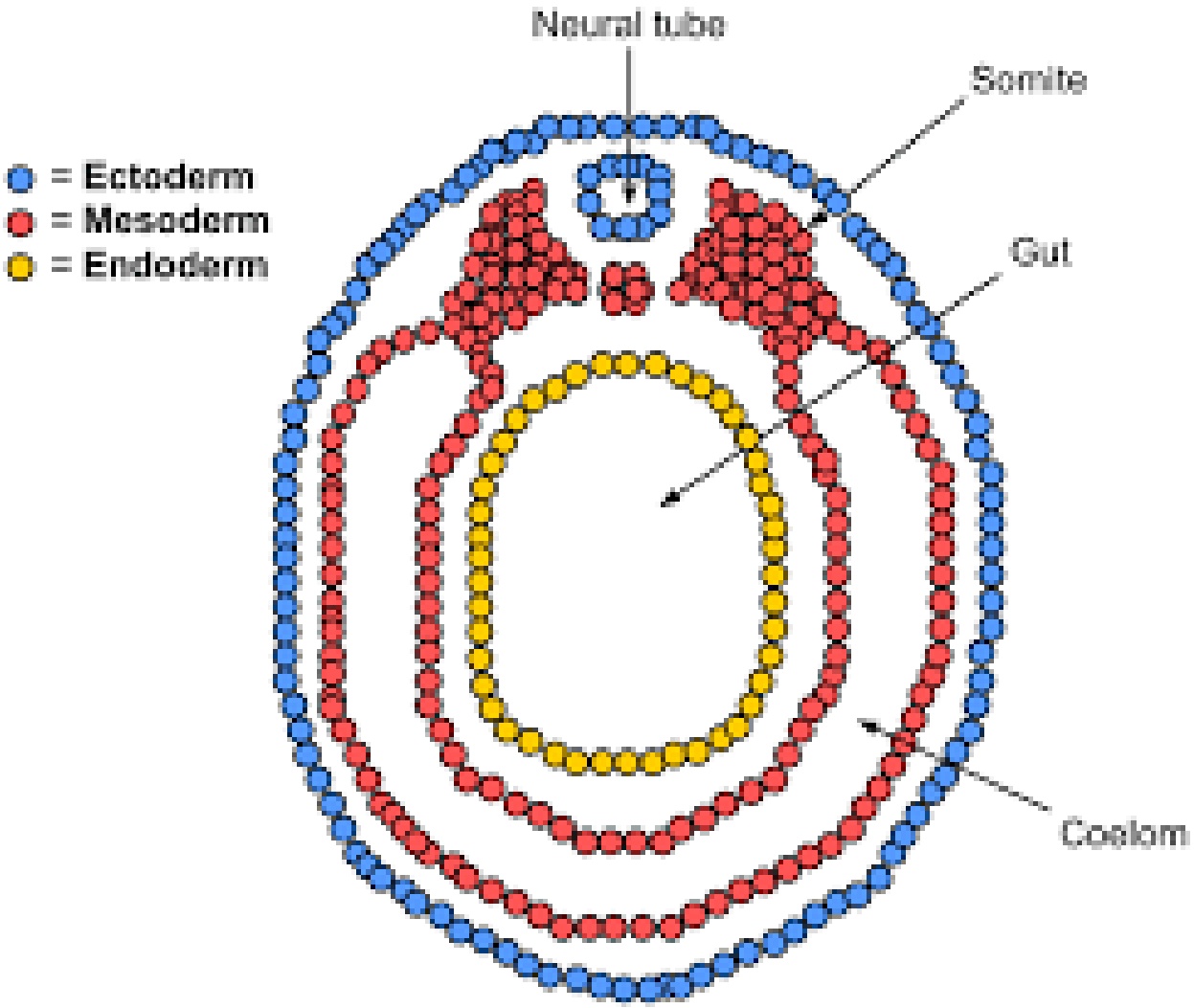
DEVELOPMENT OF THE LIMBS

Dr AMAL ALBTOOSH

https://youtu.be/VpbdqGJ9LWk?si=3regigaO_NxRs9qL

Begins with the activation of mesenchymal cells In the lateral plate somatic mesoderm.

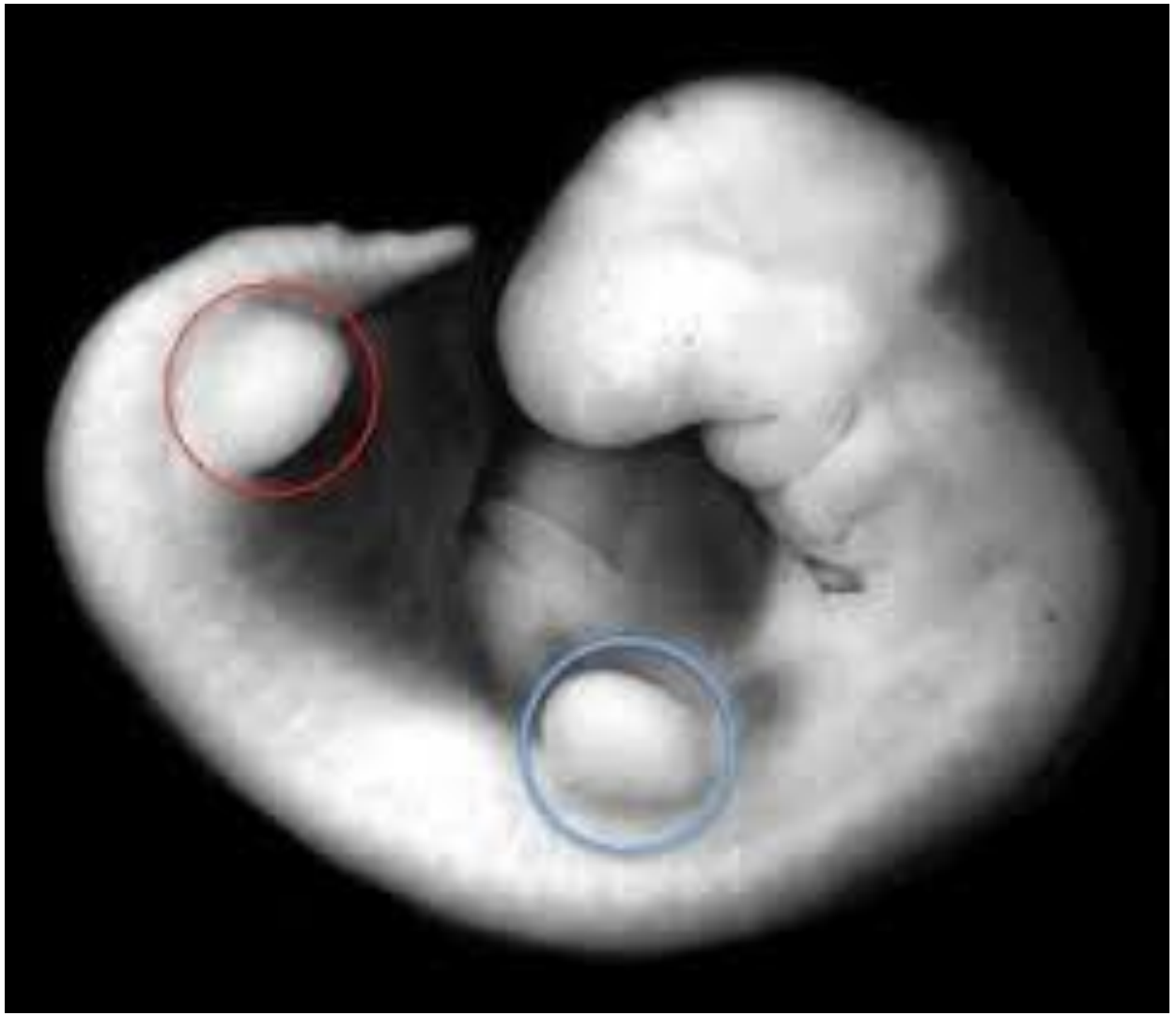


A. Appendicular skeleton

• Develops from mesenchyme derived from the somatic mesoderm in the limb buds.

1. Limb buds:

- Consist of a mesenchymal core covered with ectoderm
- Arise in somatic lateral plate mesoderm **at week 4**.
- The **upper** limb buds arise first, and **the lower limb** buds soon follow.

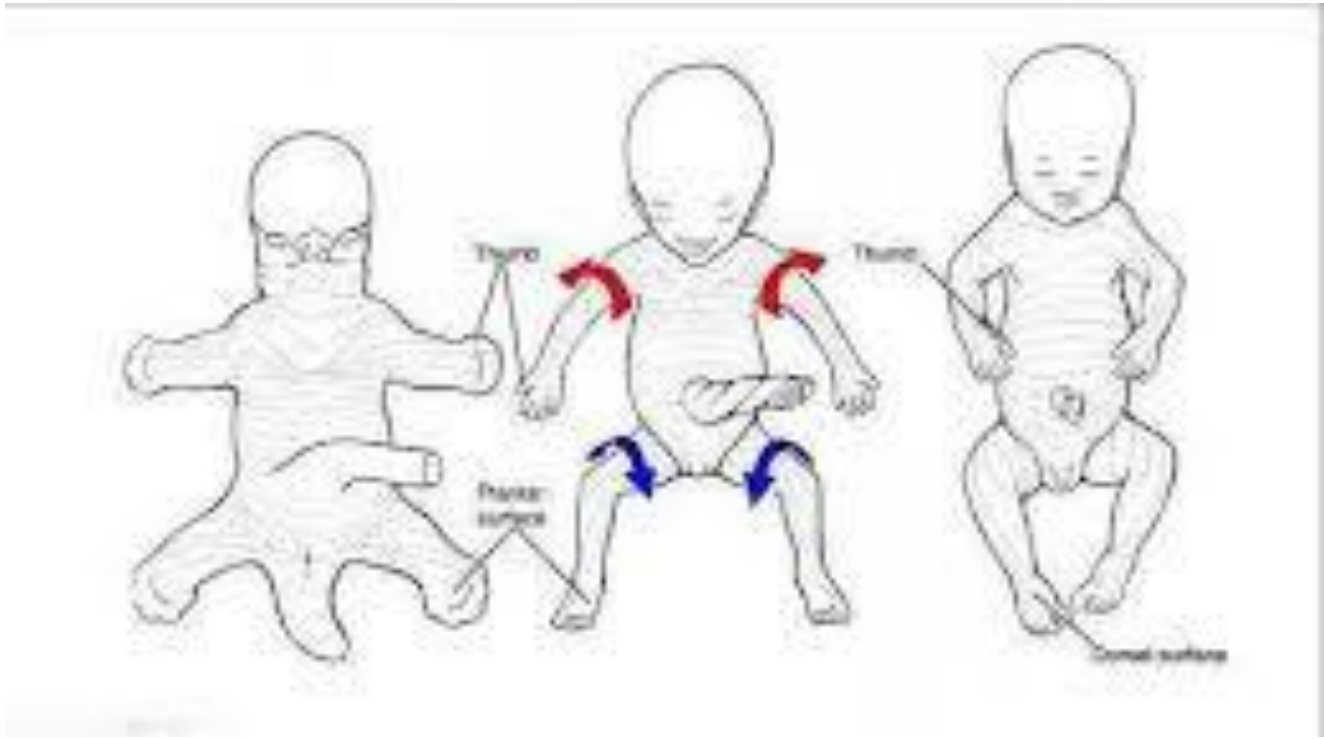


A. Appendicular skeleton

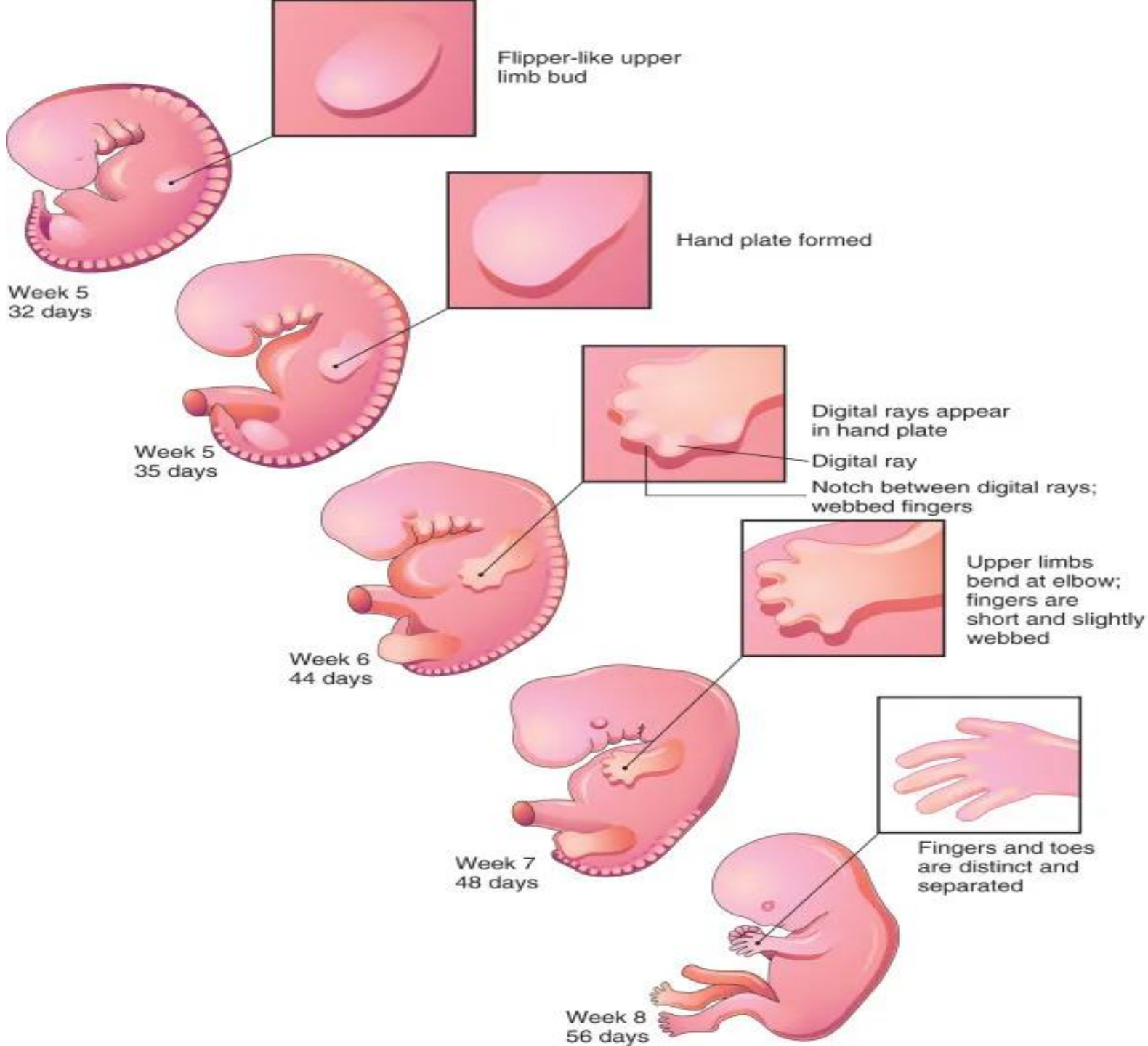
(a) Upper limb buds rotate laterally through 90 degrees,

- ✓ whereas the lower limb buds rotate medially through almost 90 degrees.
- ✓ The upper limb buds become elongated by week 5
- ✓ and soon after they are subdivided into the precursors of the arm. forearm, and hand.

(b) The hand and foot are subdivided into digits by week 6, and individual fingers and toes are visible by week 8.



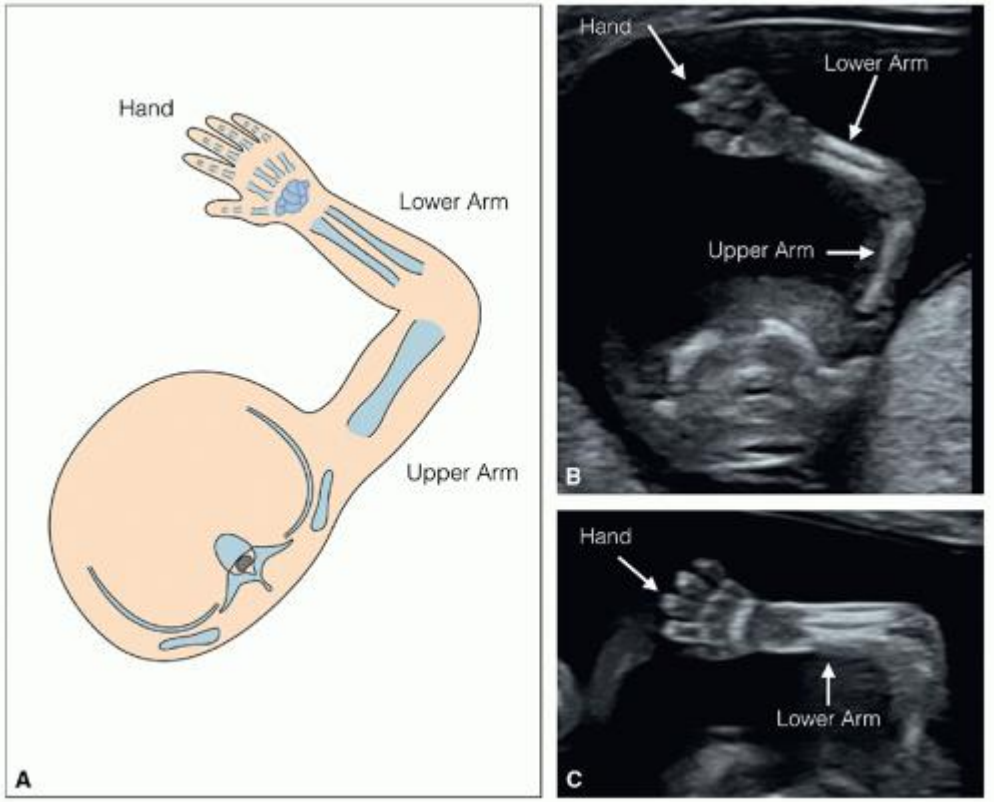

flexor
extensor
extensor
flexor


Flipper-like upper limb bud
Week 5
32 days
Hand plate formed
Week 5
35 days
Digital rays appear in hand plate
Digital ray
Notch between digital rays; webbed fingers
Week 6
44 days
Upper limbs bend at elbow; fingers are short and slightly webbed
Week 7
48 days
Fingers and toes are distinct and separated
Week 8
56 days

2. Bones of limbs

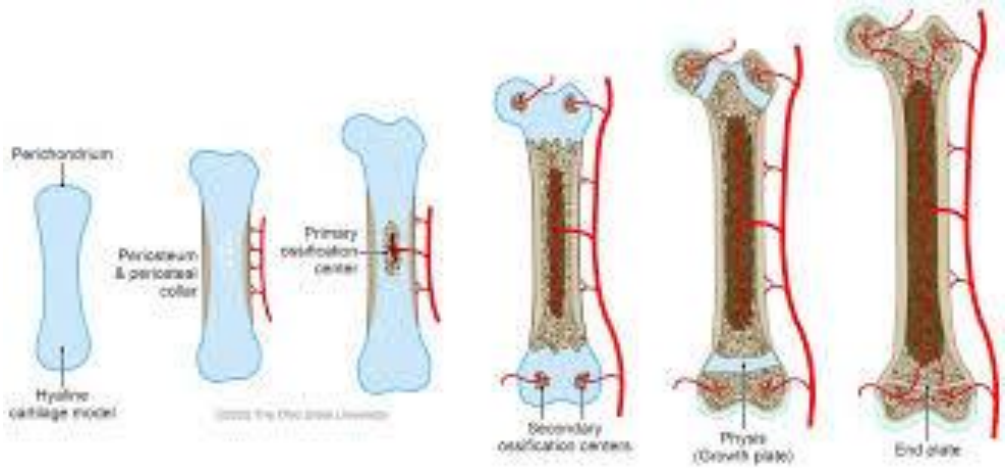
• Are derived from the lateral plate somatic mesoderm.

and develop by endochondral ossification **except for the clavicle**, which develops by intramembranous ossification.



2. Bones of limbs

Endochondral ossification involves development of hyaline cartilage models that are replaced by bone, except at epiphyseal plates and articular cartilages, whereas intramembranous ossification involves direct ossification of mesenchyme and lacks a cartilaginous precursor.)

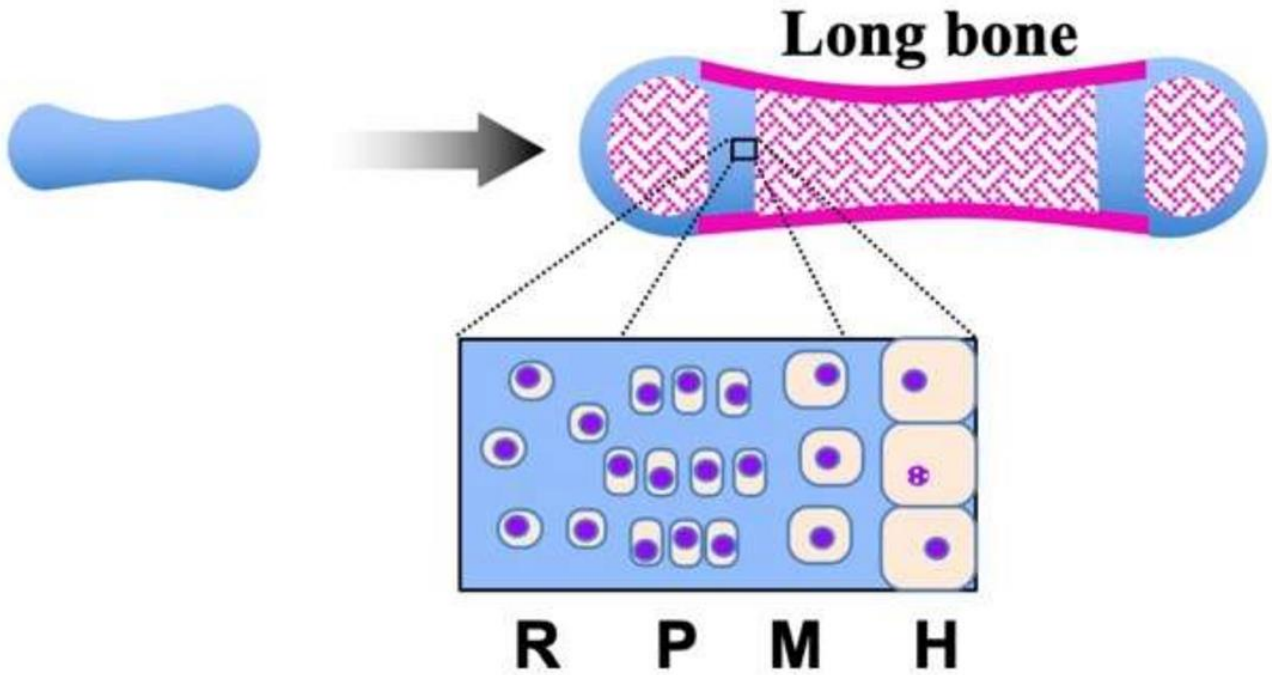


Continue to grow after birth because of activity of the epiphyseal plates. (At birth, the diaphysis of the bone is ossified, but the epiphyses are still cartilaginous.)

Intramembranous ossification

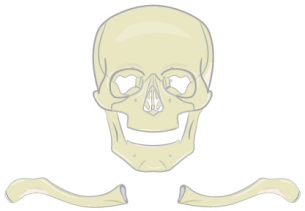
Formed, grown & mineralized by osteoblasts

Endochondral ossification



Formed & grown by chondrocytes & mineralized by osteoblasts

Intramembranous vs Endochondral Ossification

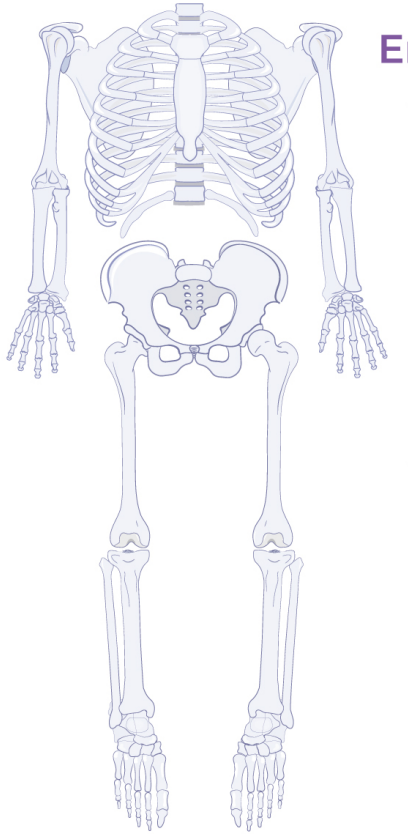


Intramembranous O.

* Cranial vault
* Facial bones
* Clavicles

DIRECT ossification

NO hyaline cartilage model.



Endochondral O.

* Axial s.
  (except the head)
  Sternum
  Ribs
  Vertebrae

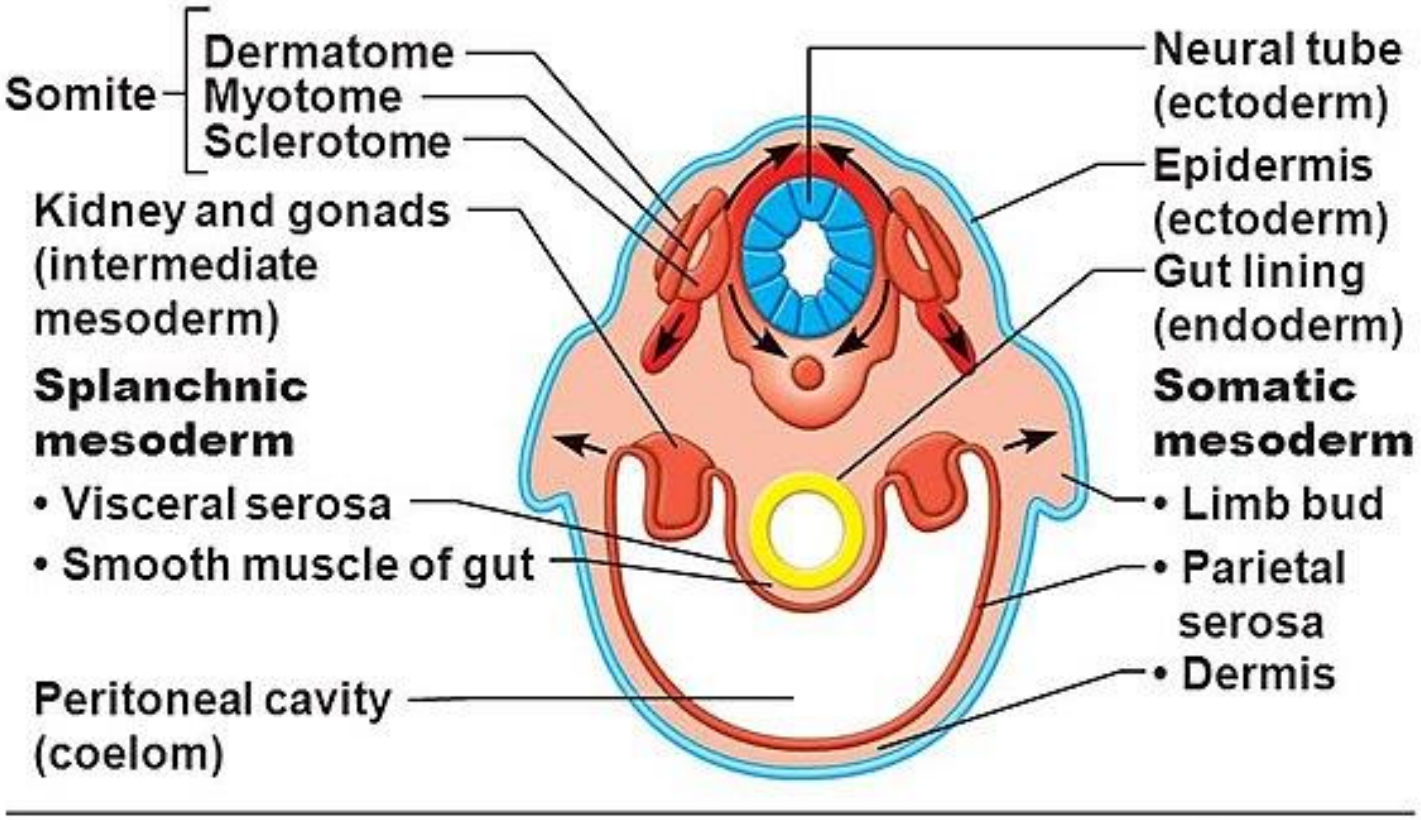
* Appendicular s.
  (except the clavicles)
  Shoulder & hip girdles
  Limbs

INDIRECT ossification

Transitions through a hyaline cartilage model.

3. Muscles of limbs

• Develop exclusively from the myotomic portions of the somites (paraxial mesoderm) and form ventral (flexor) and dorsal (extensor) condensations of somites mesoderm.



- Epimysium. perimysium, and tendons develop from the lateral plate somatic mesoderm.