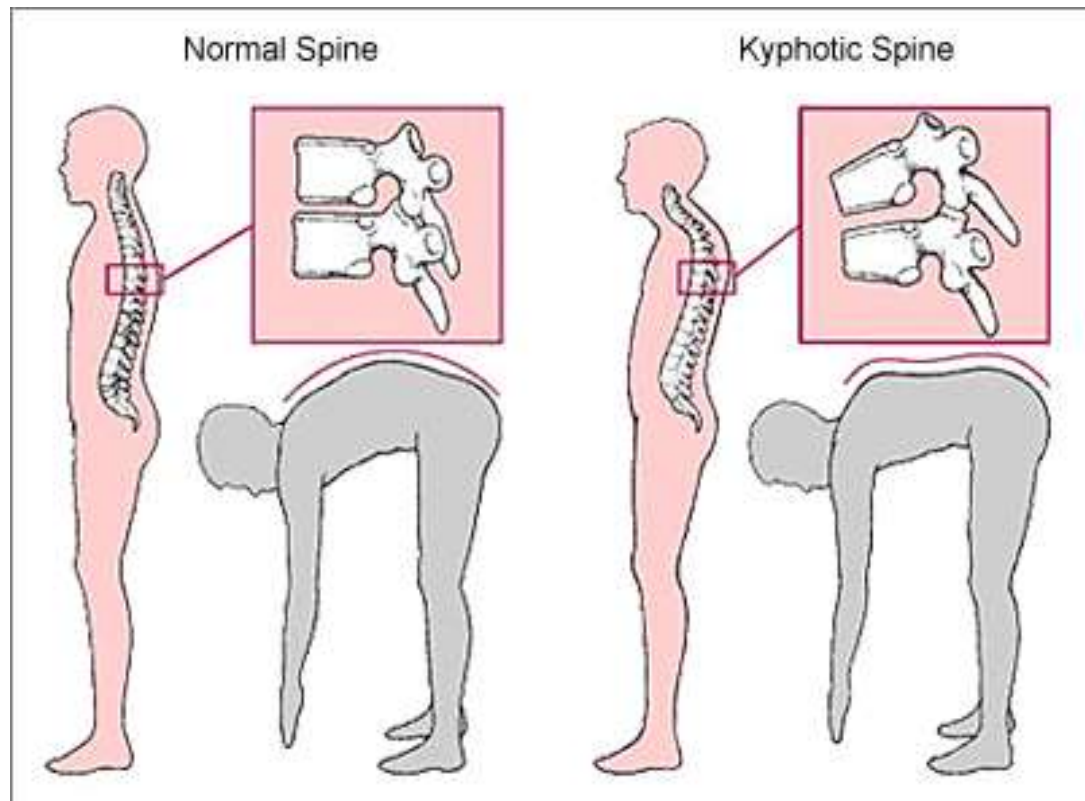
This preventable bone disease affects young children and is caused by a deficiency of the nutrient vitamin D. Rickets causes weak, brittle bones that fracture easily and bone and muscle pain.



6. ABNORMALITIES OF THE SPINE

a) **KYPHOSIS** is a hunchback curve

b) **LORDOSIS** is a swayback in the lower region.



c) ANKYLOSIS is severe arthritis in the spine and the vertebrae fuse.

Normal spine



Early ankylosing
spondylitis



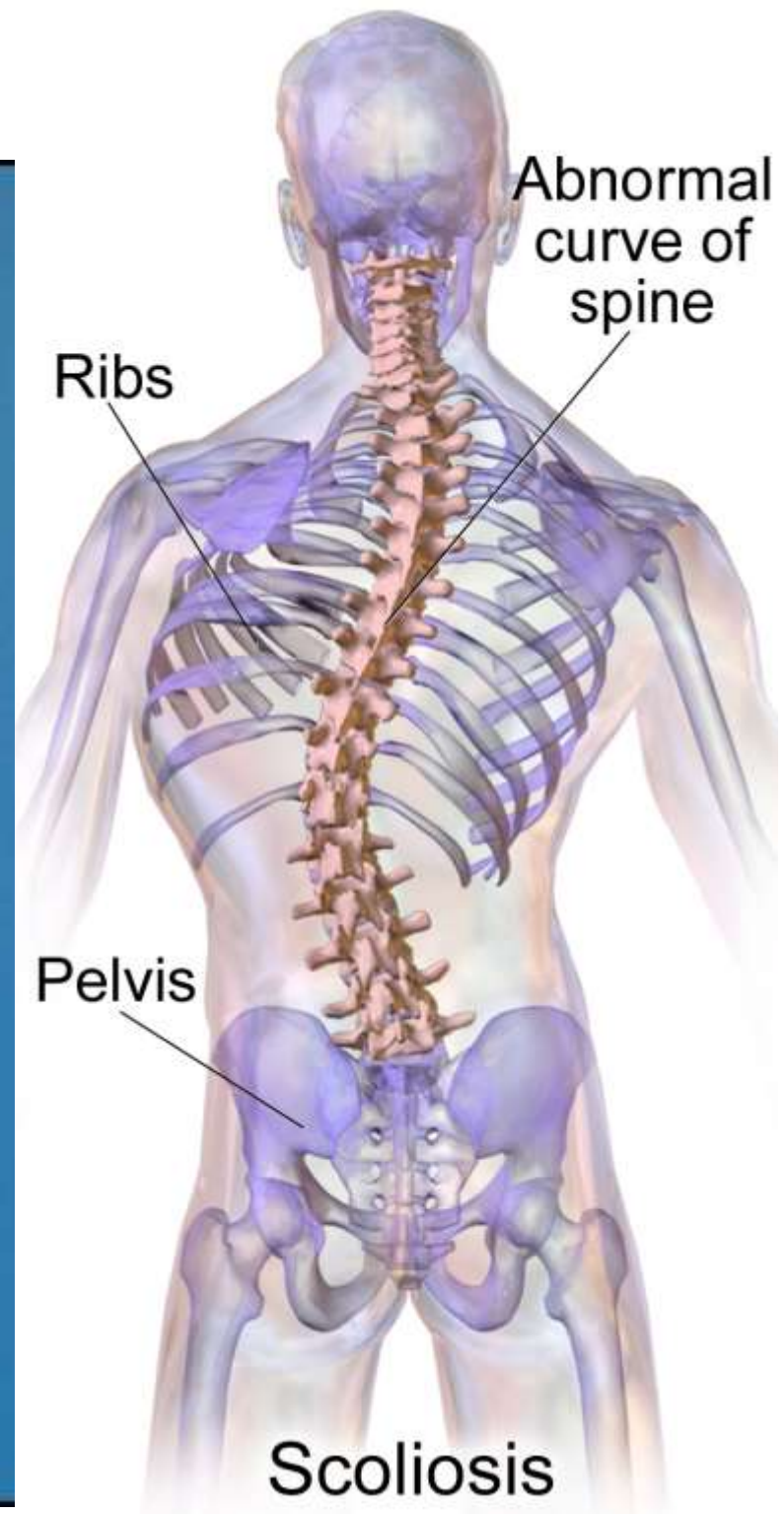
Inflammation

Advanced
ankylosing
spondylitis



Fusion

d) SCOLIOSIS



7. Fibrodysplasia ossificans progressiva (FOP) →
soft tissue regrows as bone. Sufferers are slowly imprisoned by
their own skeletons.



"Munchmeyer disease" or "stone man syndrome"

8. Osteosarcoma

Most common bone cancer, primarily affecting the long bones, particularly those in the knee, hip, or shoulder regions. Most commonly affects teenagers and young adults.



FUN FACTS ABOUT BONES

Bone is made of the same type of minerals as limestone.

- Babies are born with 300 bones, but by adulthood we have only 206 in our bodies.
- The giraffe has the same number of bones in its neck as a human: seven in total.
- The long horned ram can take a head butt at 25 mph. The human skull will fracture at 5 mph.

