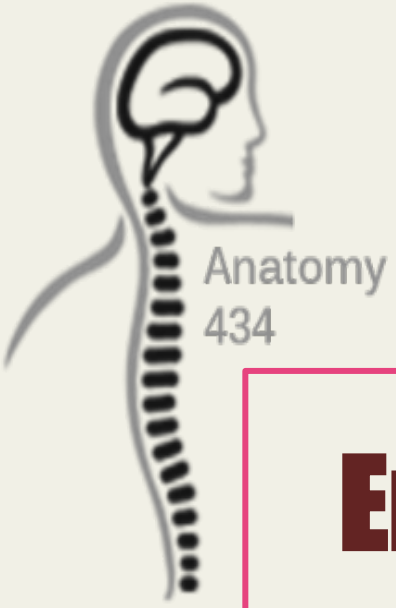

Embryonic Development

Anatomy & Embryology Teams 434

If you have any complaint or suggestion please don't hesitate to contact us on:
AnatomyTeam434@gmail.com
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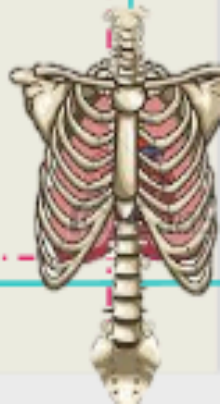
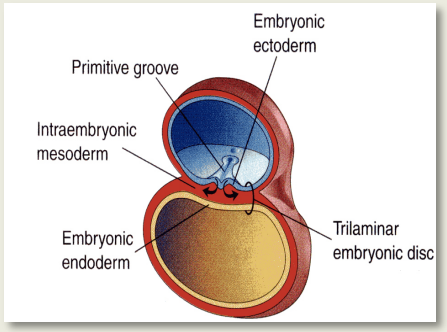
Objectives

- List the different parts of mesoderm and the different divisions of somites.
- Differentiate bones according to their embryological origin and mode of ossification.
- Describe the ossification of long bones.
- Describe the main steps for development of limbs.
- Differentiate muscles according to their embryological origin.



Intraembryonic mesoderm: Proliferates between Ectoderm and Endoderm

EXCEPT in the central axis of embryo where NOTOCHORD is found.



Differentiates into 3 parts:

Lateral mesoderm

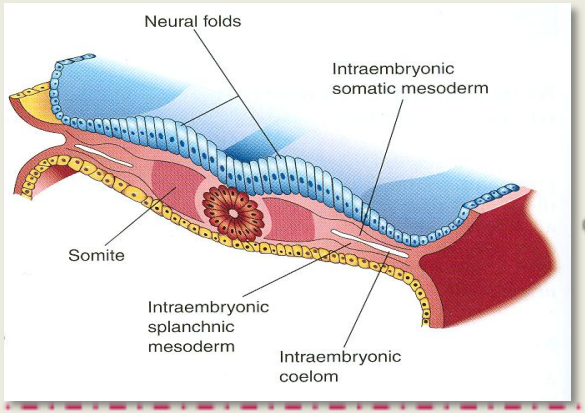
Divided by Intraembryonic coelom into:

- **Somatic mesoderm** — Between Ectoderm and Coelom
- **Splanchnic mesoderm** — Between Endoderm and Coelom

Intermediate mesoderm

Paraxial mesoderm

On each side of notochord.
Divides into units (Somites)



DEVELOPMENT OF LIMBS

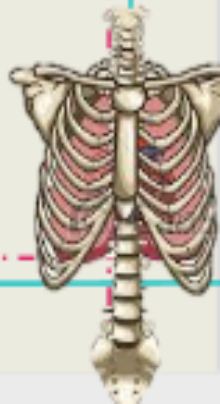
The limb Bud appears as an elevation on the ***ventrolateral body wall*** resulting from ***proliferation of mesenchyme*** of the somatic layer of lateral mesoderm, Each limb bud is surrounded by an area of ectoderm.

Upper limb buds
Appear at day 26
opposite the lower cervical segments.

Lower limb buds
Appear at day 28
opposite the lumbar sacral segments

Originally, limb buds were at right angle of the trunk with :

- Borders
  - Cranial
    Preaxial
    Radius and Tibia
  - Caudal
    Postaxial
- Surfaces
  - Ventral
    Flexor Muscles
  - Dorsal



DEVELOPMENT OF LIMBS

During 7th week

Adduction of limb buds occurs with 90° rotation :

In The Upper Limb

Rotation occurs **Laterally:**

- Radius → Lateral
- Flexor muscles → Anterior

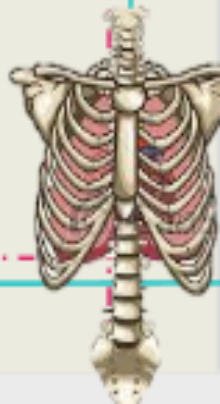
In The Lower Limb

Rotation occurs **Medially:**

- Tibia → Medial
- Flexor muscles → Posterior

YouTube **Helpful video**

http://www.youtube.com/watch?v=VpbdqGJ9LWk&channel=Itzy2512

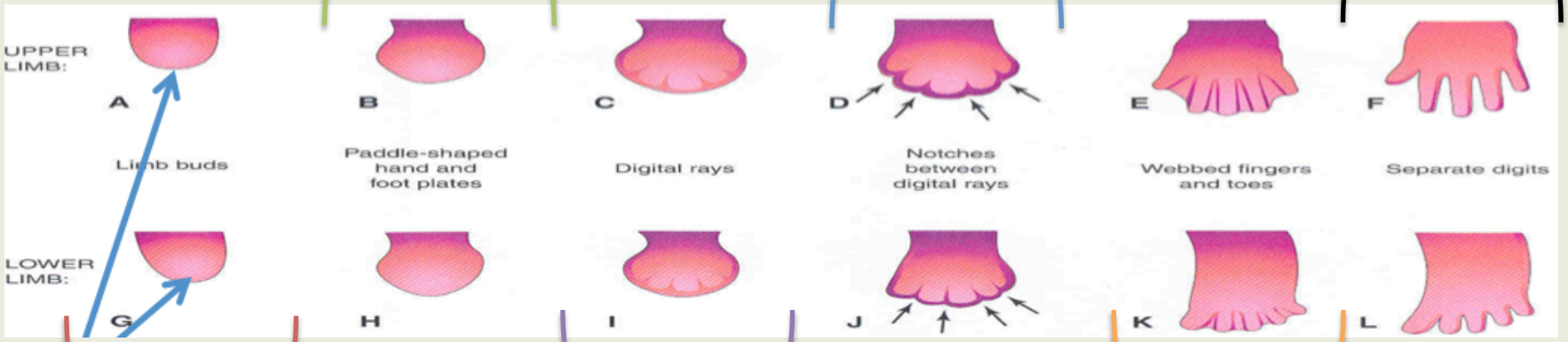


DEVELOPMENT OF LIMBS

Distal ends of buds fla]en into paddle-like hand and foot plates.

Mesenchyme between rays disappears to form notches.

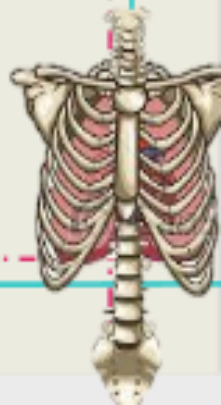
Mesenchyme Between digits disappear to separate them.



Apical ectodermal ridge: appears at the apex of limb bud and stimulates Proliferation of mesenchyme And elongation of limb bud.

Digital rays appear as Mesenchymal condensations that outline the patterns of digits.

Digits form inside rays,elongate and appear webbed.



DEVELOPMENT OF LIMBS

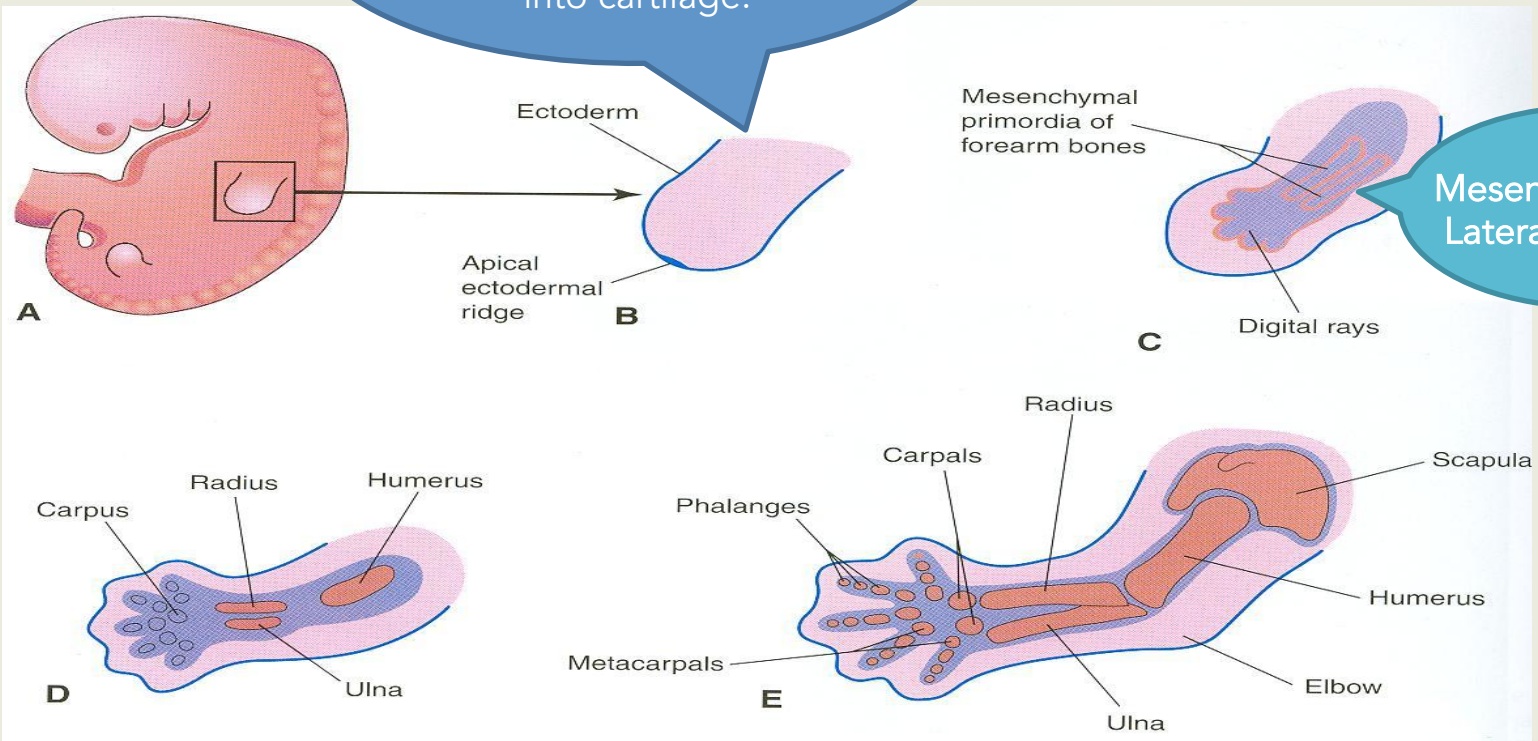
in Paraxial mesoderm

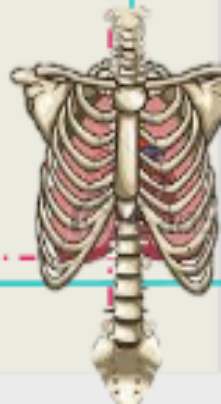
There is Myotomes (somite)

Myoblasts migrate from those Myotomes to limbs

to form Muscles of limbs

Apical Ectodermal Ridge : Will induces growth of Mesenchyme and its transformation into cartilage.





DEVELOPMENT OF BONES

*All bones Develop from Mesoderm.
*All bones Ossify by Endochondral Ossification *EXCEPT:*
1. Some bones of Skull
2. Clavicle

Appendicular Skeleton

from Somatic Part of Lateral Mesoderm

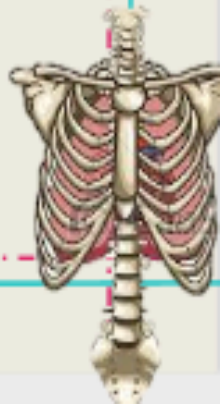
Axial Skeleton

Vertebrae, Ribs and Sternum

from Sclerotomes of Somites (Paraxial Mesoderm)

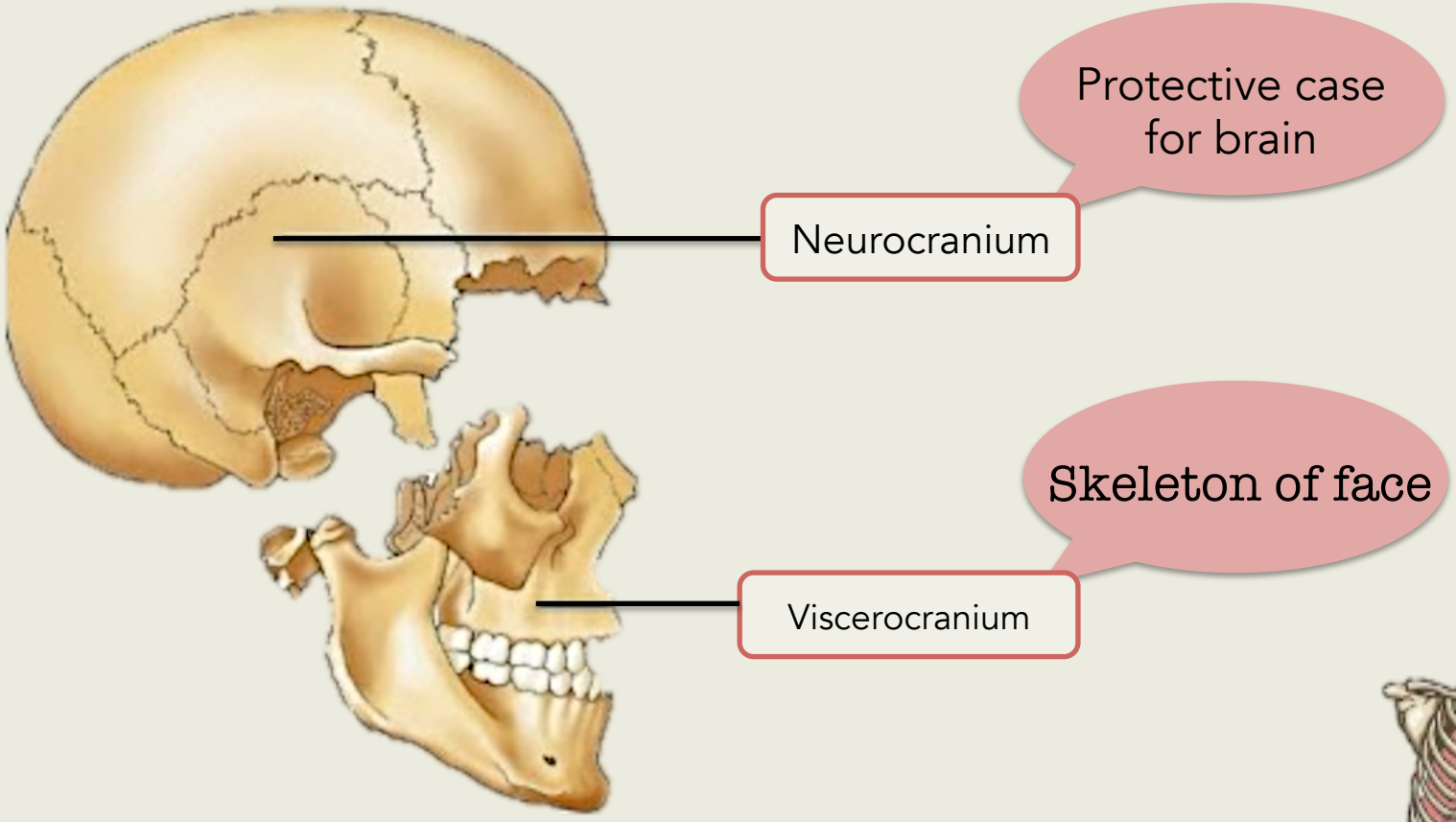
Skull

from Mesoderm surrounding the Brain



DEVELOPMENT OF CRANIUM (SKULL)

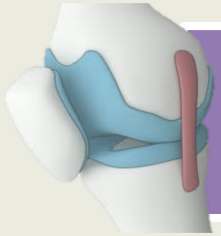
*The skull develops from Mesoderm around the developing brain.



There are two essential processes during fetal development of the skeletal system by which bone tissue is created

Bones

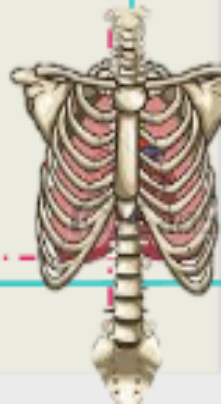
Cartilage



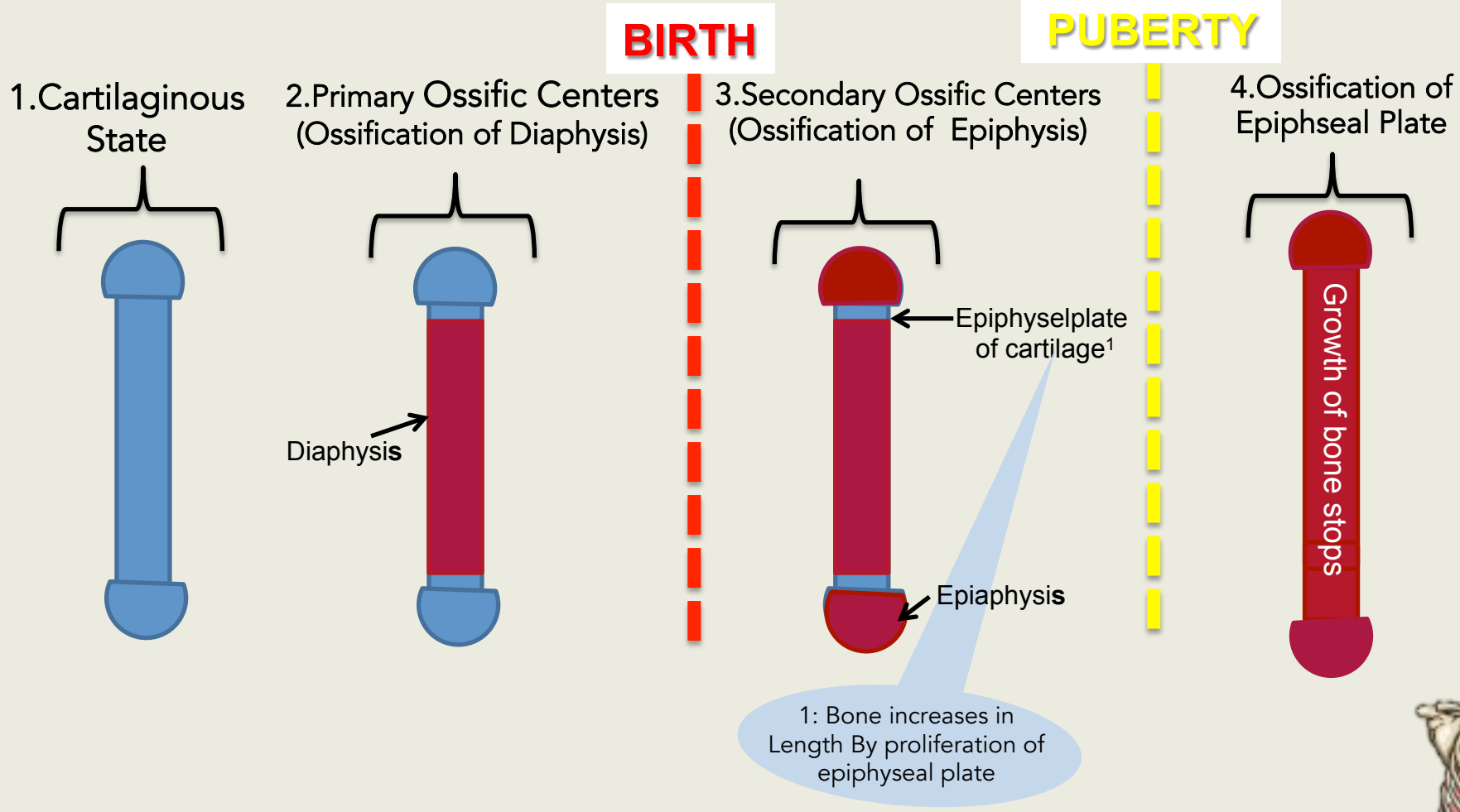
Intramembranous Ossification

Ossification Of Long Bones

Endochondral Ossification



OSSIFICATION OF LONG BONES



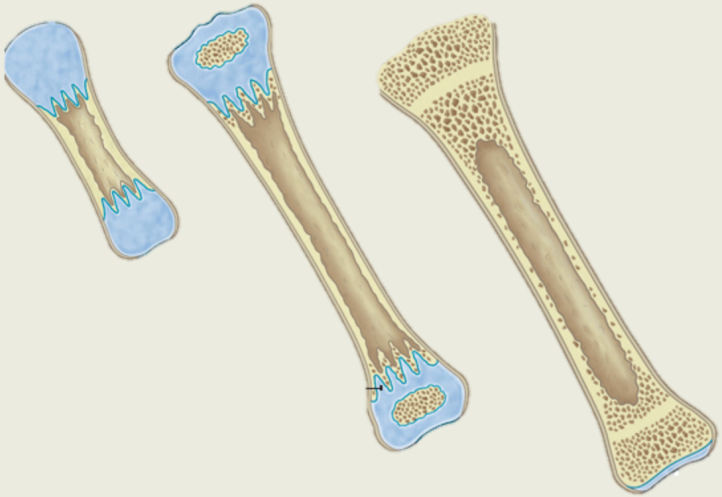
OSSIFICATION OF LONG BONES

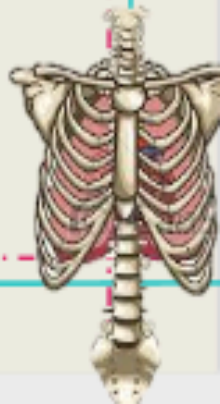
Bone age is a good index of general maturation.

Bone age is determined by:

- Appearance of Ossific centers in diaphysis and epiphysis
- Disappearance of Epiphyseal Plate

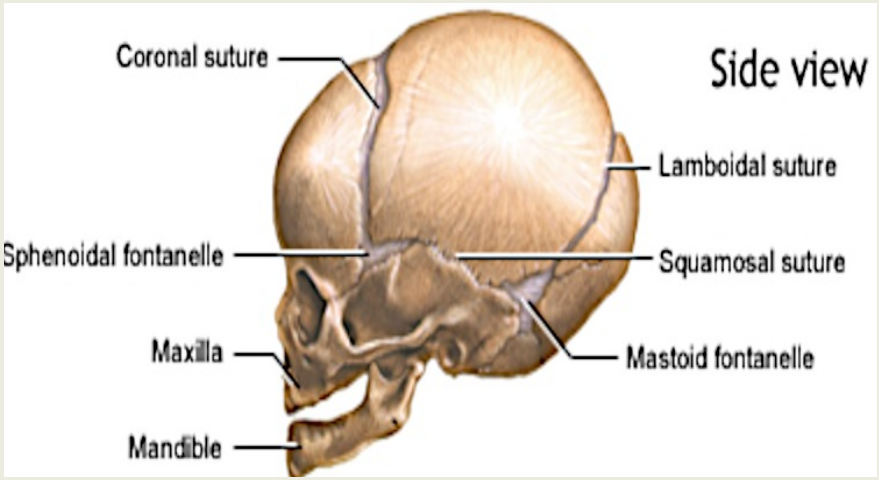
Specific for each Bone and Sex

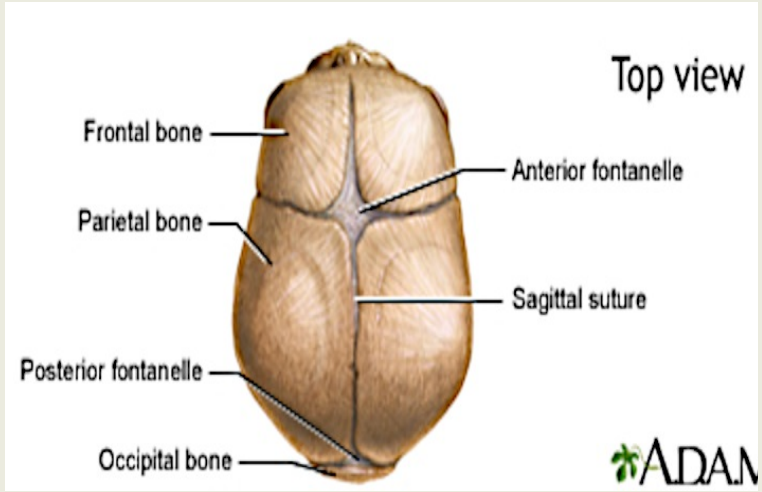


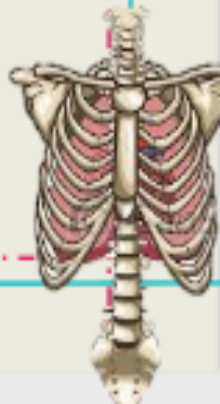


OSSIFICATION OF SKULL BONES

- **Endochondral ossification**
- **Intramembranous ossification**
  - Frontal
  - Parietal
  - Zygomatic
  - Squamous Temporal
  - Mandible
  - Maxilla







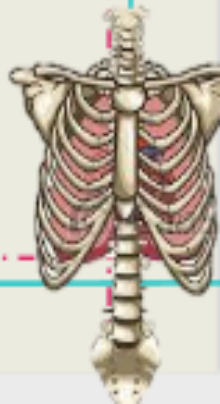
JOINTS DEVELOPMENT

Mesoderm differentiation into…

Joints develop from Mesoderm between bones:

- Fibrous joints → Dense fibrous connective tissue.
- Cartilaginous joints → Cartilage
- Synovial joints → Synovial Membrane, Capsule, Ligaments

A synovial cavity is Formed inside mesoderm



MUSCLES DEVELOPMENT

All muscles develop from Mesoderm

From Ectoderm

EXCEPTIONS:

1. Muscles of iris (eyeball).
2. Myoepithelial cells of mammary & sweat glands.

All Skeletal muscles develop from Myotomes of Paraxial Mesoderm

EXCEPTIONS:

Some Head & Neck muscles from mesoderm of pharyngeal Arches.

Cardiac and Smooth muscles develop from Lateral Mesoderm

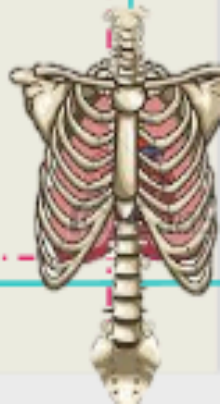
Smooth Muscles:

*In the wall of viscera: from splanchnic part of lateral mesoderm

*In the wall of blood & lymphatic vessels: from somatic part of lateral mesoderm.

Cardiac Muscles:

from Splanchnic part of Lateral Mesoderm.



SUMMARY

Mesoderm

Lateral mesoderm

- **Splanchnic** — gives:
  - 1.Cardiac muscles.
  - 2.Smooth muscles in the wall of Viscera.
- **Somatic** — gives:
  - 1.Appendicular skeleton.
  - 2. Smooth muscles in the wall of Blood & Lymphatic vessels.

Intermediate mesoderm

Paraxial mesoderm

- **Somites**
  - **Myotomes** — gives:
    - Skeletal muscles:
      - 1.Epaxial division. (Muscles of the back)
      - 2. Hypaxial division. (Muscles of body wall)
      - 3. Myoblasts migrate into limb. (Muscles of limbs)
  - **Sclerotomes** — gives:
    - Axial skeleton
      - 1.Vertebral column.
      - 2. Ribs
      - 3. Sternum

MCQS

1.Proliferates between Ectoderm & Endoderm EXCEPT in:
A-Somatic mesoderm.
B-Splanchnic mesoderm.
C-central axis of embryo.

2.The limb Bud appears as an elevation on:
A-the ventrolateral body wall.
B-area of ectoderm.
C-lower cervical segments.

3.During 7th week, adduction of limb buds occurs with:
A-180 rotation.
B-90 rotation.
C-30 rotation.

4.Bone increases in length by proliferation of:
A-Disphysis.
B-Epiphysis.
C-Epiphyseal Plate.

5.Which one of the following group of muscles are derivatives from epaxial division of myotomes:
A-Muscles of back.
B-Muscles of limbs.
C-Muscles of viscera.
D-Cardiac muscles.

6.Which one of the following bones ossifies by intramembranous ossification:
A-Vertebra.
B-Humerus.
C-Ribs.
D-Mandible.

7. Regarding the ossification of long bones, which one of the following statement is correct:
A-Primary ossific centre appears after birth.
B-Secondary ossific centre leads into ossification of diaphysis.
C-Long bones ossify by intramembranous ossification.
D-When epiphysis unites with diaphysis, growth of bone stops.

Answers:

1.C
2.A
3.B
4.C
5.A
6.D
7.D

Done by:

- Rana Aljunadiel
- Futoon Almutari
- Najd Alomran
- Reema Alhammad
- Najla Aldraiweesh
- Rasha Bassas
- Lama Alqahtani
- Mash'hour Alzareie
- Osama Abdulqader
- Nouf Almasoud
- Lamya Althawadi