

Embryonic Development

Anatomy & Embryology Teams 434

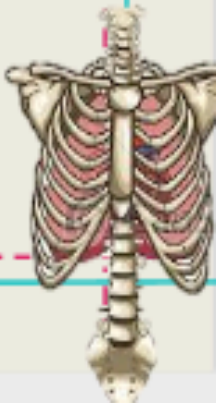
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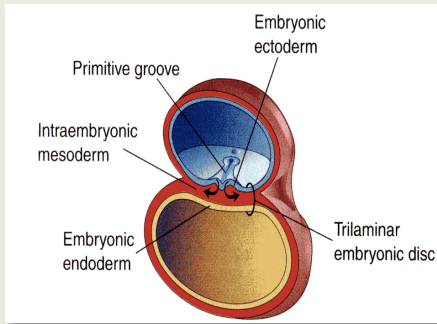
Objectives

- 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

Intermediate mesoderm

Paraxial mesoderm

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

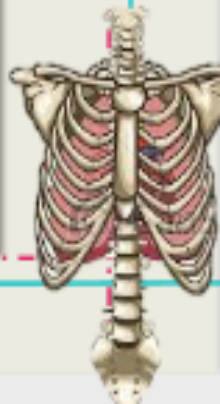
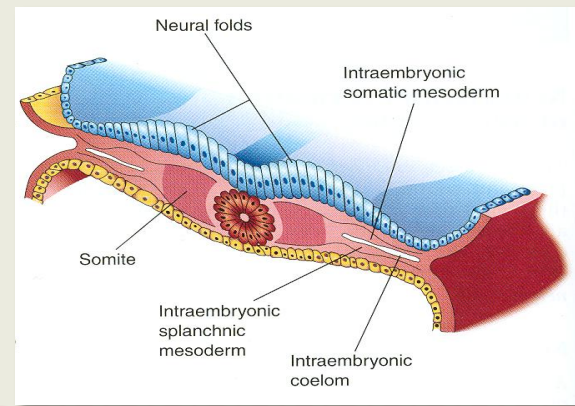
Divided by Intraembryonic coelom into:

Somatic mesoderm

Between Ectoderm and Coelom

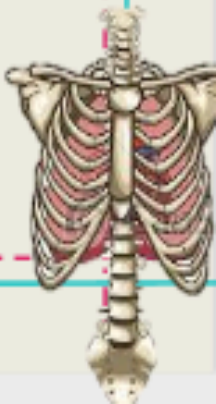
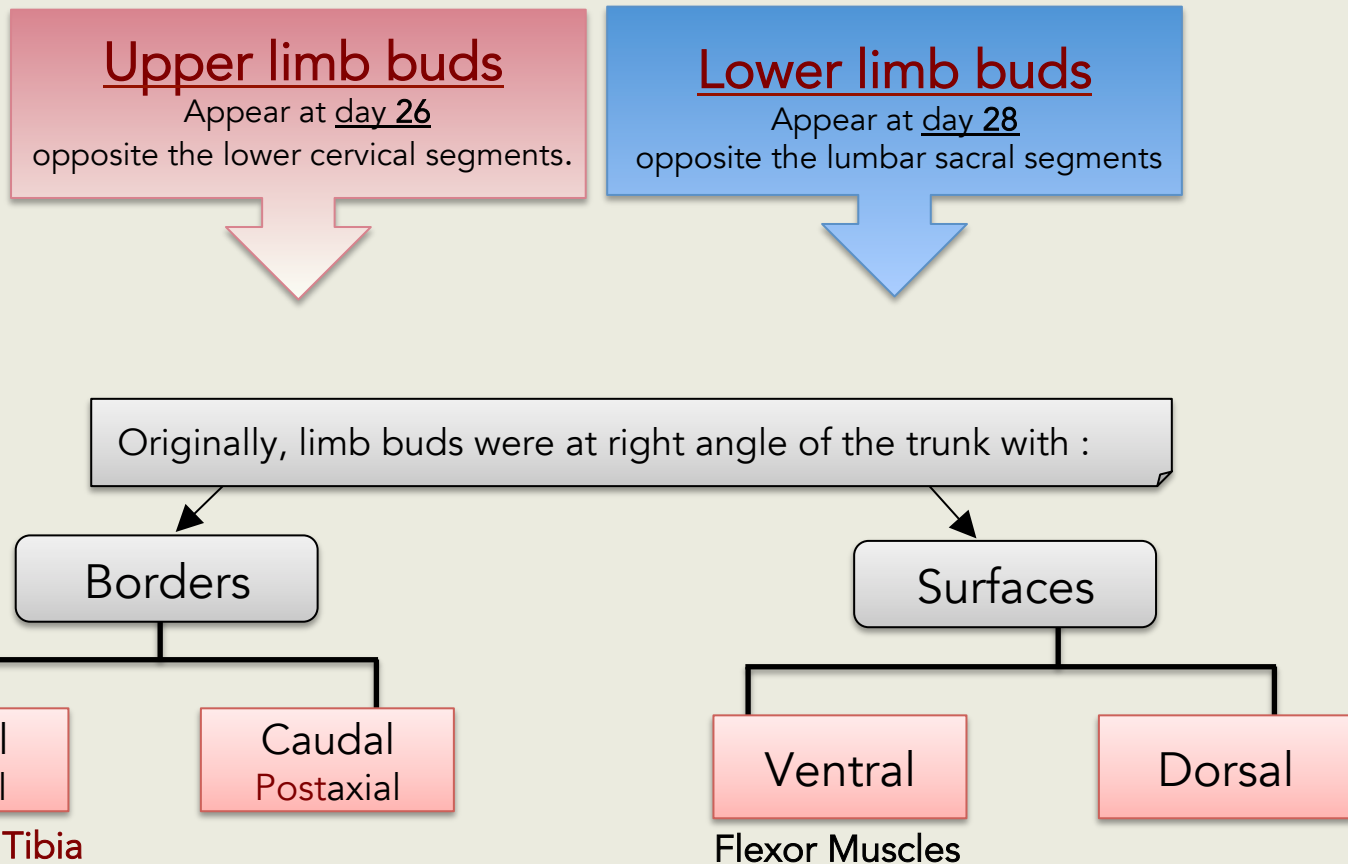
Splanchnic mesoderm

Between Endoderm and Coelom



DEVELOPMENT OF LIMBS

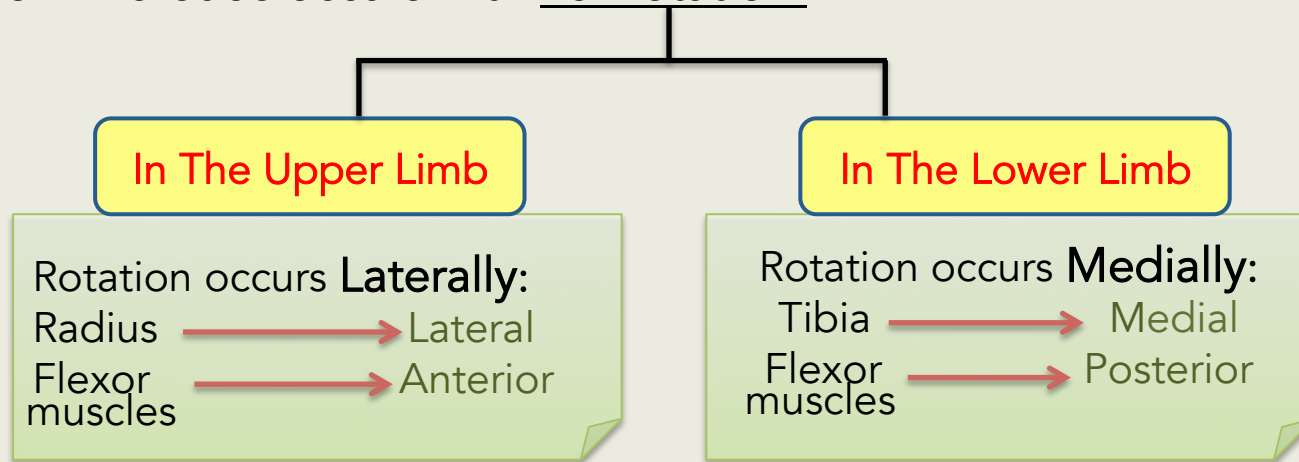
The limb Bud appears as an elevation on the *ventrolateral body wall* resulting from *proliferation of mesenchyme* of the somatic layer of lateral mesoderm, Each limb bud is surrounded by an area of ectoderm.



DEVELOPMENT OF LIMBS

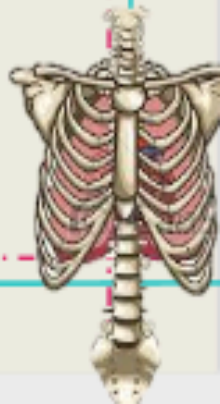
During 7th week

Adduction of limb buds occurs with 90° rotation :



You Tube Helpful video

<http://www.youtube.com/watch?v=VpbdqGJ9LWk&channel=ltzy2512>

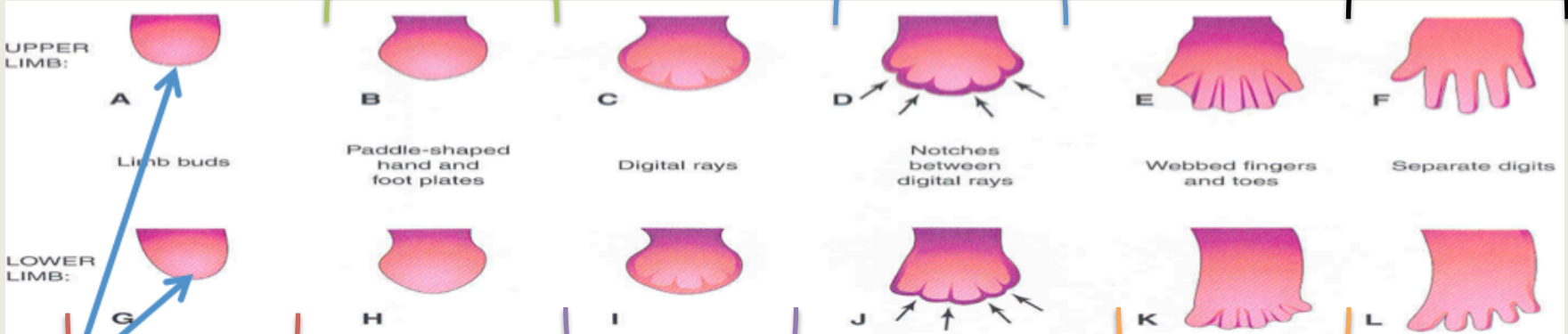


DEVELOPMENT OF LIMBS

Distal ends of buds flatten 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

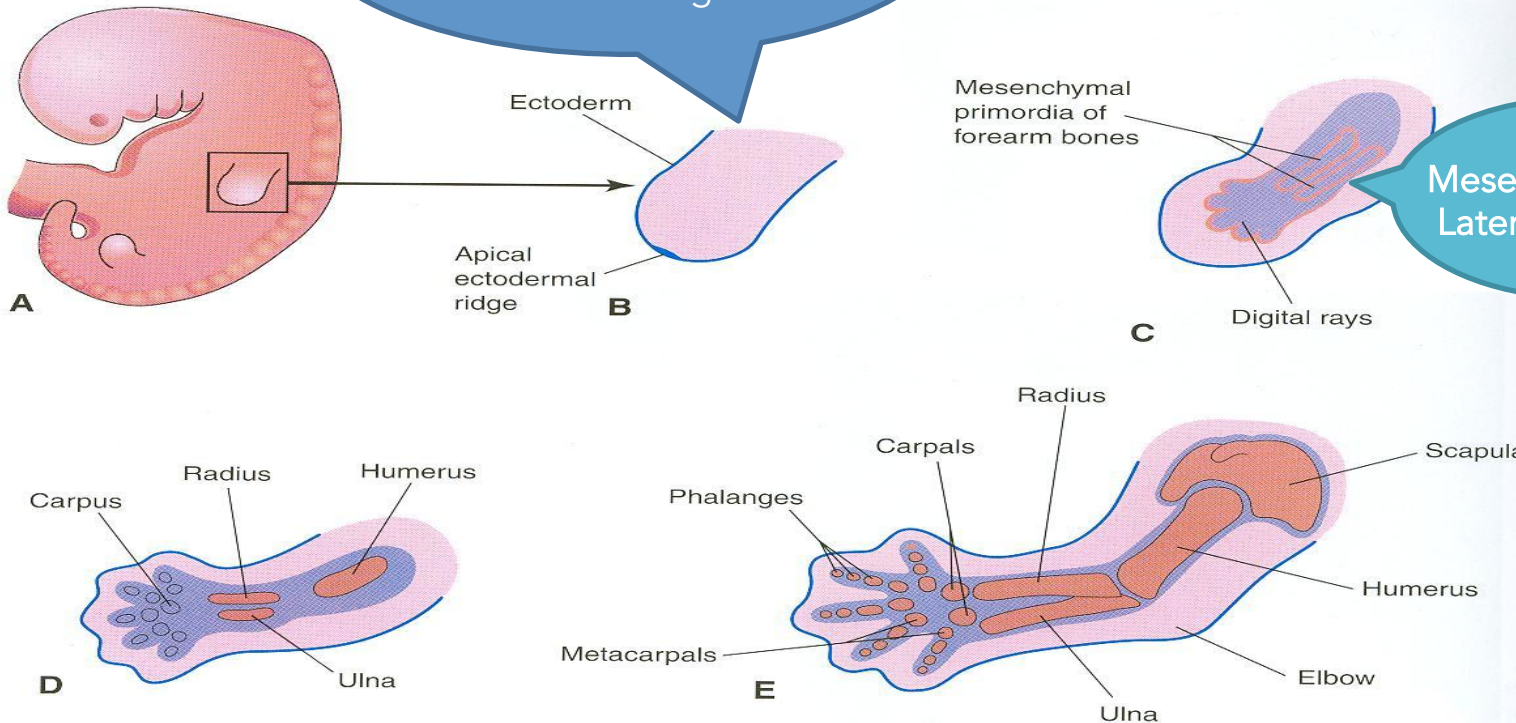
in Paraxial mesoderm

There is Myotomes (somite)

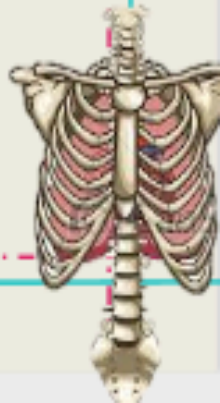
Myoblasts migrate from those Myotomes to limbs

to form Muscles of limbs

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



Mesenchyme from Lateral Mesoderm



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



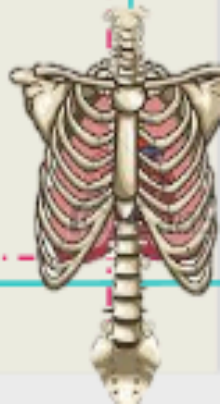
Axial
Skeleton

Vertebrae, Ribs
and Sternum

from Sclerotomes
of Somites
(Paraxial Mesoderm)

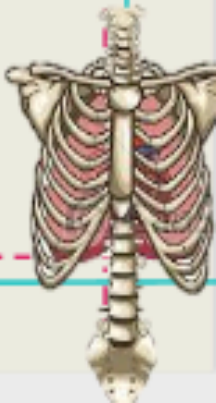
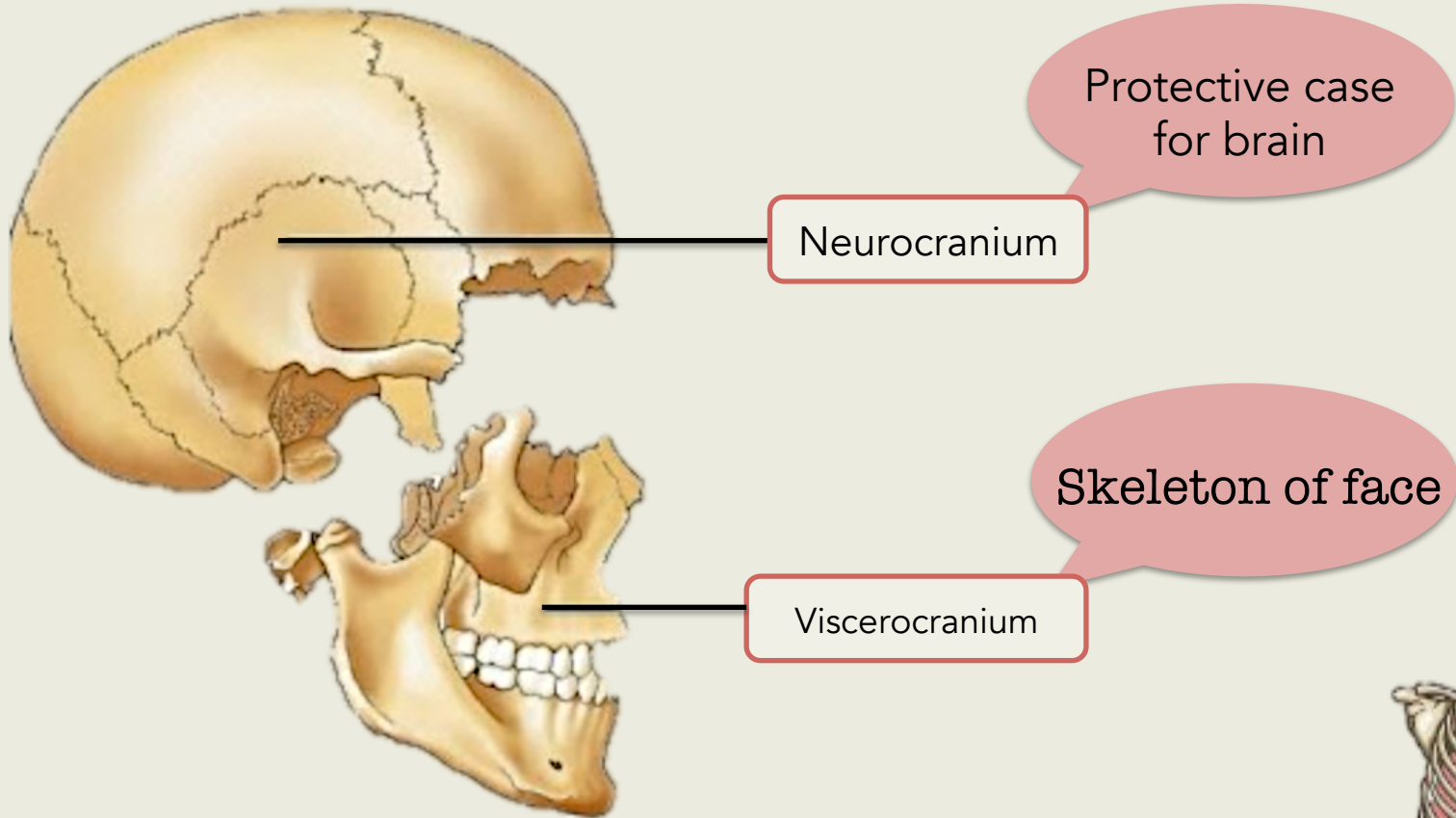
Skull

from Mesoderm
surrounding the Brain



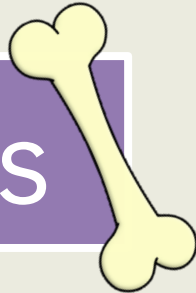
DEVELOPMENT OF CRANIUM (SKULL)

*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

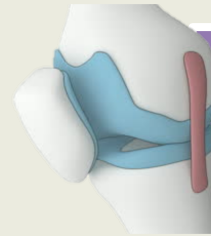
Bones



Intramembranous
Ossification

Ossification Of
Long Bones

Cartilage

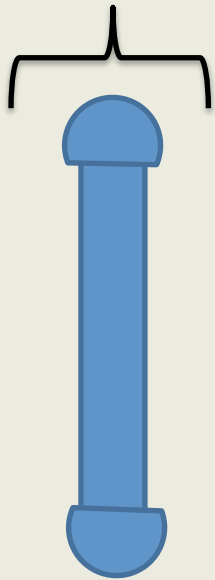


Endochondral
Ossification

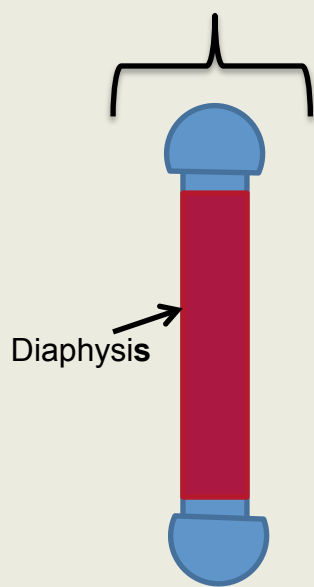


OSSIFICATION OF LONG BONES

1. Cartilaginous State

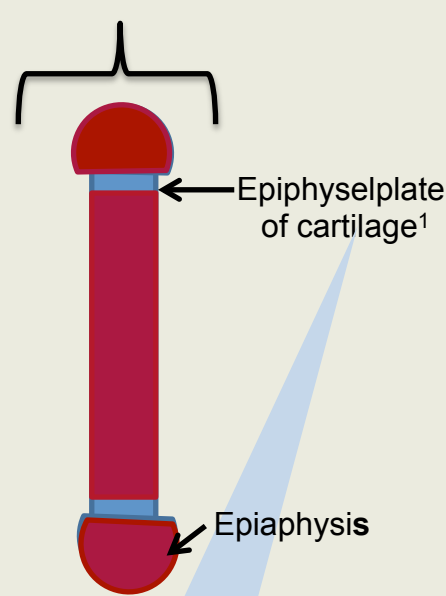


2. Primary Ossific Centers (Ossification of Diaphysis)



BIRTH

3. Secondary Ossific Centers (Ossification of Epiphysis)



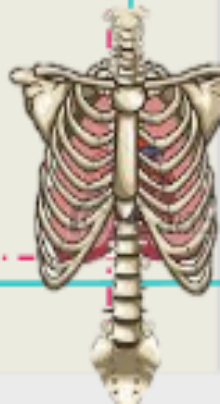
PUBERTY

4. Ossification of Epiphseal Plate



1: Bone increases in Length By proliferation of epiphyseal plate

Cartilage Bone



OSSIFICATION OF LONG BONES

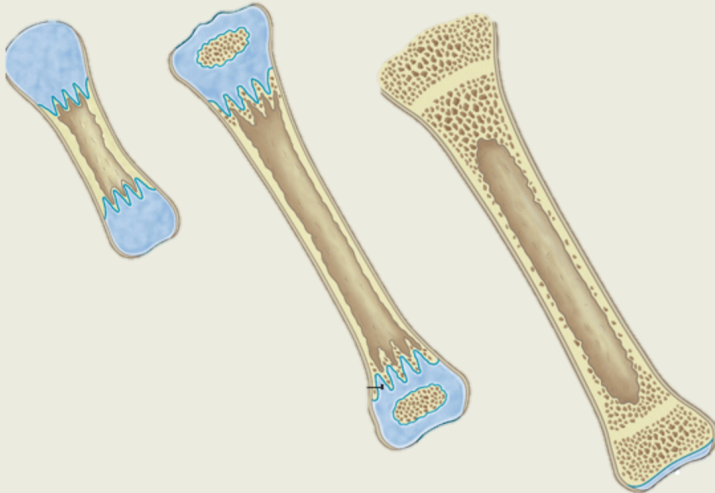
Bone age is a good index of general maturation.

Bone age is determined by:

Appearance of Ossific centers in diaphysis and epiphysis

Specific for each Bone and Sex

Disappearance of Epiphyseal Plate



OSSIFICATION OF SKULL BONES

Endochondral
ossification

Intramembranous
ossification

Frontal

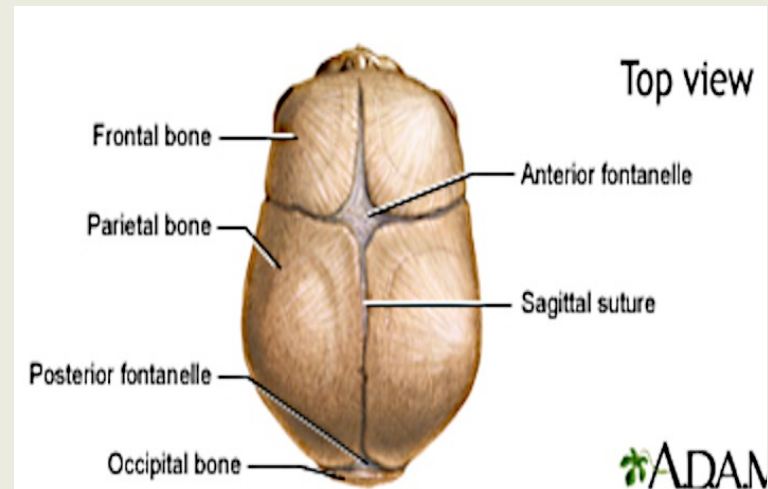
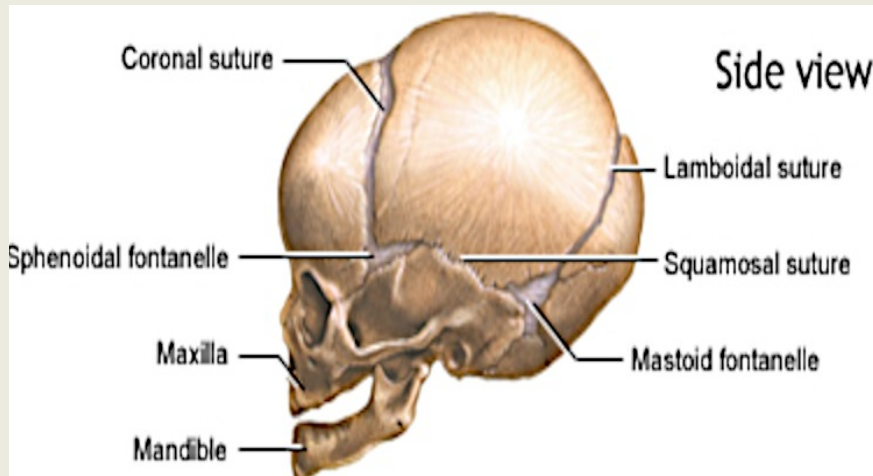
Parietal

Zygomatic

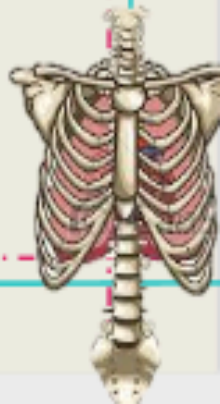
Squamous
Temporal

Mandible

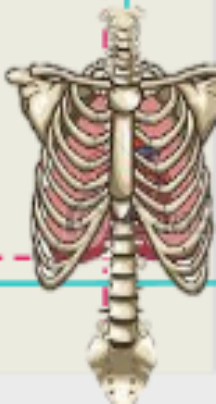
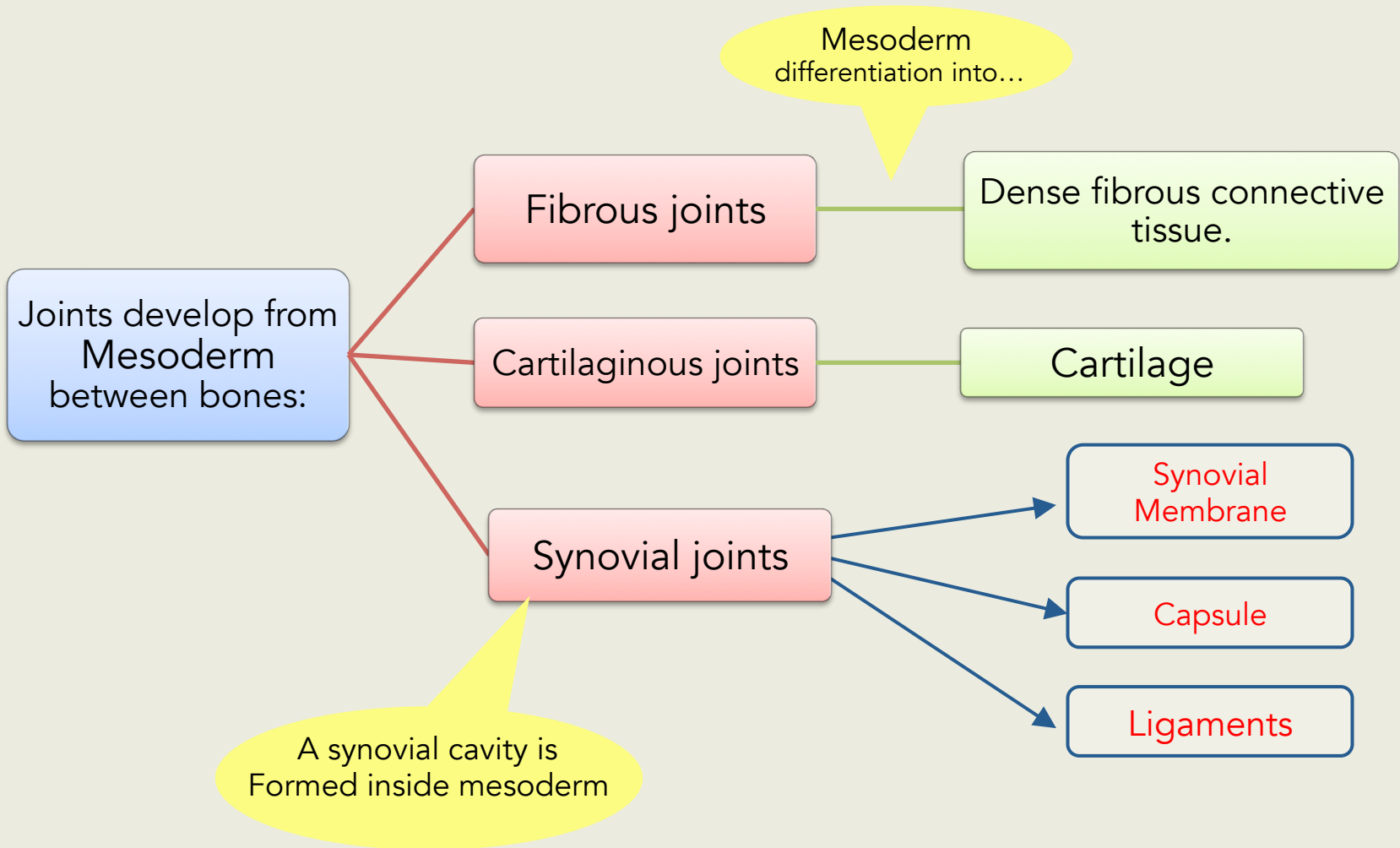
Maxilla



ADAM



JOINTS DEVELOPMENT



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**

Cardiac and Smooth muscles develop from **Lateral Mesoderm**

EXCEPTIONS:

Some Head & Neck muscles from mesoderm of pharyngeal Arches.

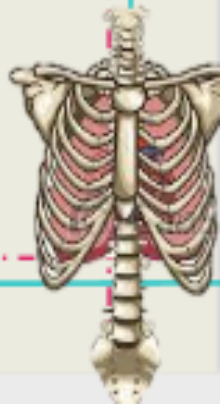
Smooth Muscles:

*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

Intermediate mesoderm

Paraxial 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.

Somites

Myotomes

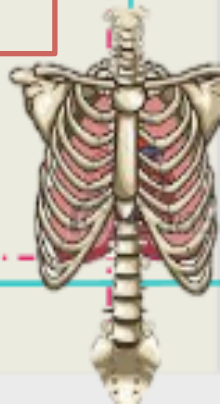
gives

- 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





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



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GOOD
LUCK

