

Review of orthopedic anatomy

Introduction

- ▶ In Metabolic terms, bone is an illusion.
- ▶ Although it is concrete in substance (and hence has a finite and almost rigid structure that has a characteristic and specific shape), metabolically it is almost explosively active and serves as an extension and a reservoir for the extra cellular space.

Calcium

- ▶ Bone is the reservoir of 99% of Ca.
- ▶ Plasma Ca: 48% free ionised,
46% bound (0.8 mg/dl for 1gm).
6% complexed citrate, phosphate
- ▶ CaHPO_4 is not freely soluble, if the concentration of Ca or HPO_4 exceeds the critical solubility product, ectopic calcification is likely to occur.
- ▶ More soluble in acidic media.

► Bone as a tissue:

- Cells osteoblasts.

Osteocytes.

bone lining cells

osteoclasts.

- Extra cellular matrix

Organic

fibers

ground substance.

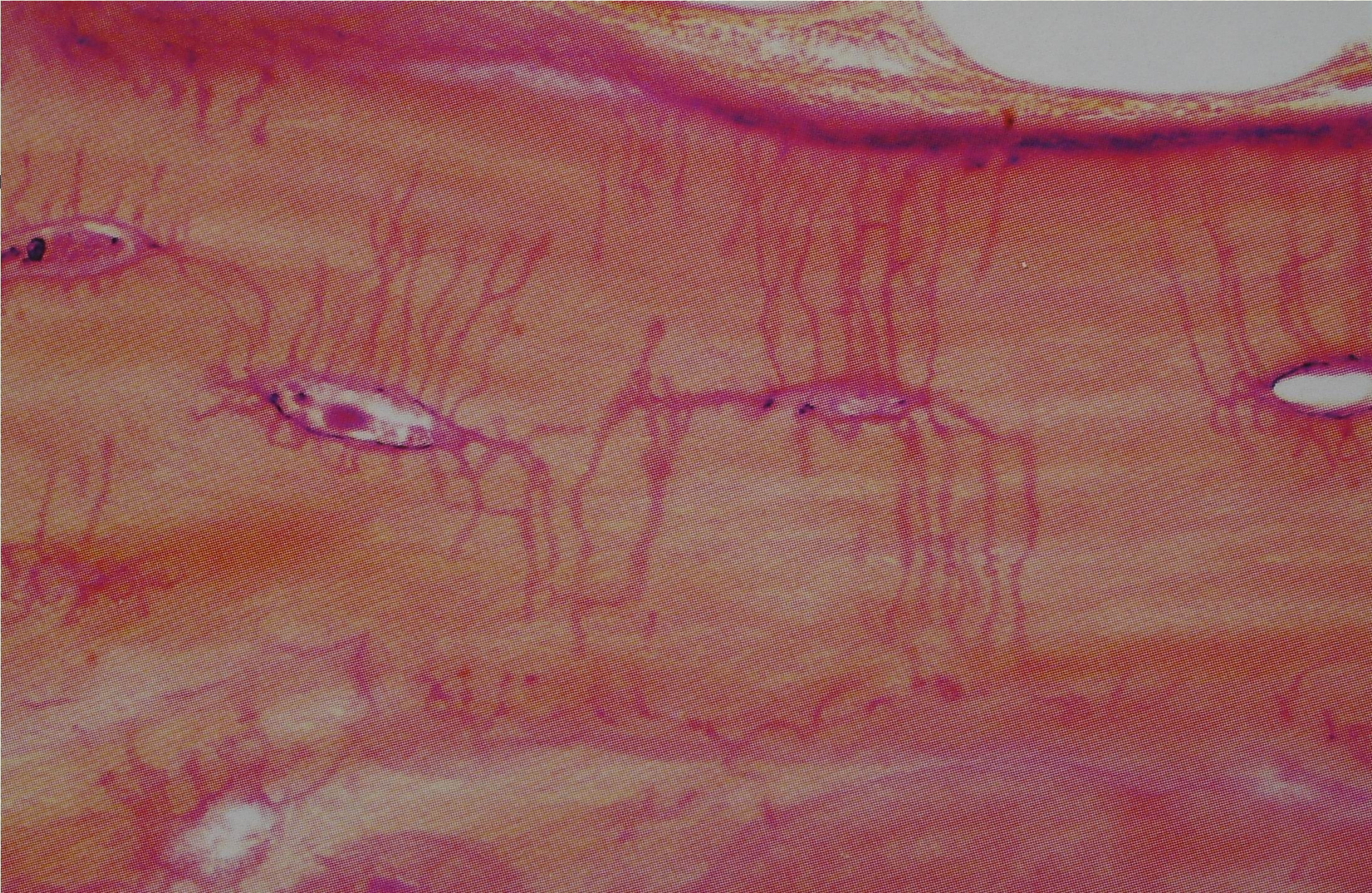
connecting proteins.

Inorganic

Ca $10(\text{po}_4)_6(\text{OH})_2$

Osteoblastes

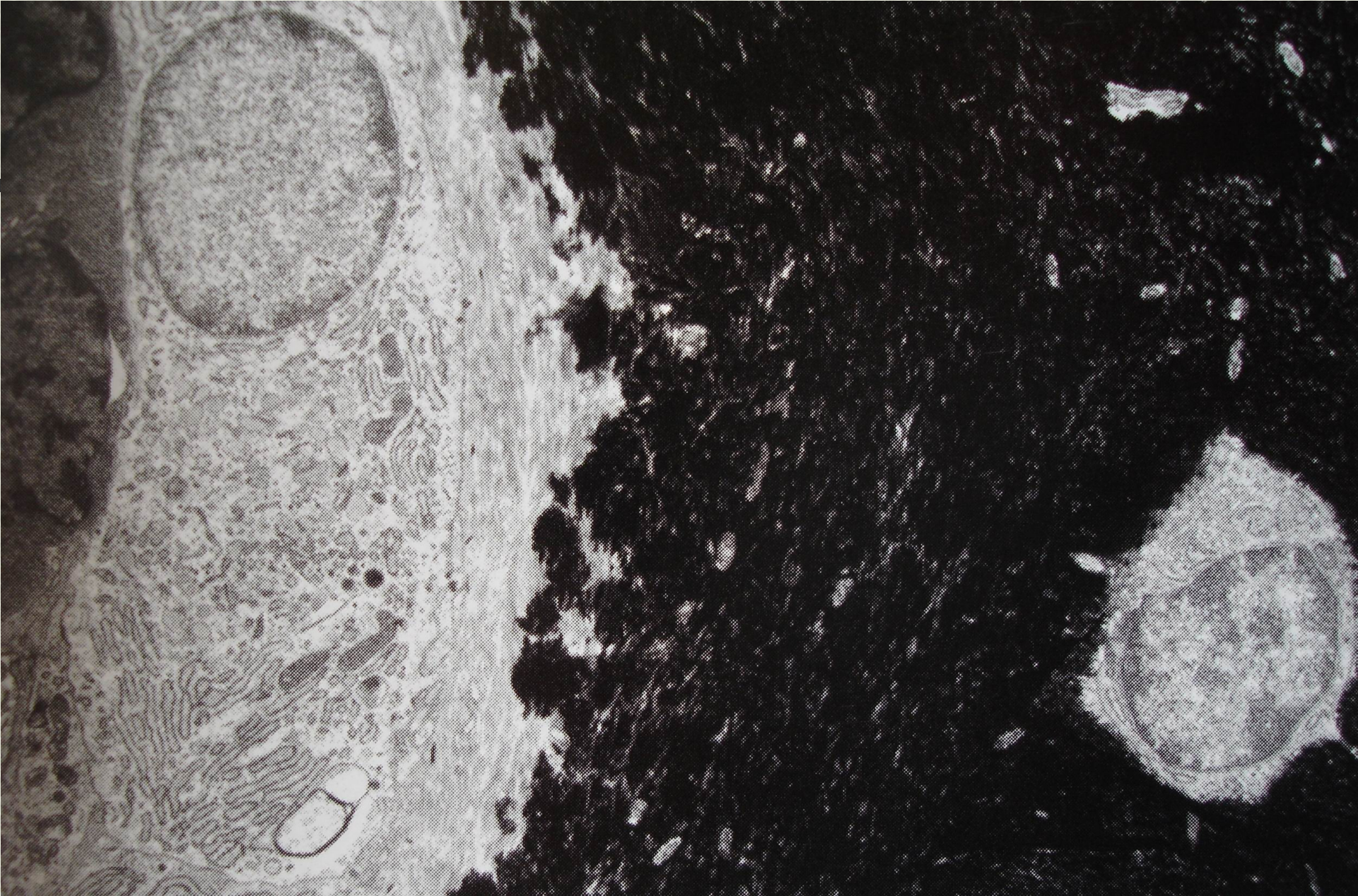
- ▶ Multipotential primitive mesenchymal cells.
- ▶ Synthesize osteoid (pro alpha-1 collagen, osteocalcin, BMP).
- ▶ One osteoblast can produce 0.5-1.5 mic m/day of an osteoid seam for 8 weeks.
- ▶ Fate : apoptosis, osteocyte, bone lining cell.
- ▶ Gap junctions.
- ▶ Receptors for: PTH, vitD, TNF, oestrogen, IGF.

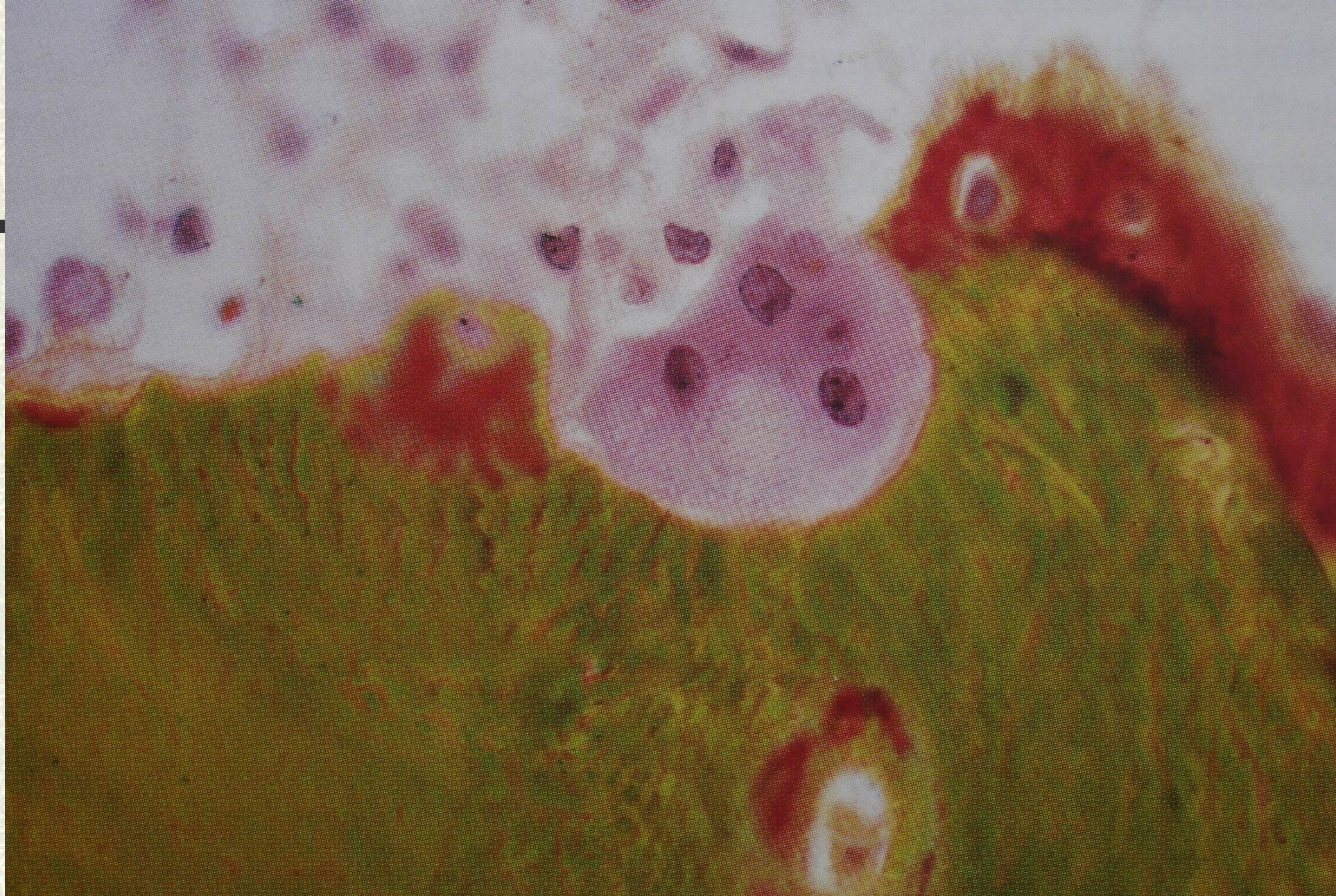


osteoclasts

- # Macrophage-monocyte origin.
 - # IL-3, GM-CSF.
 - # PTH, 1,25D3, TNF in the presence of bone stromal elements induce the production of calcitonin receptors, carbonic anhydrase, TRALP.
 - # IL-1, IL-6.
 - # Integrin.
-







Bone matrix.

70% mineralised matrix, 25% cells and organic matrix, 5% water.

Organic matrix 94% collagen.

resisting deformation in tension.

Collagen: 1 α 1 chain and 2 α 2 chains.

Microscopic periodicity of 640 nm.

Classification by anatomical location.

- ▶ Epiphysis.
- ▶ Metaphysis.
- ▶ Diaphysis.
- ▶ Capsule.
- ▶ Articular surface.
- ▶ Growth plate.

etal Skeleton



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ones
6-9 inches
g)

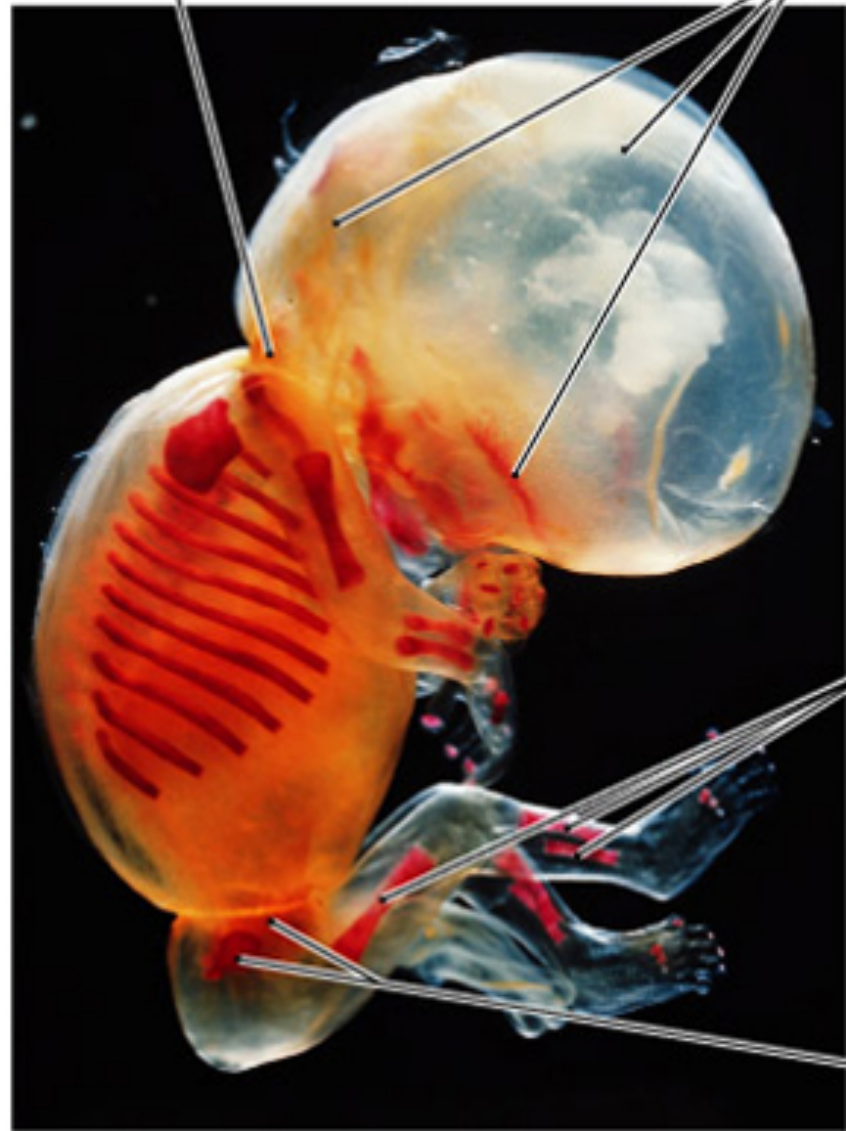


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Endochondral ossification
replaces cartilages of
embryonic skull

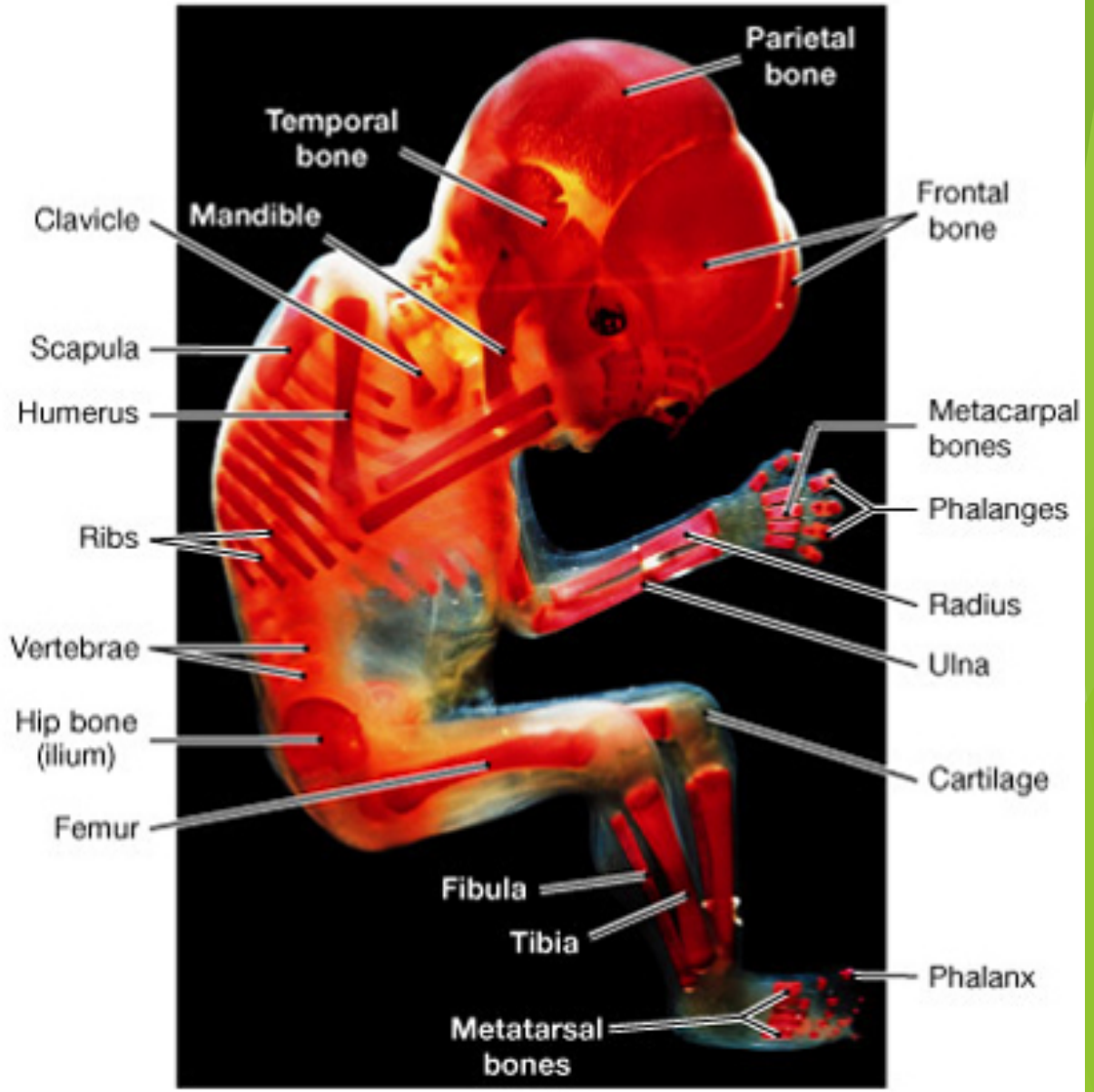
Intramembranous
ossification
produces the roofing
bones of the skull



Primary
ossification
centers of the
diaphyses
(bones of
the lower limb)

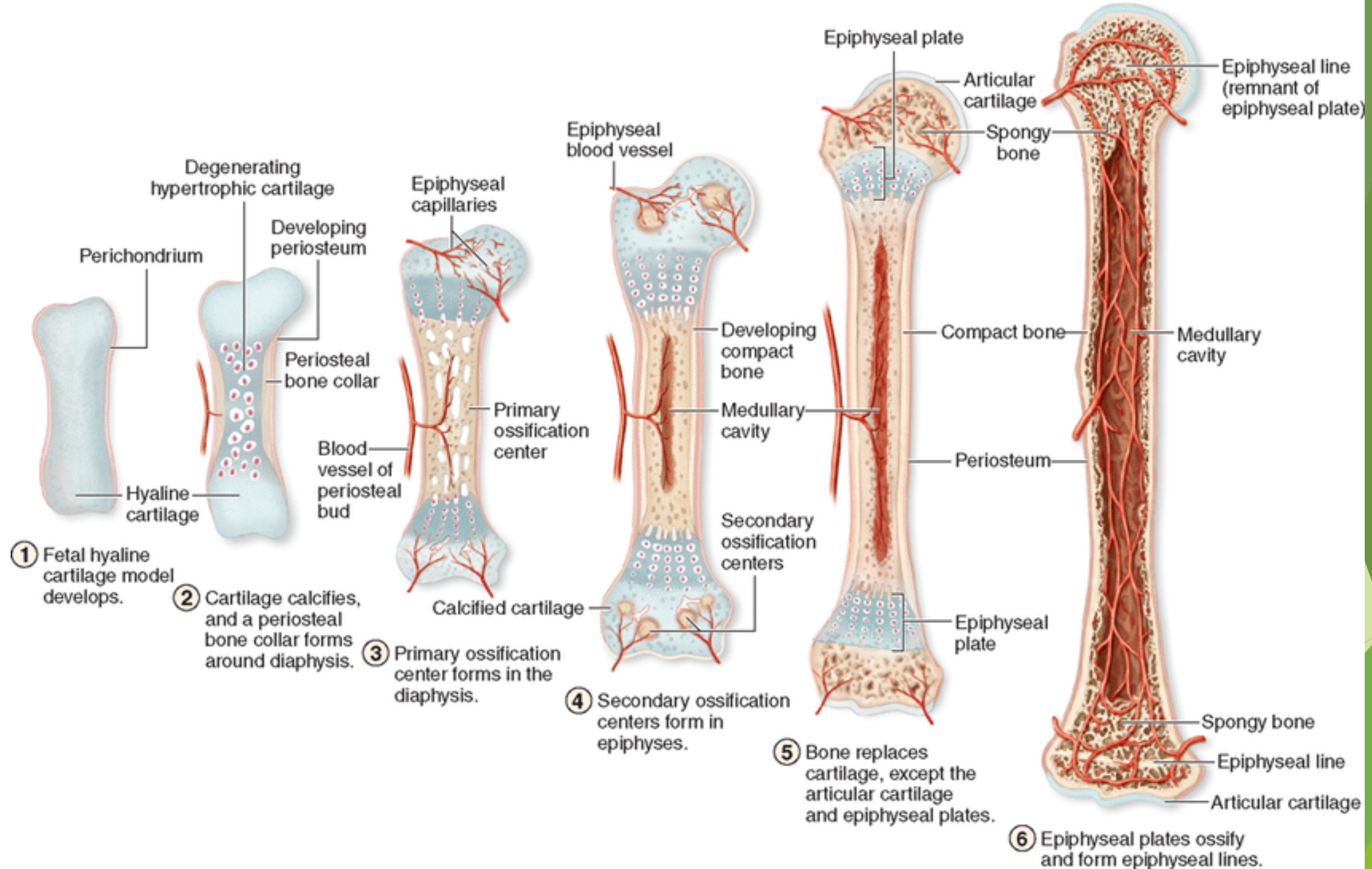
Future
hip bone

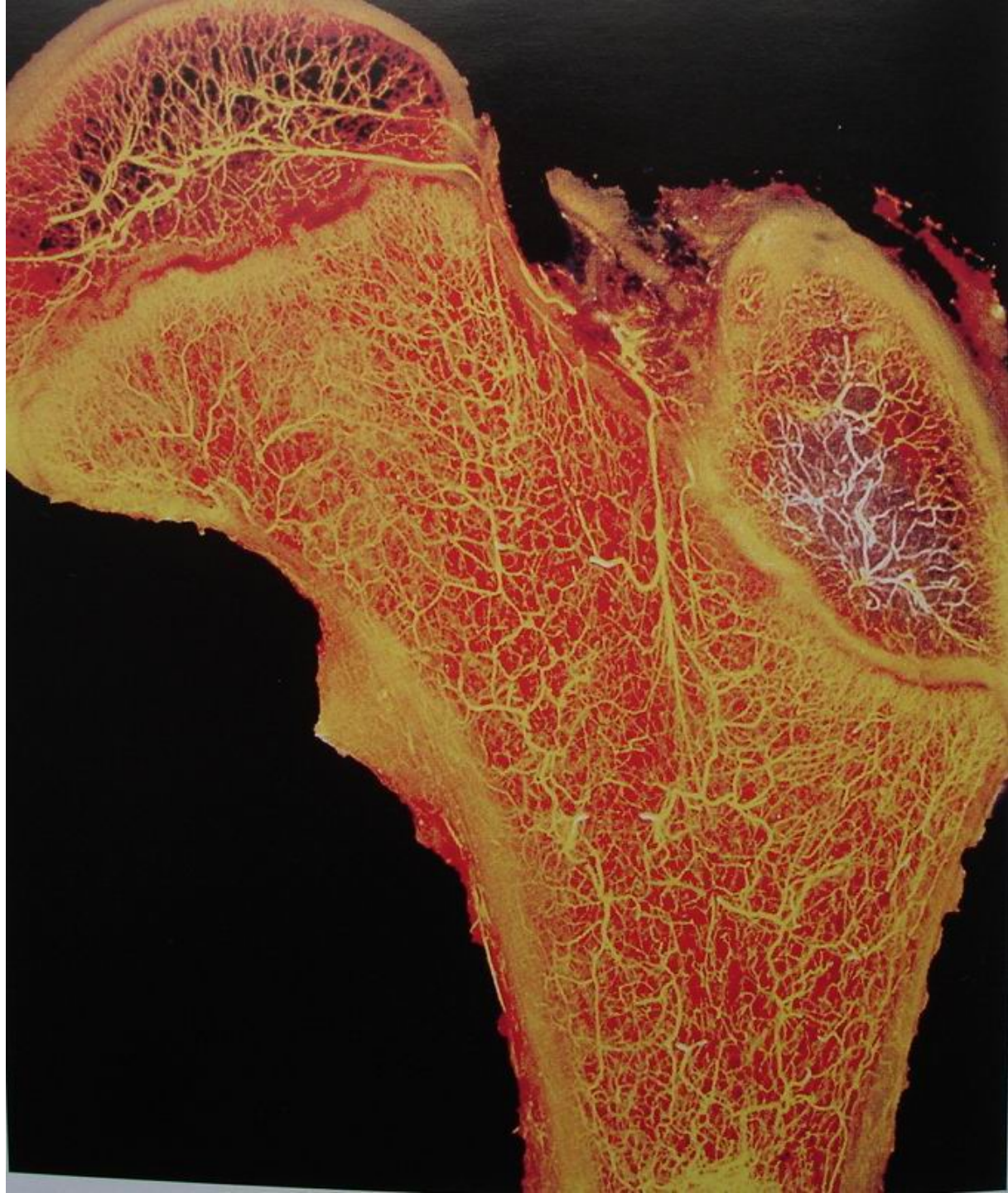
(a)



Parietal bone
Temporal bone
Frontal bone
Mandible
Clavicle
Scapula
Humerus
Ribs
Vertebrae
Hip bone (ilium)
Femur
Fibula
Tibia
Metatarsal bones
Metacarpal bones
Phalanges
Radius
Ulna
Cartilage
Phalanx

(b)

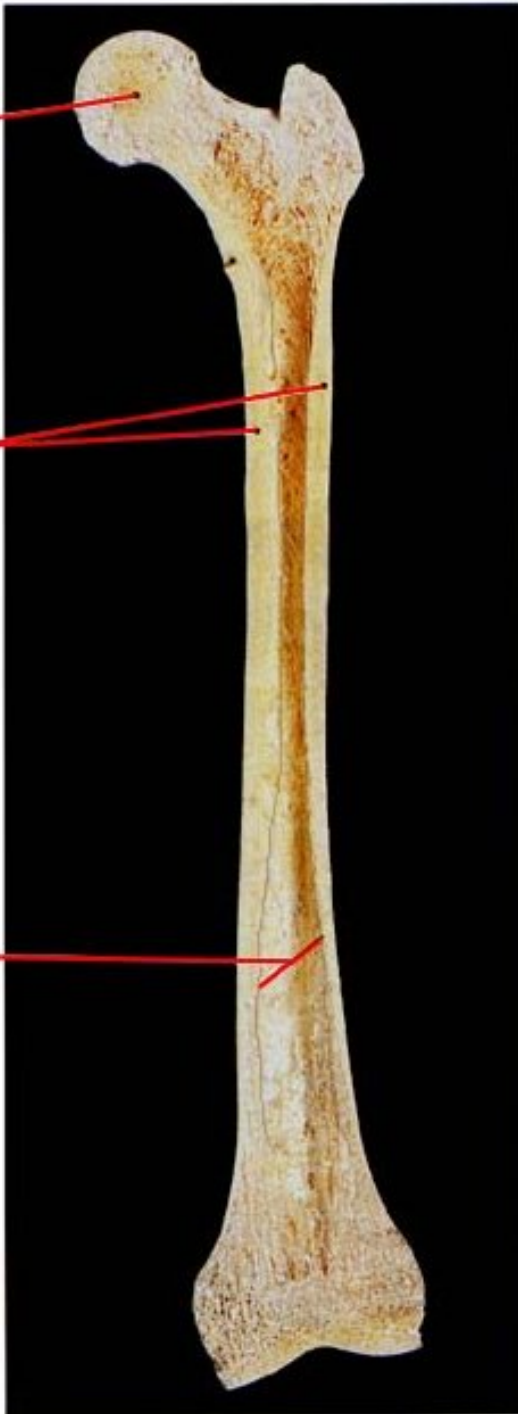




**spongy
bone**

**compact
bone**

**medullary
(marrow)
cavity**



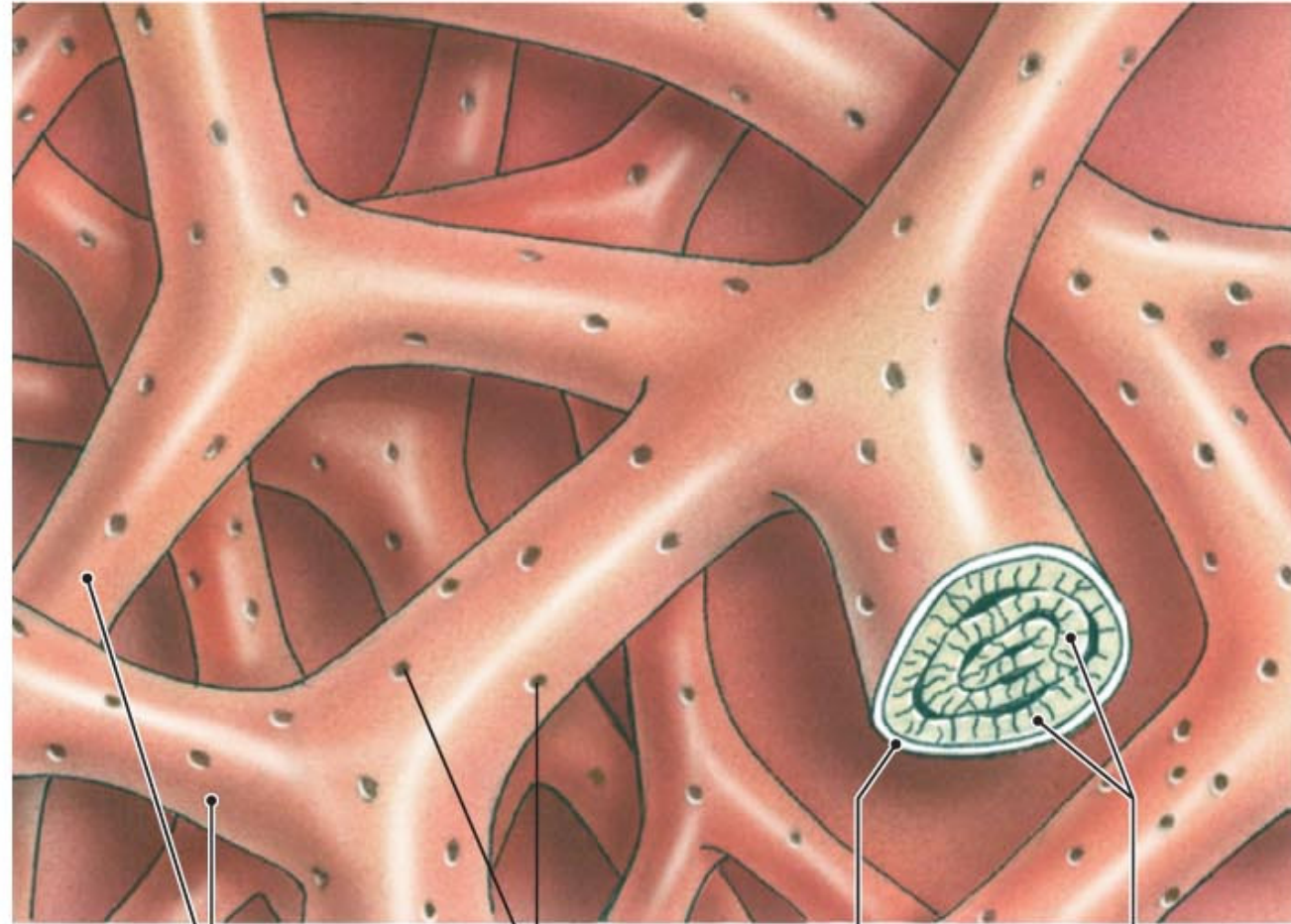
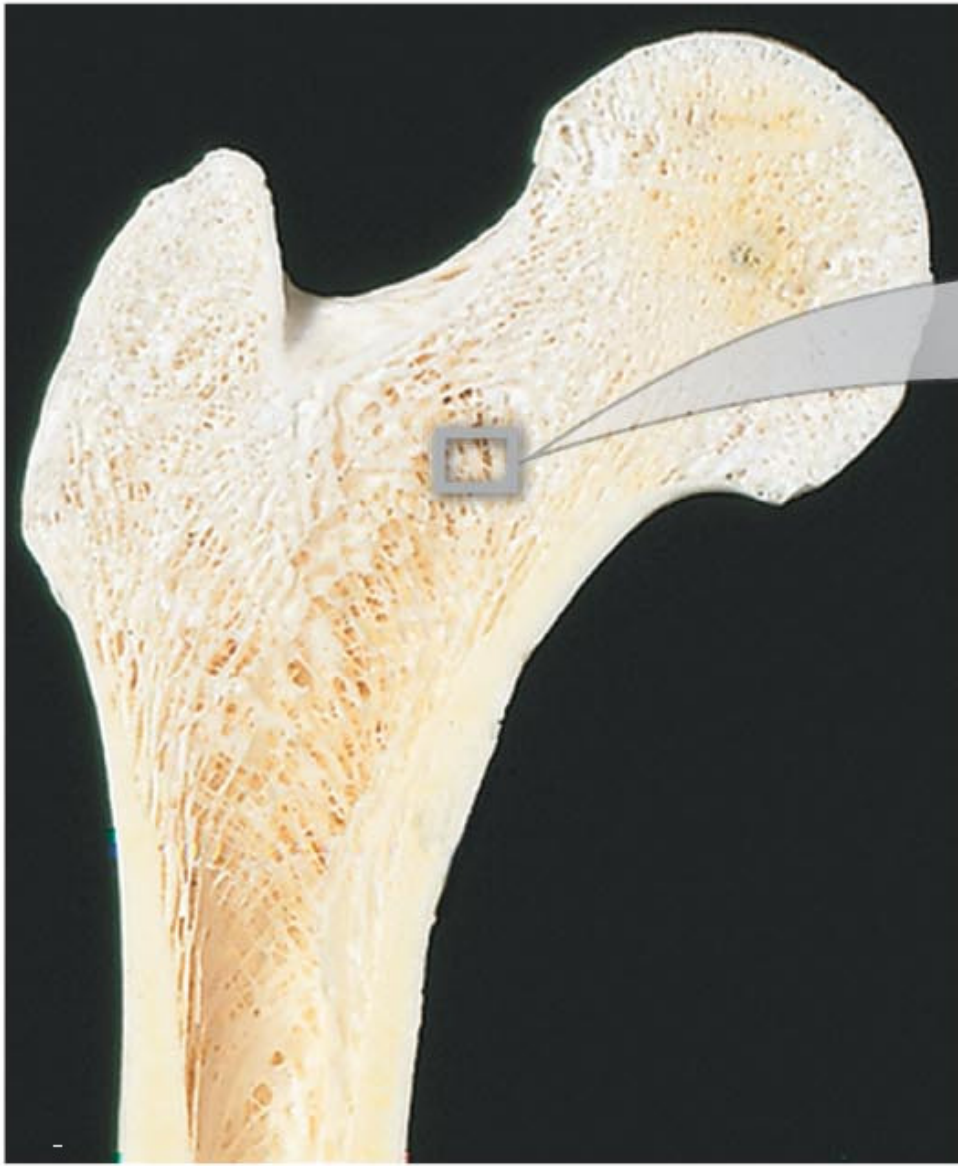
**epiphysis
(head)**

**diaphysis
(shaft)**

epiphysis



The structure of spongy bone, as shown in the head of the femur



Trabeculae of spongy bone

Canaliculi opening on surface

Endosteum

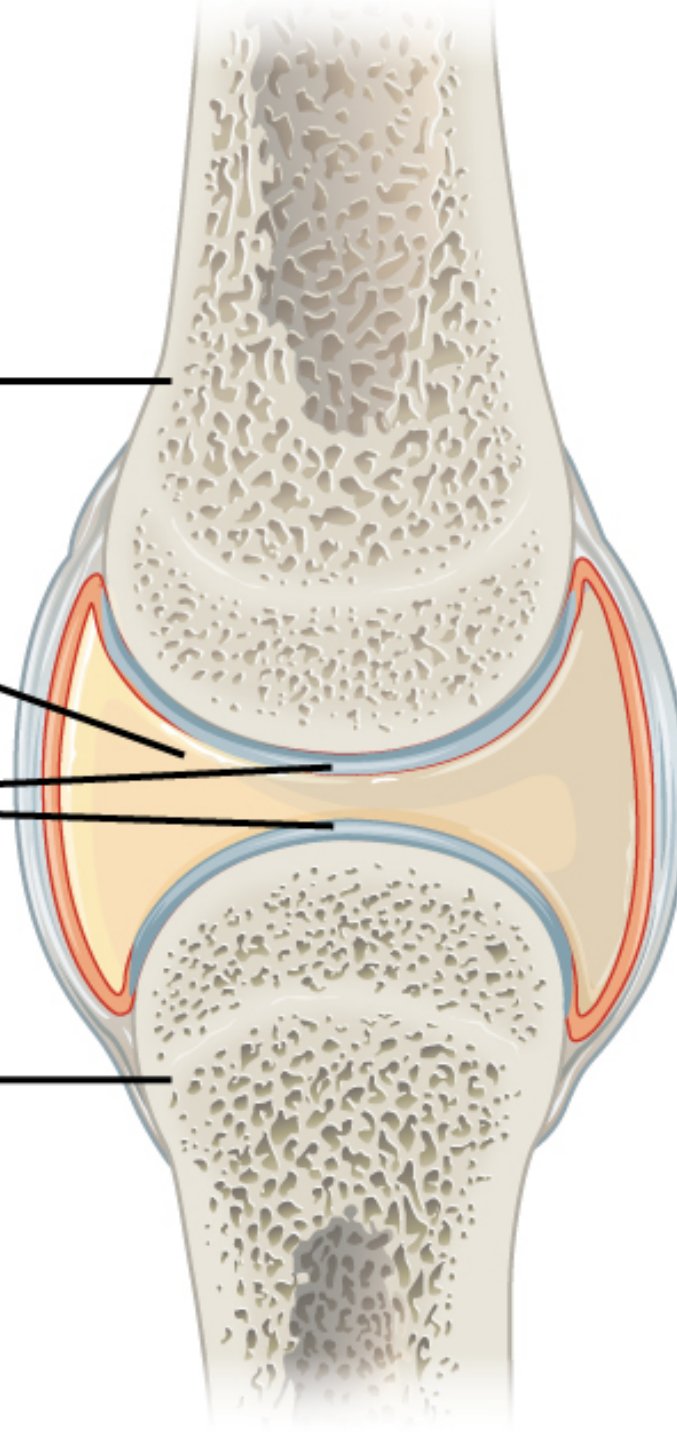
Lamellae

Bone

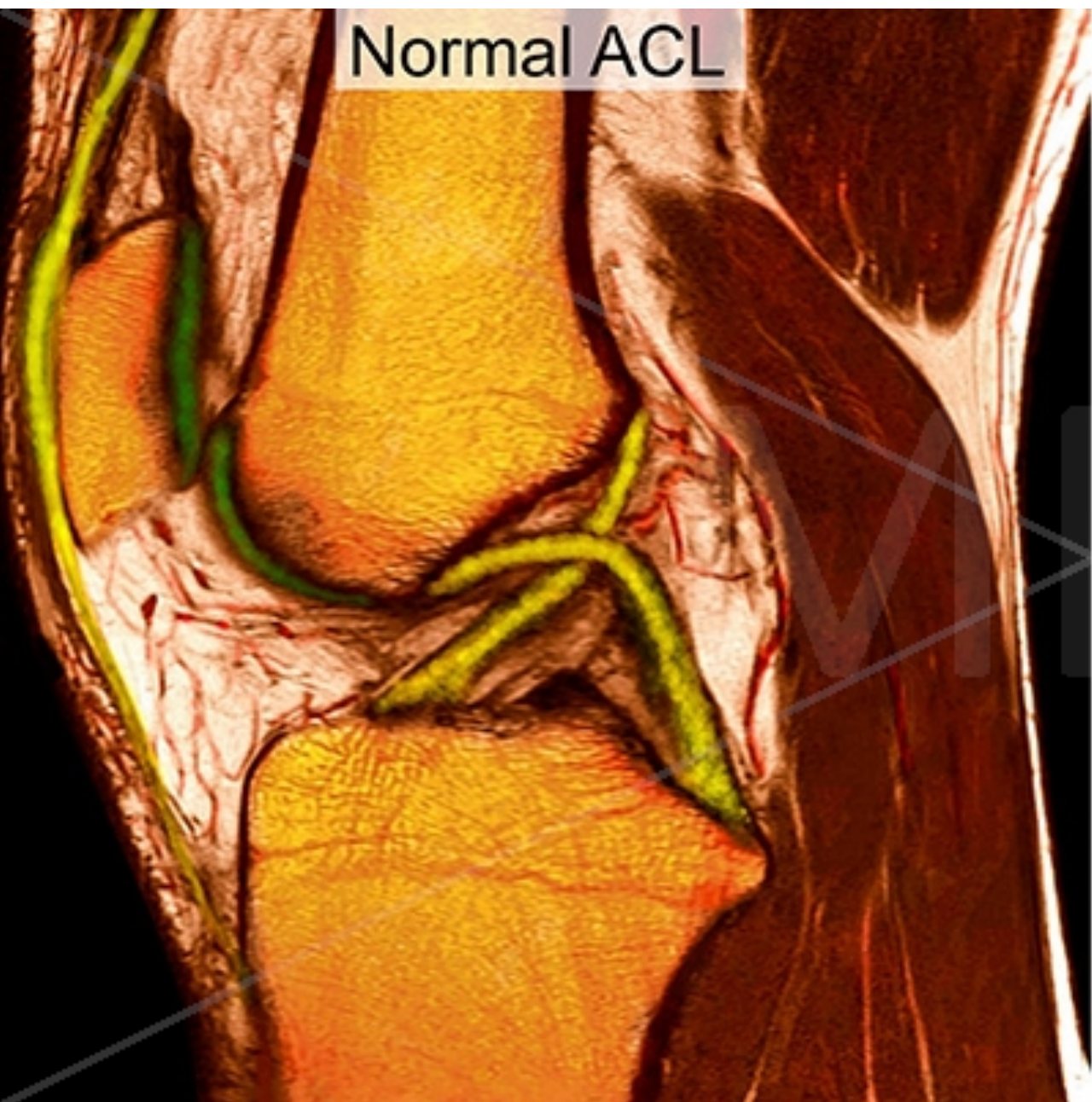
Joint cavity
containing
synovial fluid

Articular
cartilage

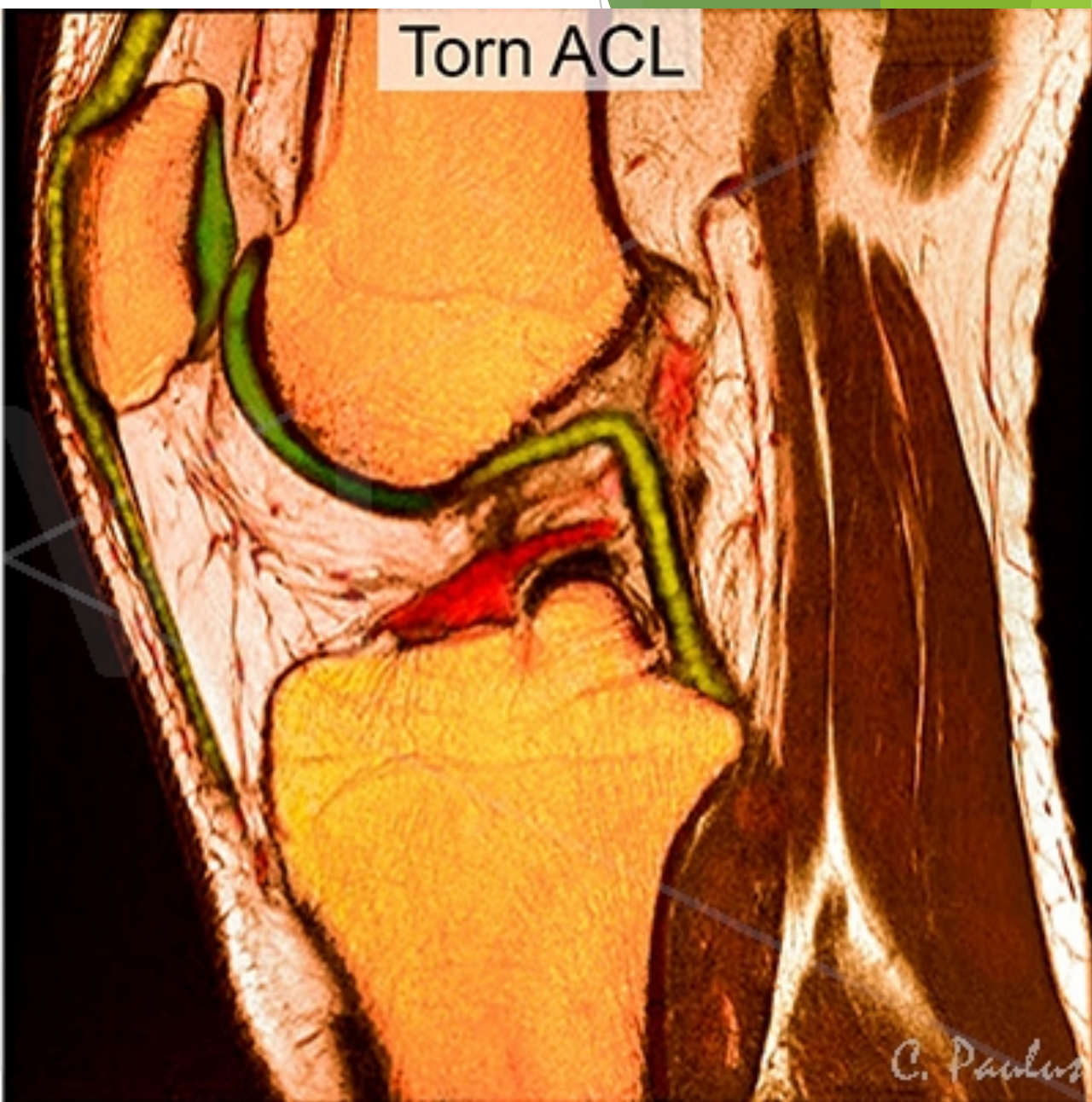
Bone



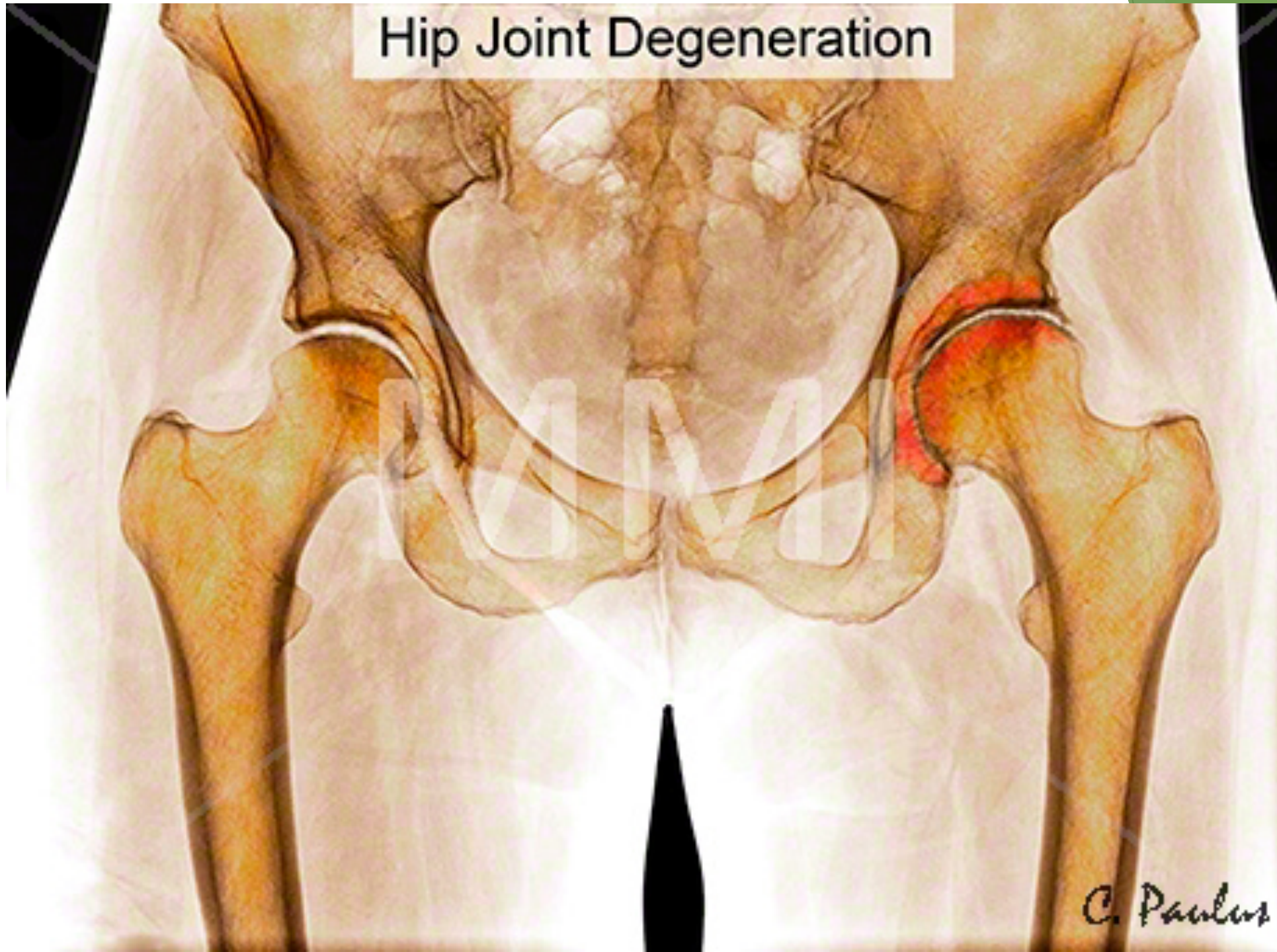
Normal ACL



Torn ACL



Hip Joint Degeneration

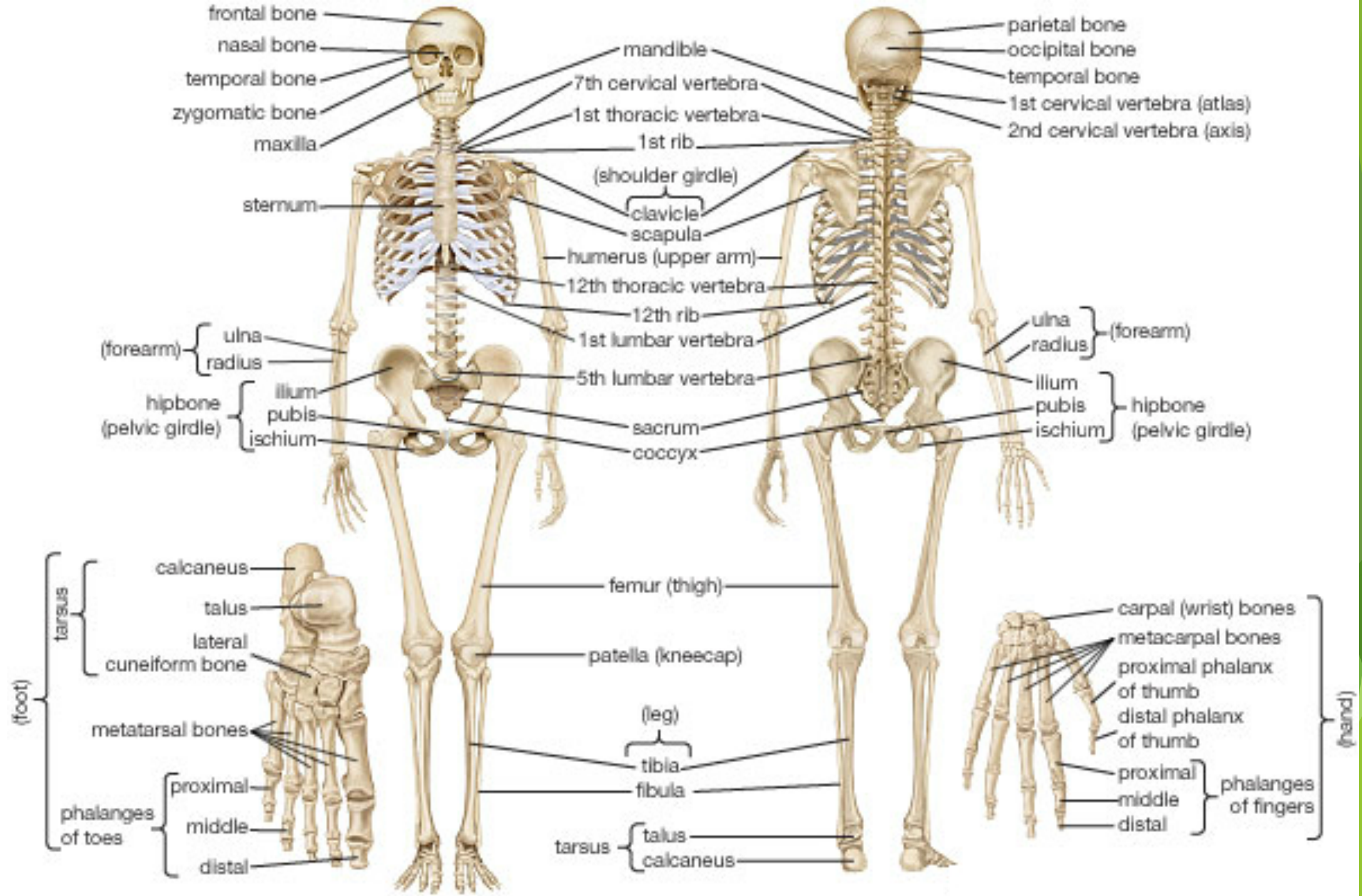


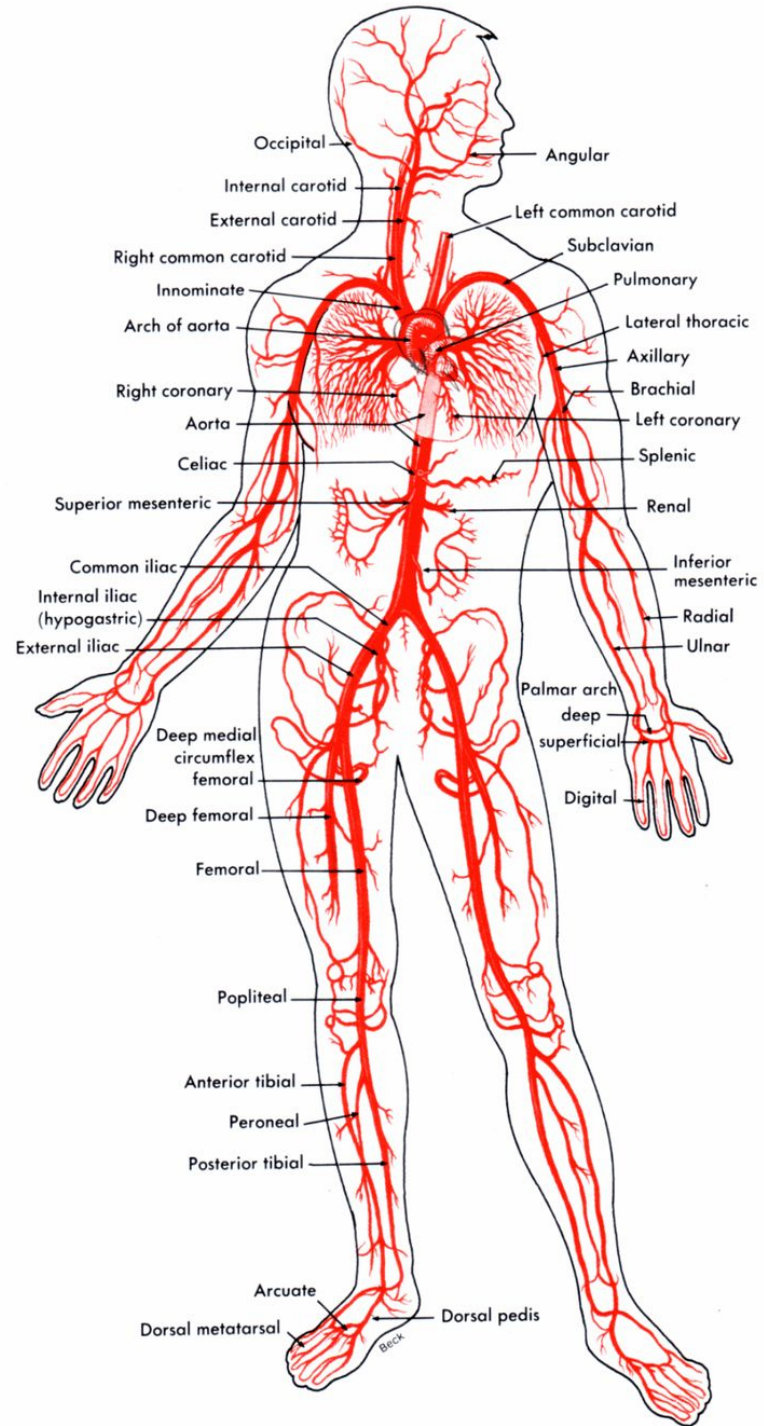
C. Paulos

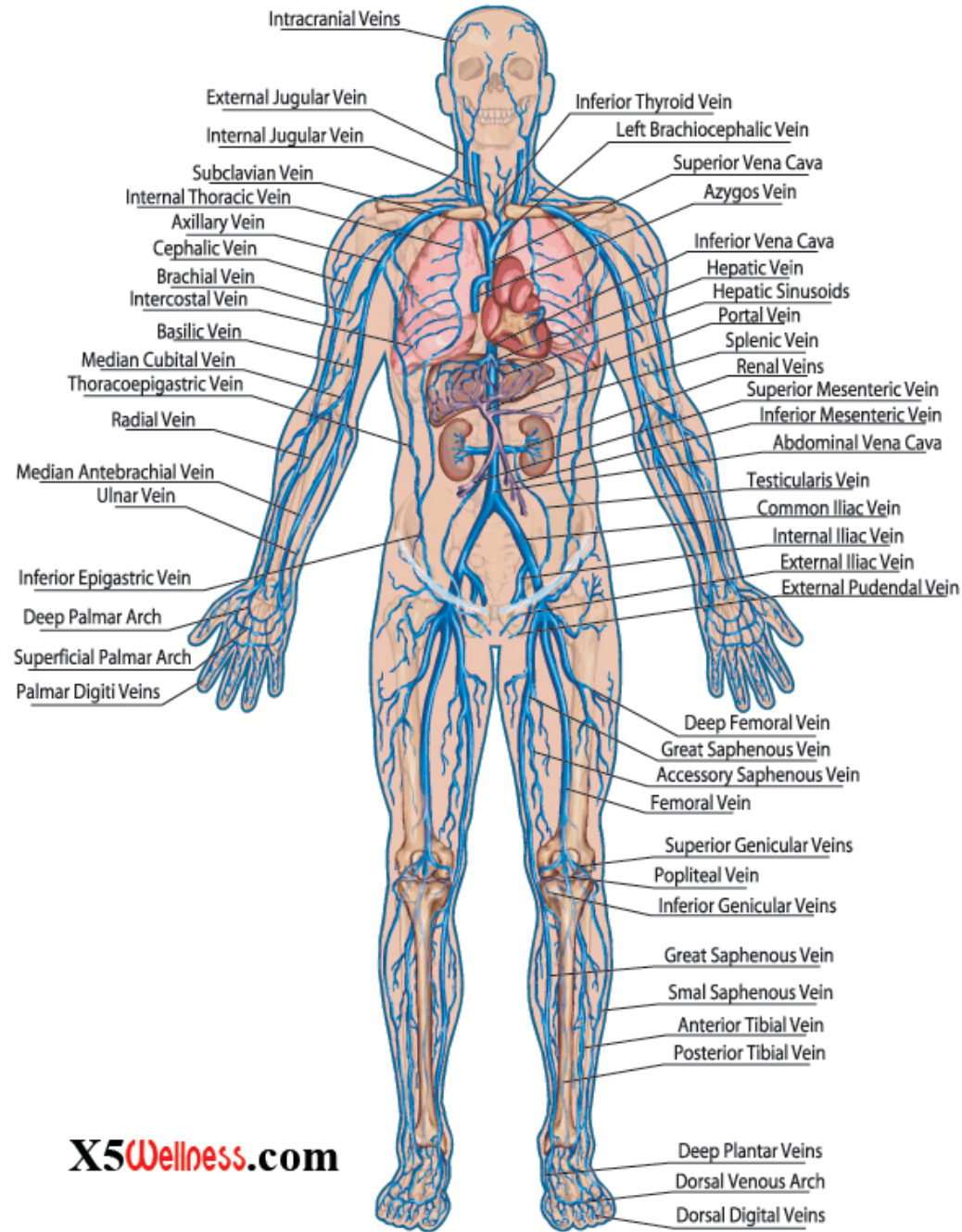
Body dimensions and planes.

- ▶ Superior-inferior, proximal-distal, cephalocodal.
 - ▶ Anterior posterior.
 - ▶ Medial lateral.
-
- ▶ Axial, transverse.
 - ▶ Sagittal.
 - ▶ Coronal.



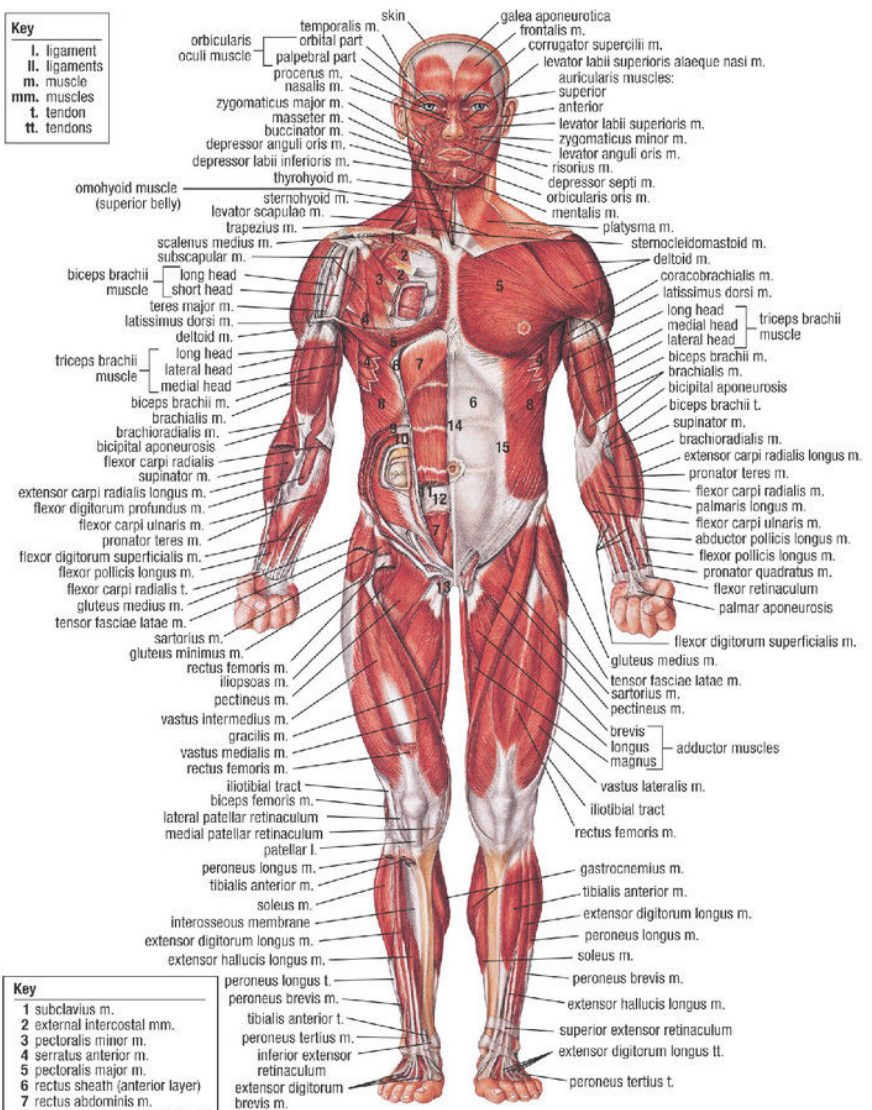






MUSCULAR SYSTEM (ANTERIOR VIEW)

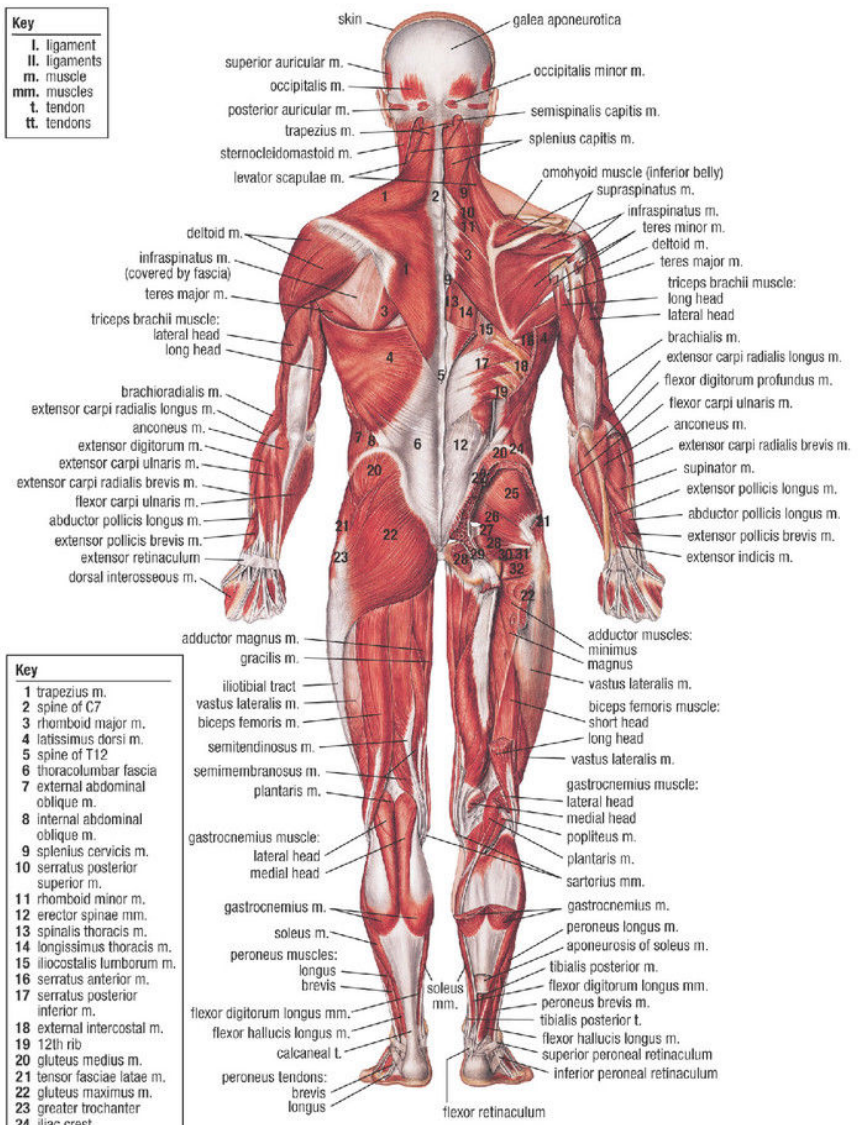
Key
I. ligament
II. ligaments
m. muscle
mm. muscles
t. tendon
tt. tendons



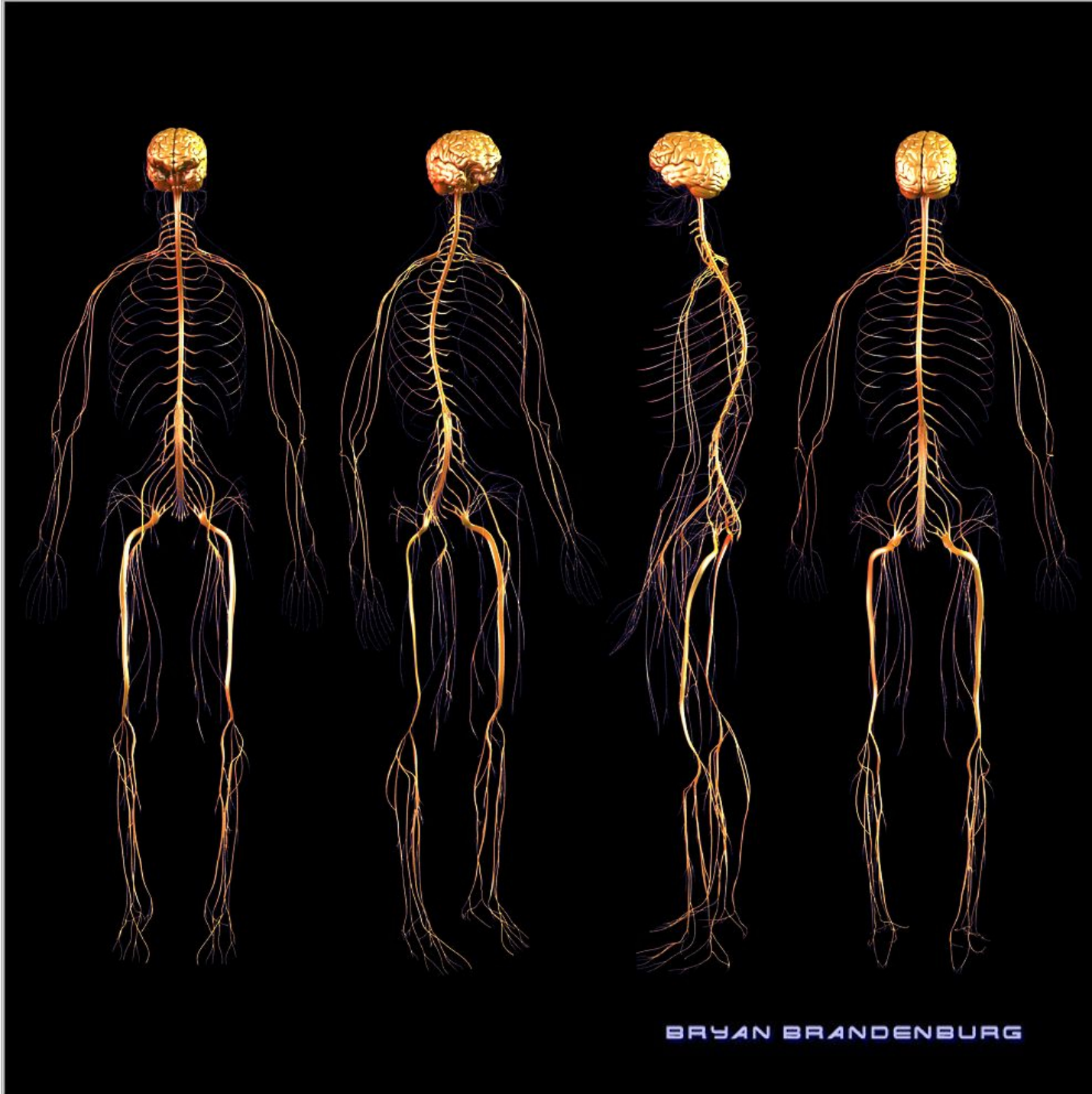
Key
 1 subclavius m.
 2 external intercostal mm.
 3 pectoralis minor m.
 4 serratus anterior m.
 5 pectoralis major m.
 6 rectus sheath (anterior layer)
 7 rectus abdominis m.
 8 external abdominal oblique m.
 9 internal abdominal oblique m.
 10 transversus abdominis m.
 11 rectus sheath (posterior layer)
 12 arcuate line
 13 cremaster m.
 14 linea alba
 15 aponeurosis of external abdominal oblique m.

MUSCULAR SYSTEM (POSTERIOR VIEW)

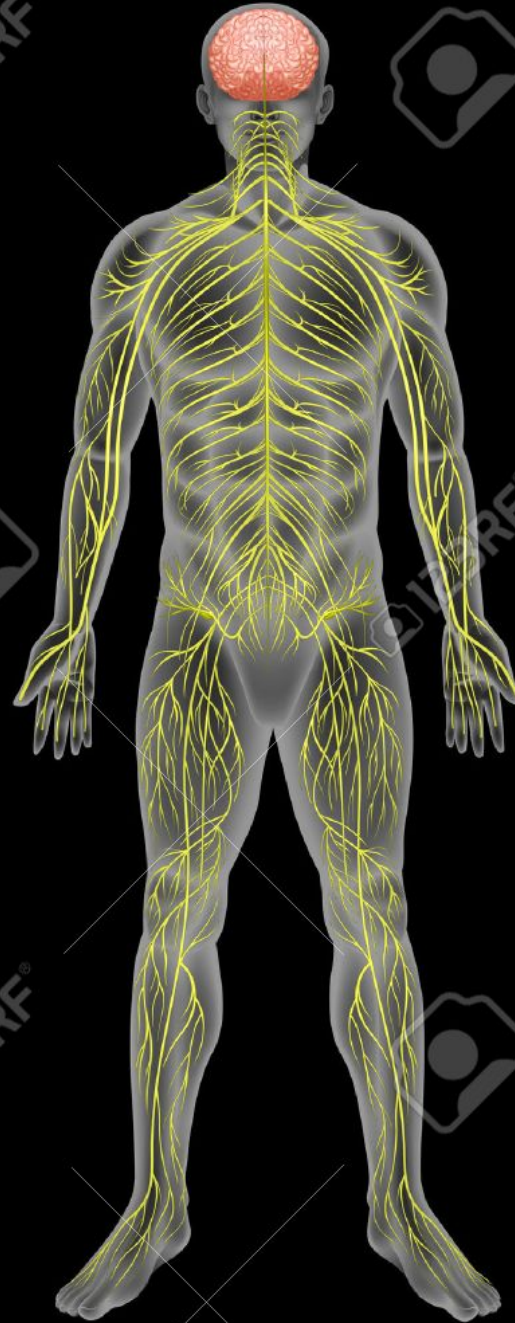
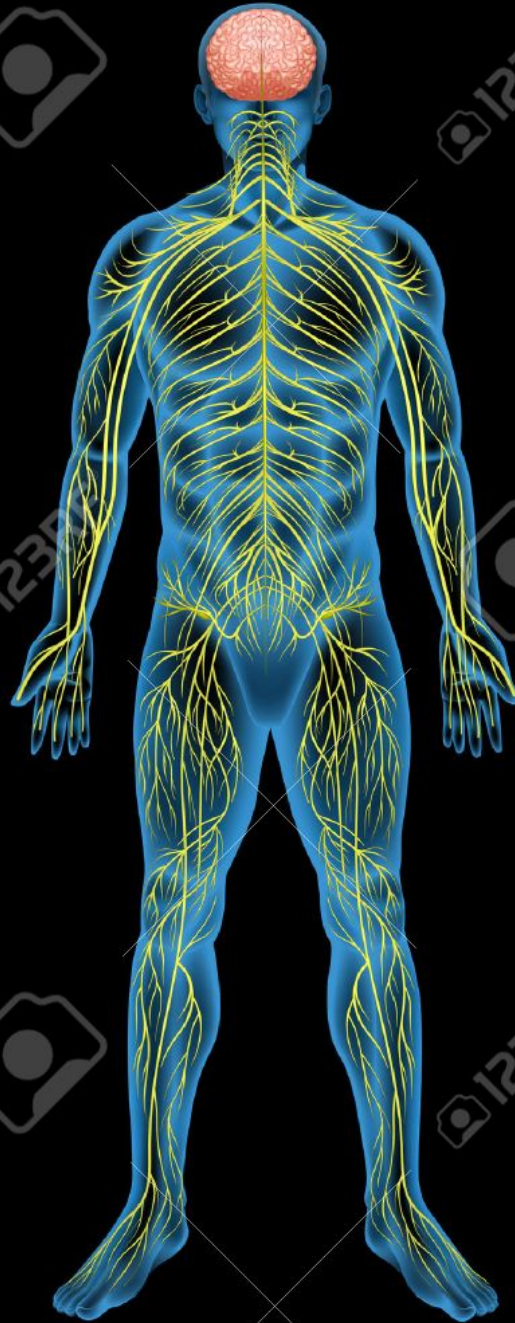
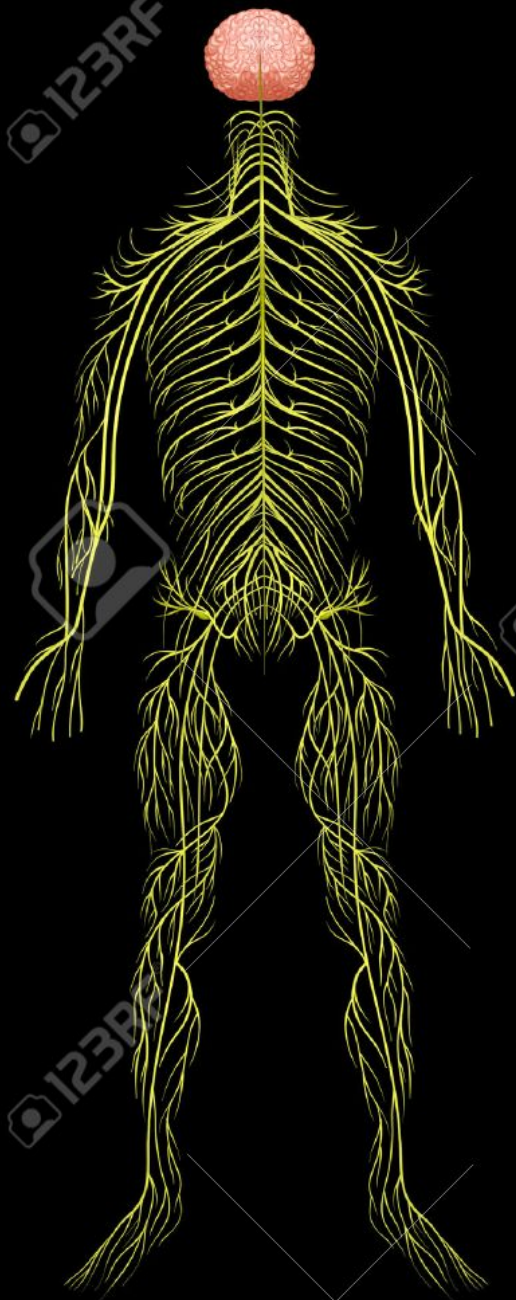
Key
I. ligament
II. ligaments
m. muscle
mm. muscles
t. tendon
tt. tendons



Key
 1 trapezius m.
 2 spine of C7
 3 rhomboid major m.
 4 latissimus dorsi m.
 5 spine of T12
 6 thoracolumbar fascia
 7 external abdominal oblique m.
 8 internal abdominal oblique m.
 9 splenius cervicis m.
 10 serratus posterior superior m.
 11 rhomboid minor m.
 12 erector spinae mm.
 13 spinalis thoracis m.
 14 longissimus thoracis m.
 15 iliocostalis lumborum m.
 16 serratus anterior m.
 17 serratus posterior inferior m.
 18 external intercostal m.
 19 12th rib
 20 gluteus medius m.
 21 tensor fasciae latae m.
 22 gluteus maximus m.
 23 greater trochanter
 24 iliac crest
 25 gluteus minimus m.
 26 piriformis m.
 27 superior gemellus m.
 28 obturator internus m.
 29 sacrotuberous l.
 30 inferior gemellus m.
 31 obturator externus m.
 32 quadratus femoris m.



BRYAN BRANDENBURG

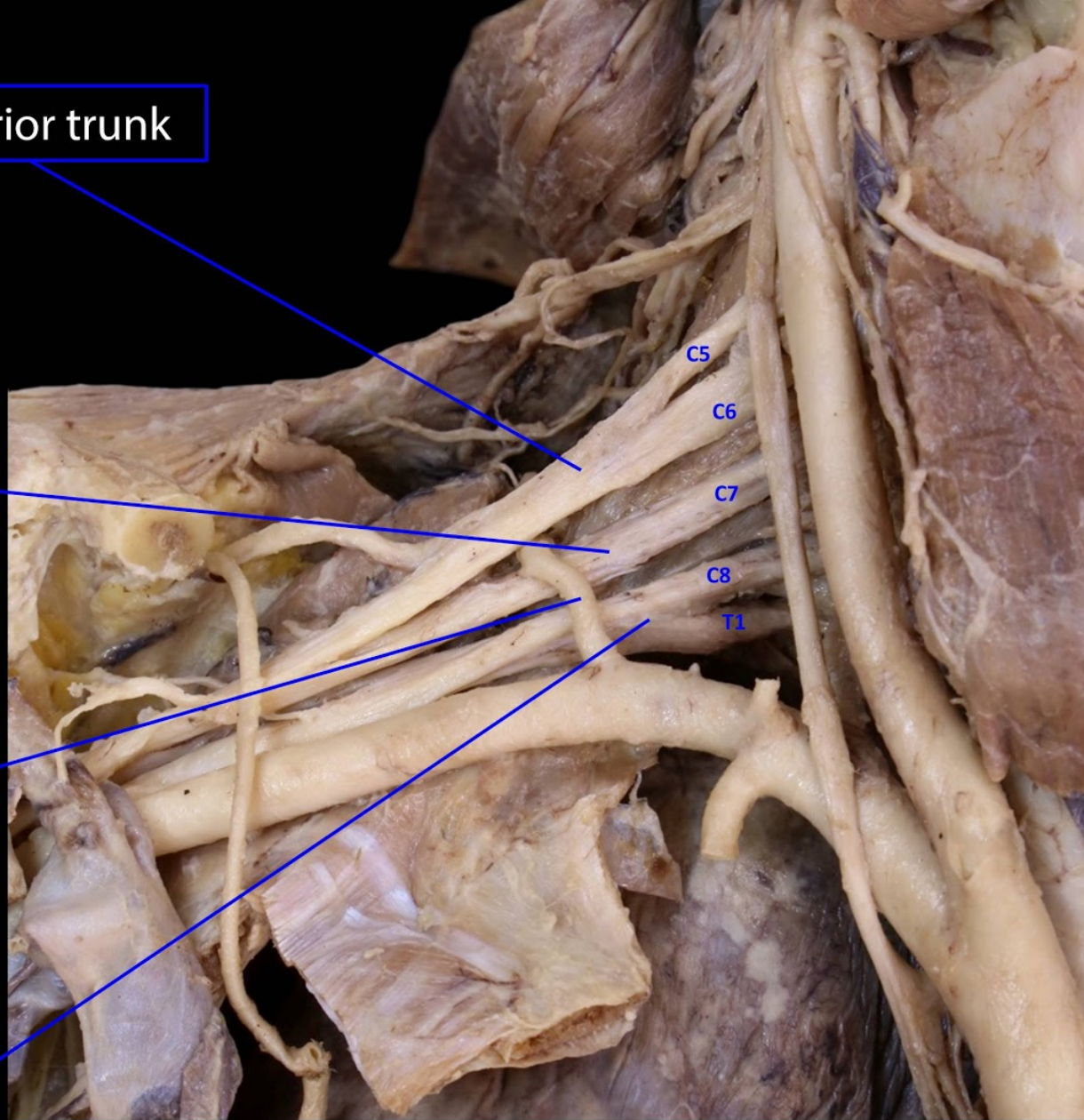


Superior trunk

Middle trunk

Dorsal scapular a.

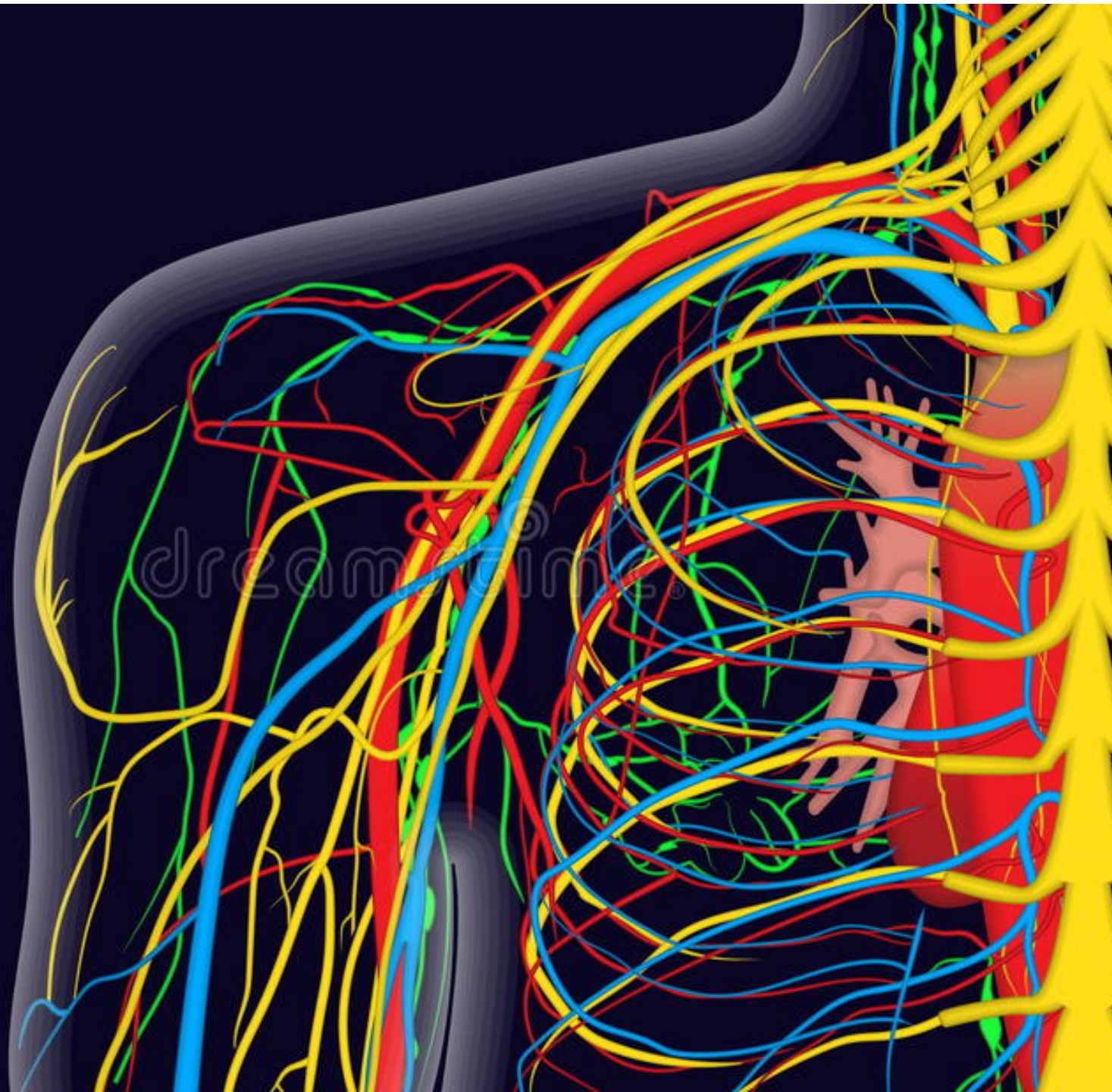
Inferior trunk



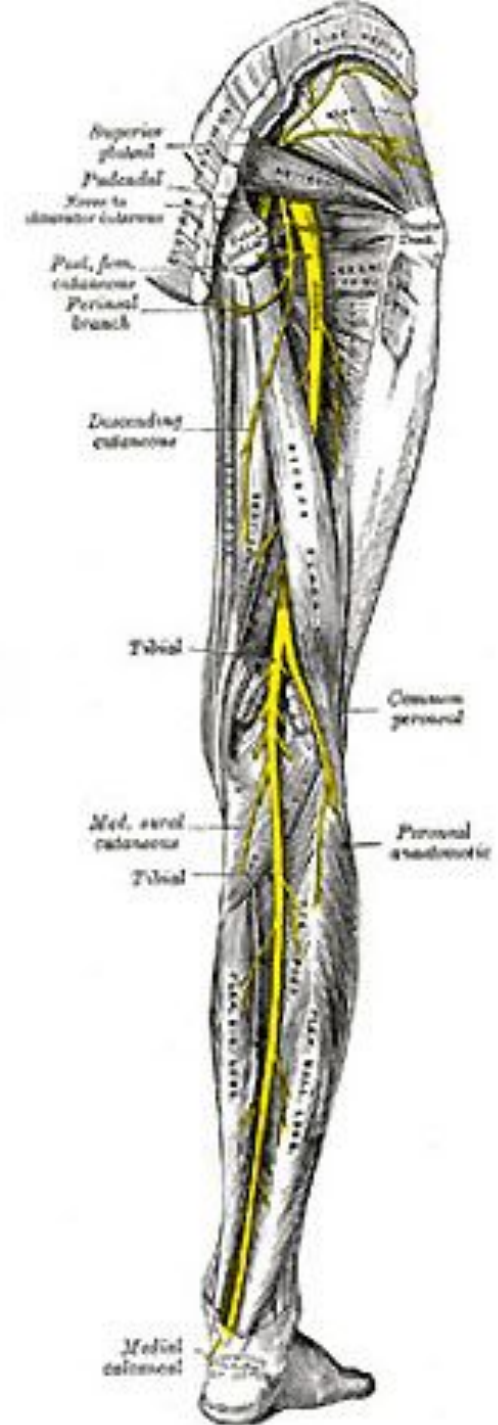
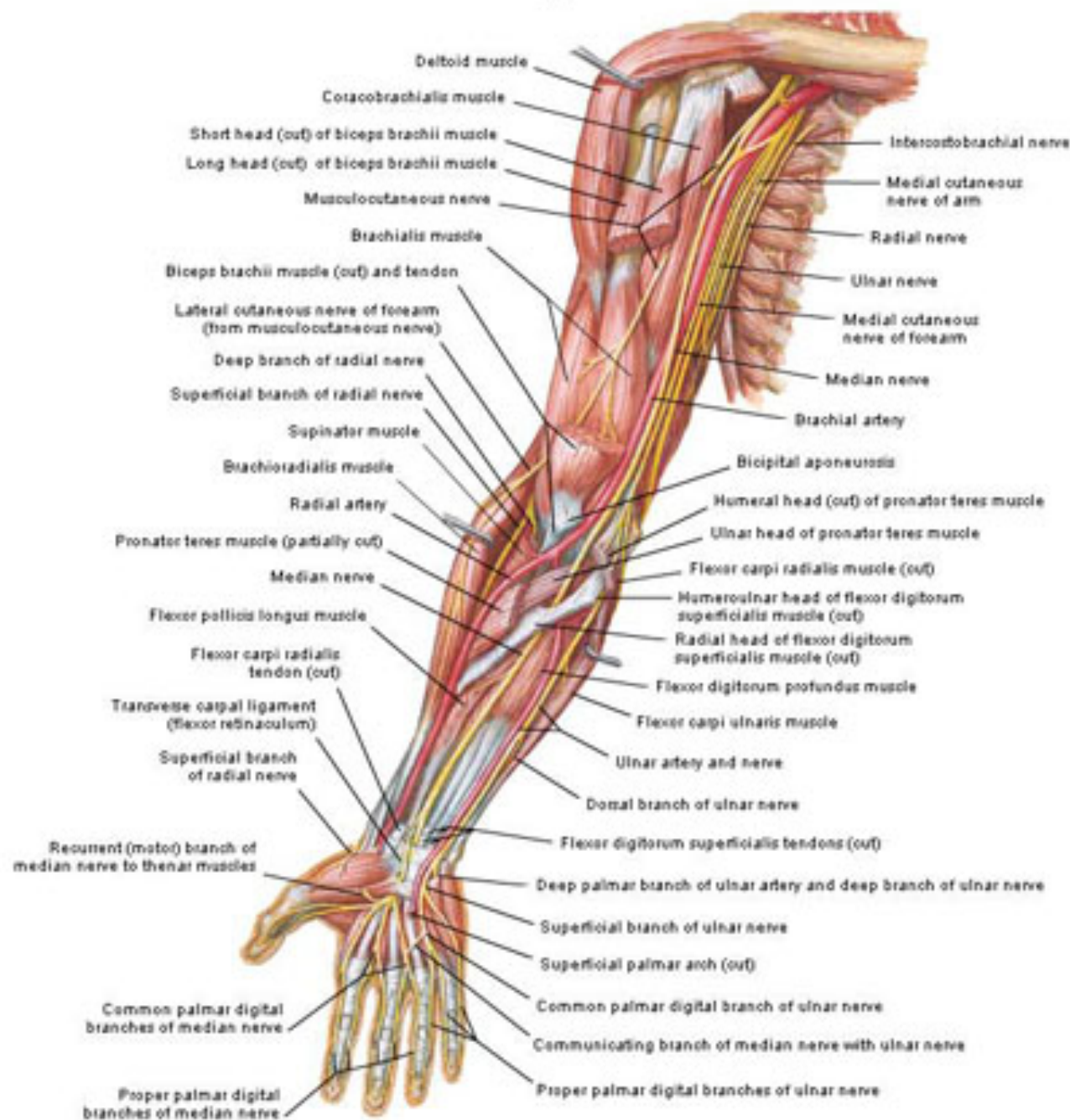
Root of neck, anterior

BlueLink

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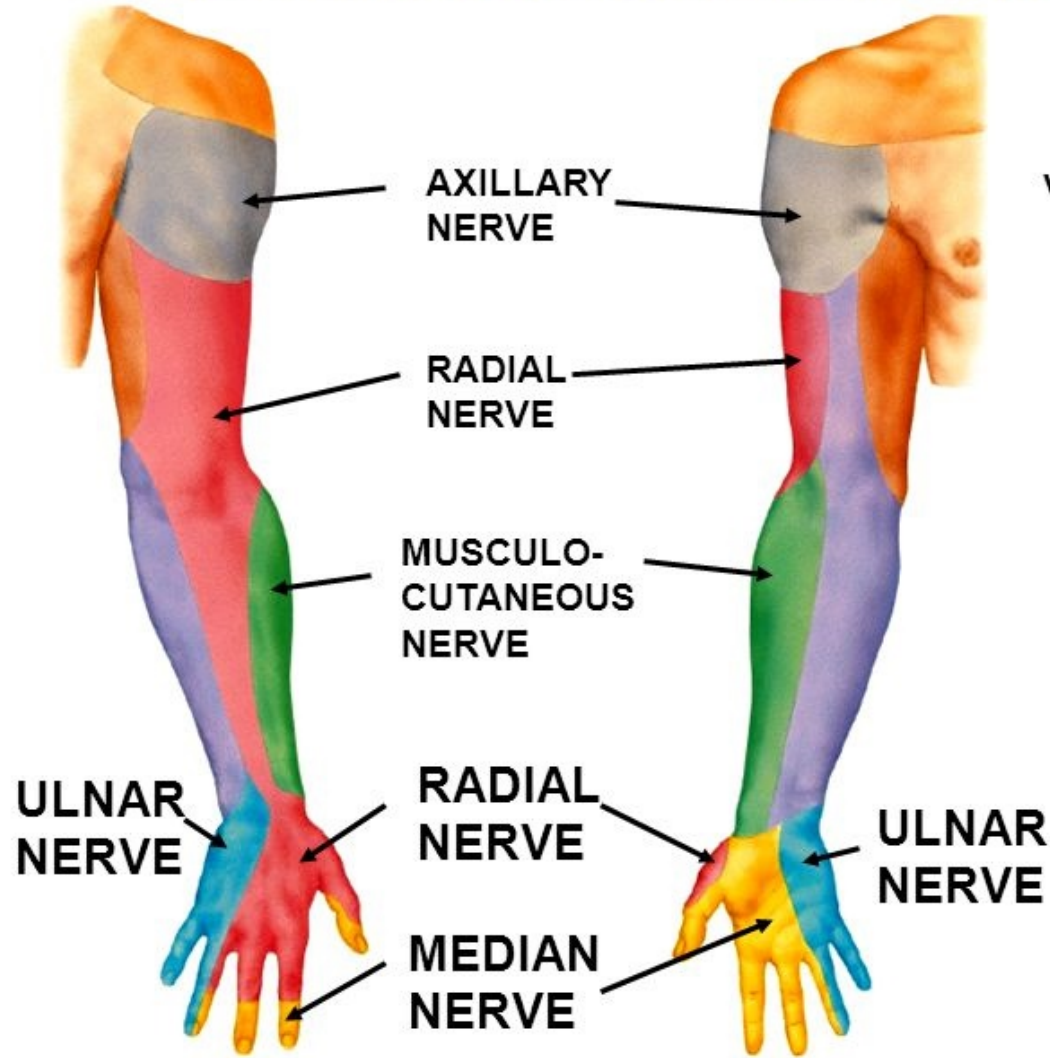


Arteries and Nerves of Upper Limb: Anterior View

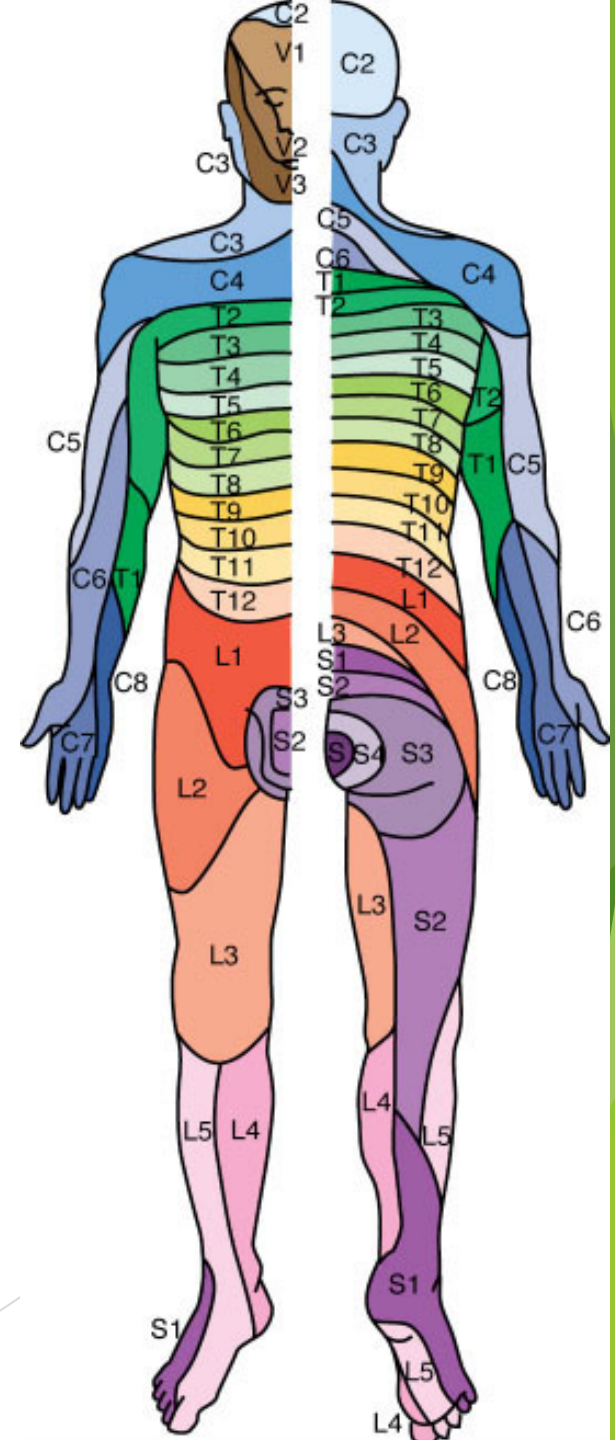


BRANCHES OF BRACHIAL PLEXUS PROVIDE SENSORY INNervation TO SKIN OF ARM AND HAND

DORSAL



VENTRAL



Bone pathology:

- ▶ Congenital.
- ▶ Developmental.
- ▶ Degenerative.
- ▶ Trauma.
- ▶ Ischaemia.
- ▶ Neoplasia: primary benign and malignant. Secondary..
- ▶ Infection: viral, bacterial, fungal, parasite.
- ▶ Metabolic.
- ▶ Autoimmune.
- ▶ Idiopathic or unknown.

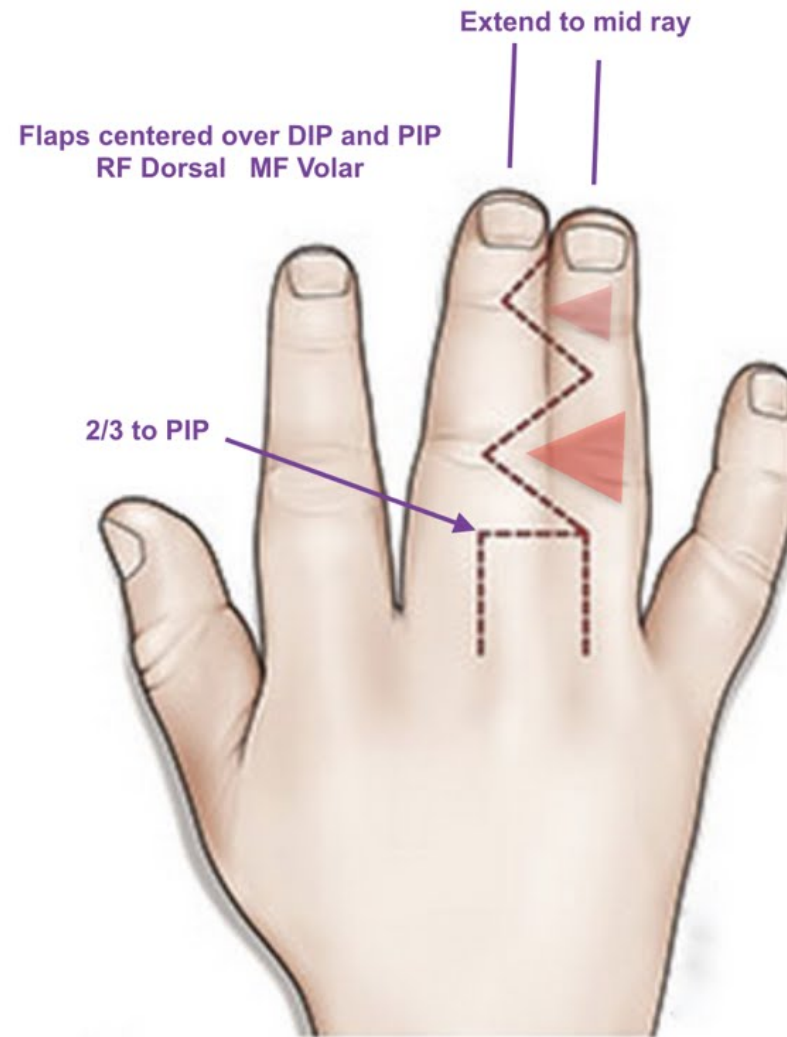
Bone pathology: inflammation.

- ▶ Swelling.
- ▶ Hotness.
- ▶ Redness.
- ▶ Pain.
- ▶ Loss of function.

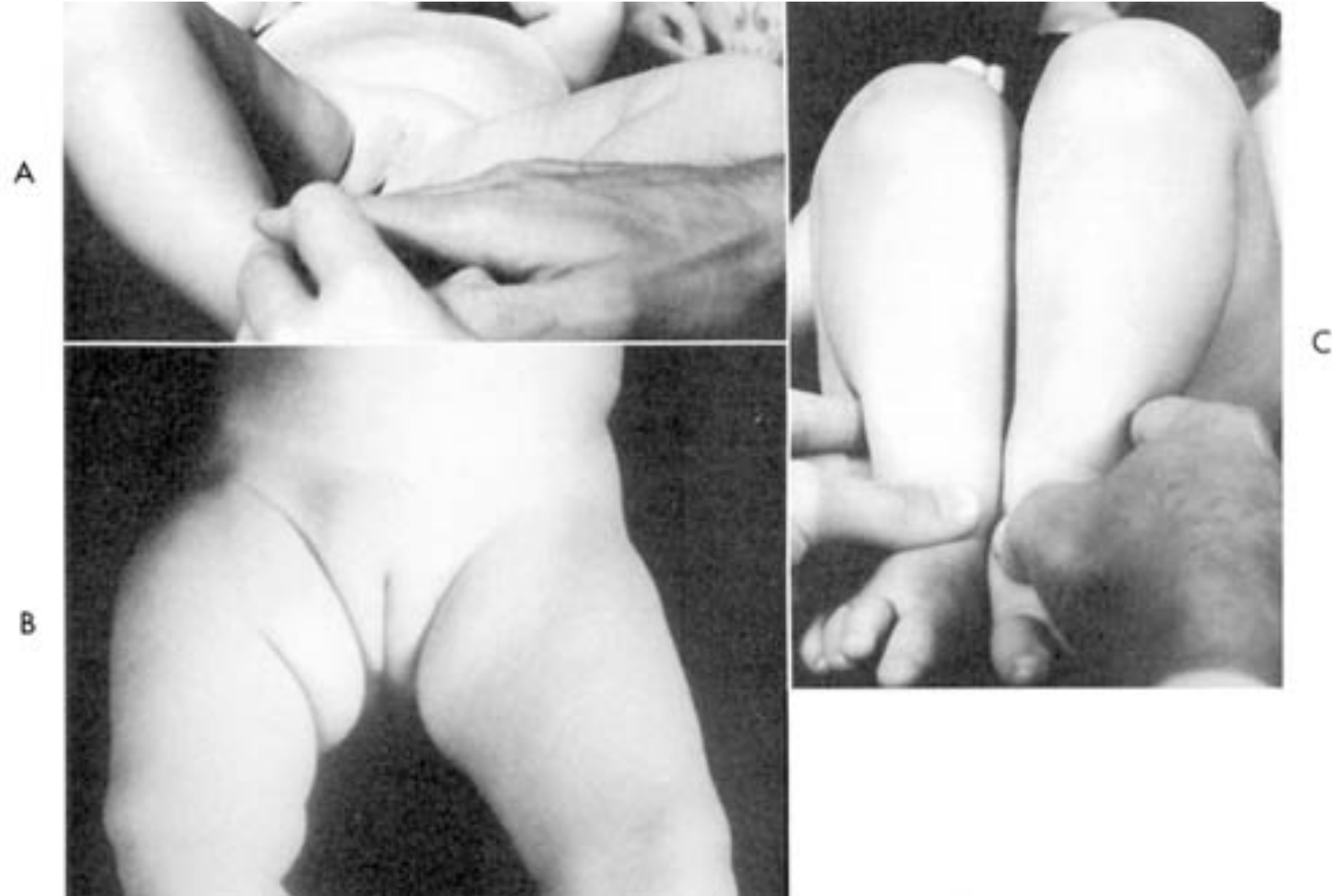
Bone pathology

- ▶ Pain.
- ▶ Deformity.
- ▶ Loss of function.

Congenital.



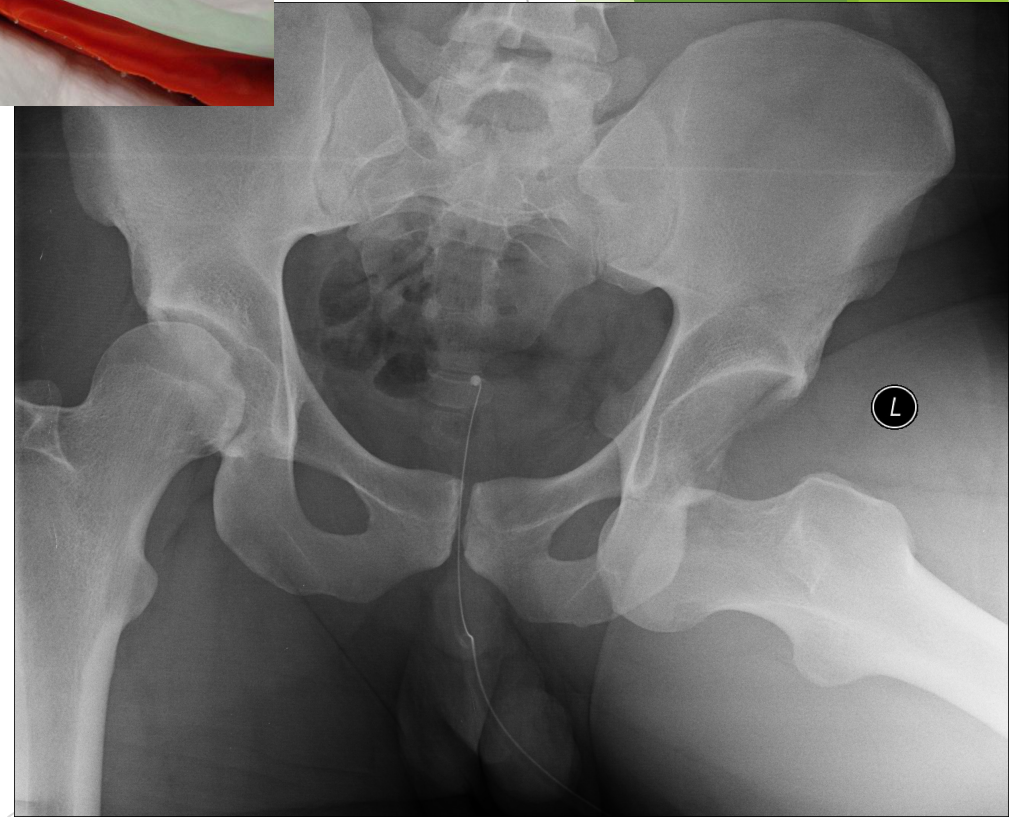
Developmental:



Degenerative.



Trauma.



Autoimmune:



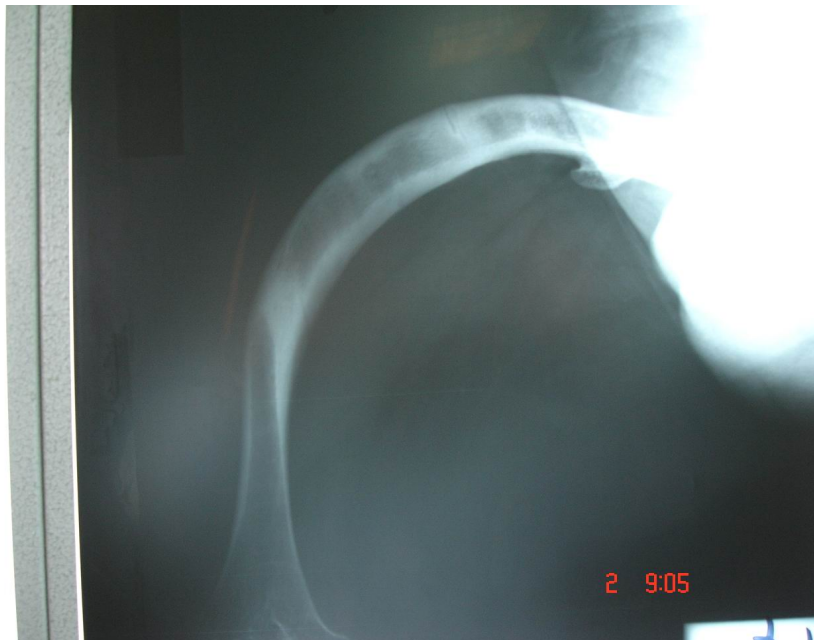
Autoimmune:



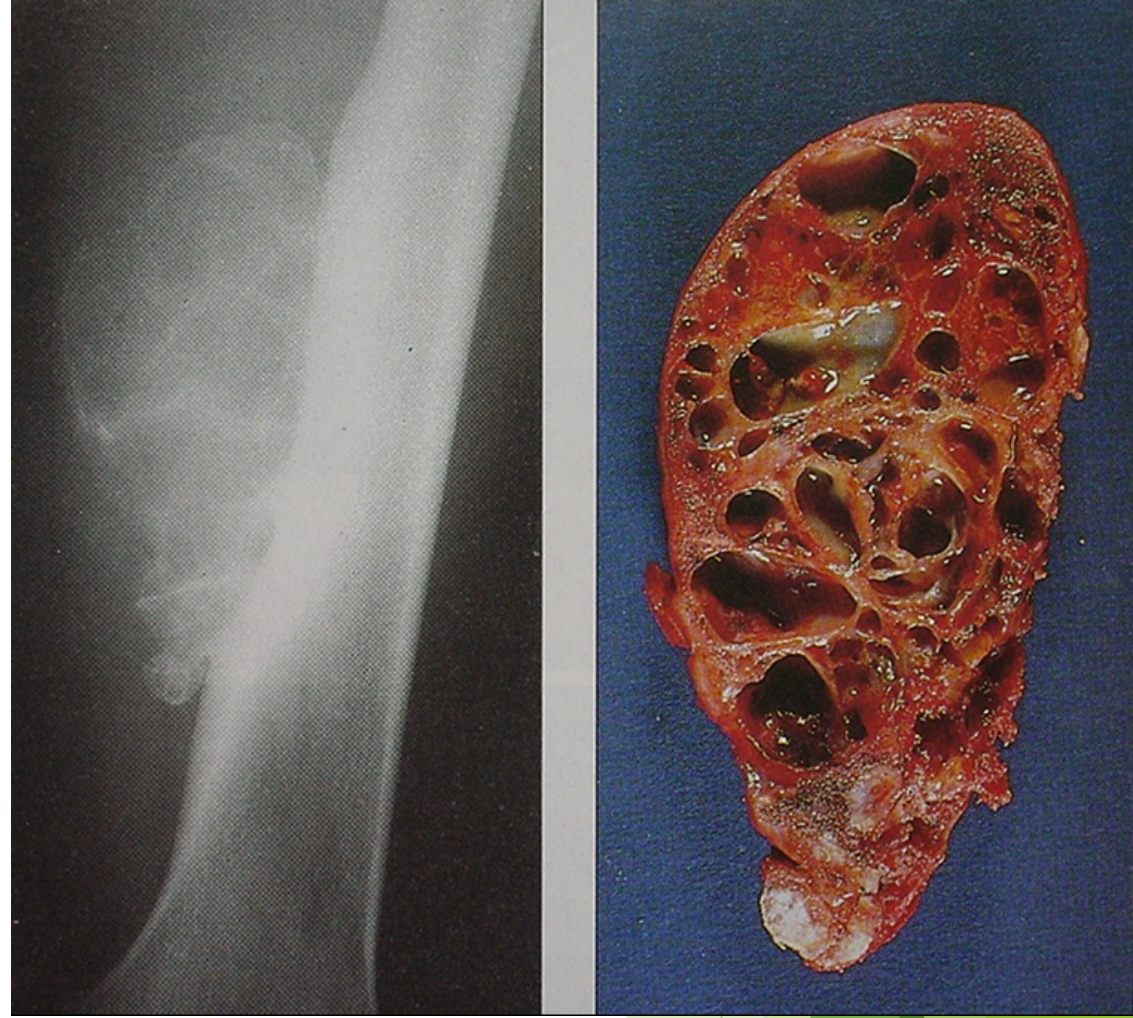
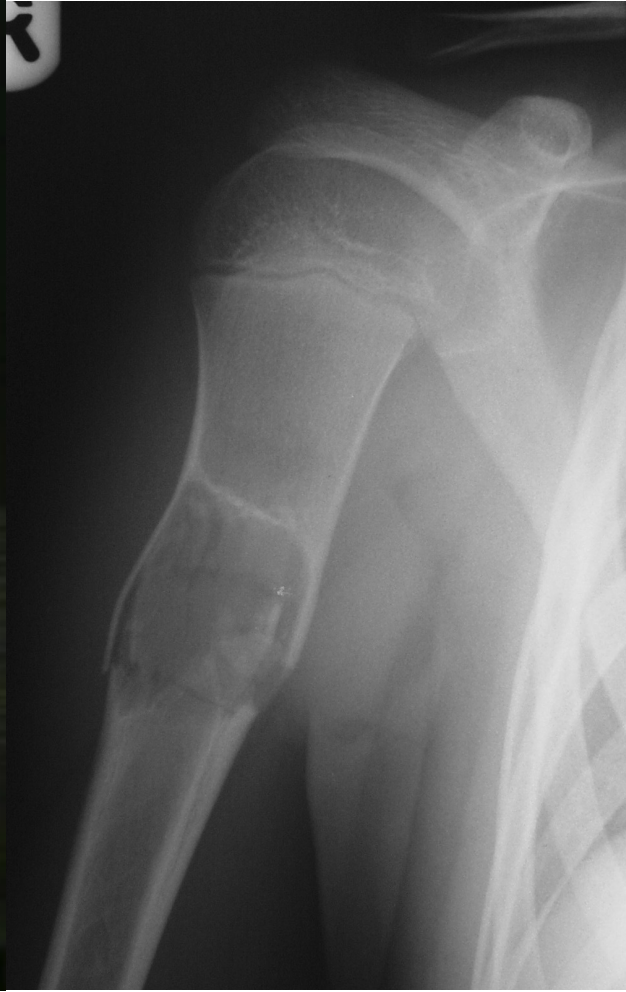
Figure 1 Patient with severe dislocation of both wrists.



Metabolic:



neoplasia



neoplasia





Ischaemia



Infection:

