

Embryology Team 430

The first lecture

Development of skeletal and muscular system

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***Important Not:** 1- we asked male and Female Doctors about the important thing in each slide but they said that all the lecture is important but slide 16 **slide 5 in male lecture** is not important.

2- in **green** is in the male slides only and **yellow** in the female slides only, but the rest is in male and female slides .

* The musculoskeletal elements are mesodermal in origin.

Intraembryonic Mesoderm:

❑ Develops between Ectoderm & Endoderm **EXCEPT** in the central axis of embryo where NOTOCHORD is found.

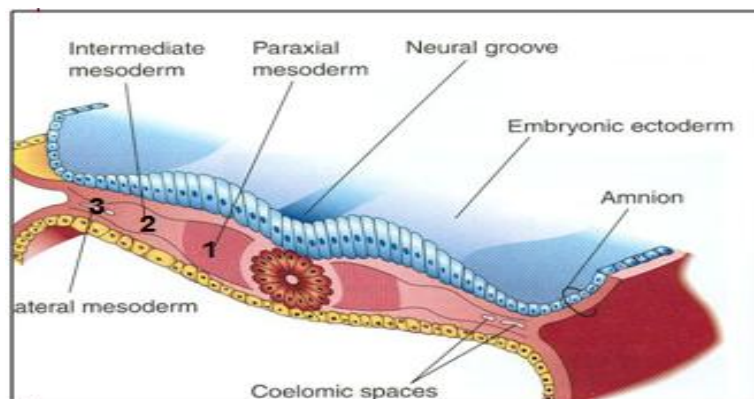
❑ Differentiates into 3 parts:

1-Paraxial mesoderm: on each side of notochord.

2-Intermediate mesoderm.

3-Lateral mesoderm.

Notochord(الحبل الظهري): stimulates neural tube formation

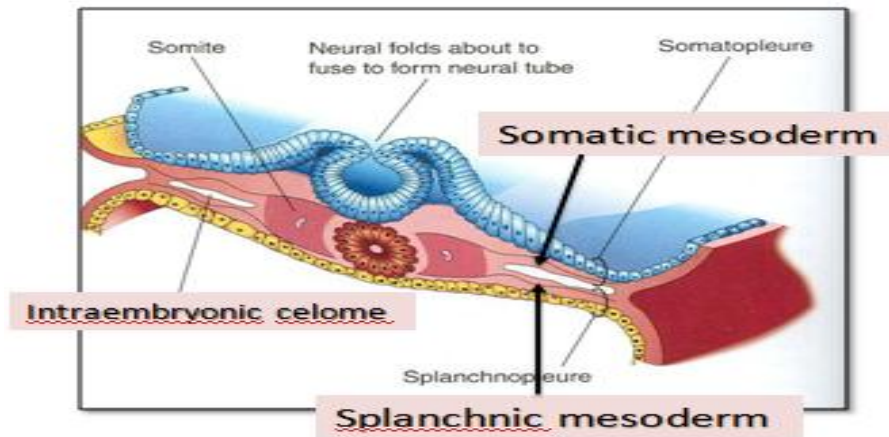


❑ Paraxial mesoderm divides into units (**somites**).

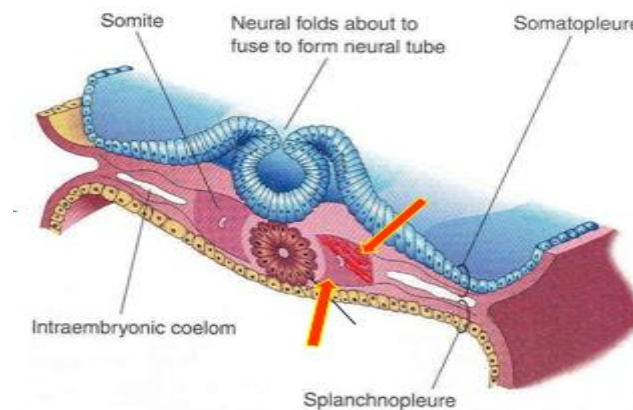
❑ Lateral mesoderm divides by intraembryonic coelom into:

❑ **Somatic mesoderm**(أديم متوسط جسدي) (between ectoderm & coelom).

❑ **Splanchnic mesoder** (أديم متوسط حشوي) (between endoderm & coelom).



- A small cavity, the **myocoele** appears in each somite but soon disappears.
- Each somite divides into ventromedial part (جزء بطني وسطي) called **sclerotome** and dorsolateral part (جزء ظهري جانبي) the **dermomyotome**.



Sclerotome:

Bones of the axial skeleton (**cranium, vertebral column, ribs and sternum**).

Myotome: Hypaxial division: Muscles of body wall , Myoblasts migrate into limb: Limb muscles
wall Associated muscles of the back.

Dermatome: The adjacent dermis of the skin.

Development of the Bones

Cartilage bones	Membrane bones
develop via intracartilagenous (endochondral ossification).	that develop via intramembranous ossification.
A cartilage model first forms and	Bone forms directly from

is eventually replaced with bone	mesenchymal cells without the prior formation of cartilage
e.g. formation of the bones of the axial & appendicular skeletons and the cranial base.	e.g. majority of bones of the face and skull

Development of BONE:

All bones develop from MESODERM.

❑ AXIAL SKELETON:

*Vertebrae, ribs & sternum: from sclerotomes of somites (paraxial mesoderm)

*Skull: from mesoderm surrounding the brain

❑ APPENDICULAR SKELETON: from somatic part of lateral mesoderm

All bones ossify by endochondral ossification EXCEPT:

1. Some bones of skull

2. Clavicle

Development of Skull

The skull bones develop from mesoderm around the developing brain.

Bones of skull ossify either by:

Intracartilagenous (Endochondral) ossification	Intramembranous ossification
Base of skull	Frontal Parietal Zygomatic Squamous temporal Maxilla Mandible

Development of Cranium (skull)

❑ The skull develops from mesoderm around the developing brain.

❑ The skull consists of:

1. Neurocranium: protective case for brain

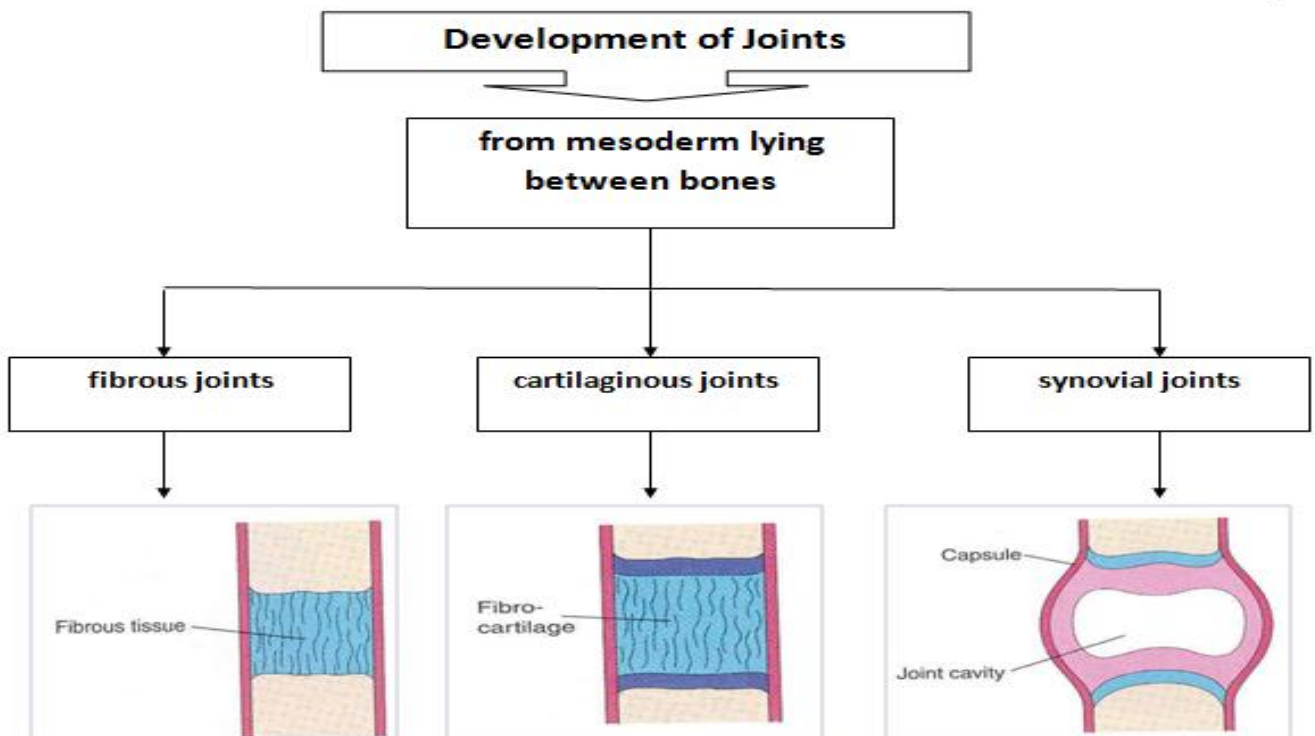
2. Viscerocranium: skeleton of face

□ Bones of skull ossify either by:

*Endochondral ossification or

*Intramembranous ossification

Before birth		After birth	At puberty
Bone in cartilaginous state	Appearance of primary ossification centers: ossification of diaphysis	Appearance of secondary ossification centers: ossification of epiphysis " bone increase in length by proliferation of epiphyseal plate "	Ossification of epiphseal plate: Complete union of epiphysis & diaphysis " groth of bone stop "



JOINT

They develop from mesoderm between bones:

❑ In fibrous joints: mesoderm differentiates into dense fibrous connective tissue.

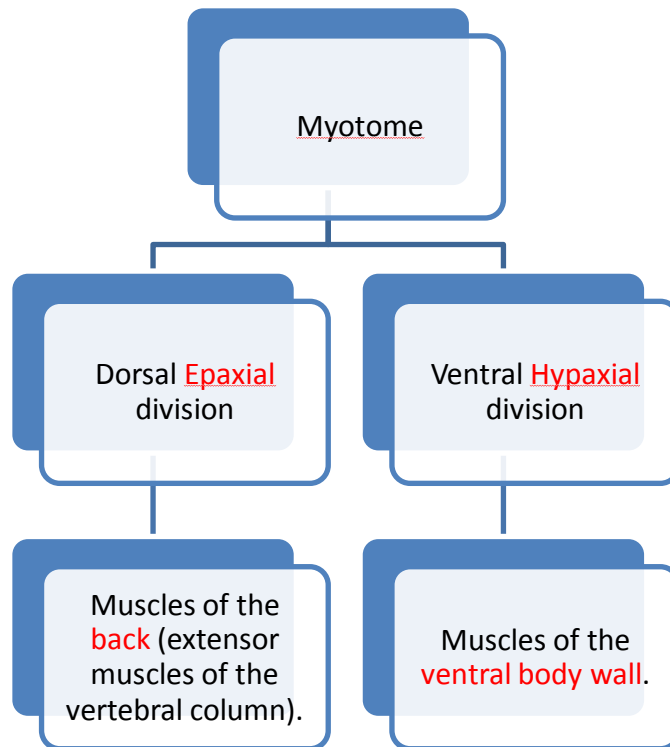
❑ In cartilaginous joints: mesoderm differentiates into cartilage.

In synovial joints: a synovial cavity is formed inside mesoderm; mesoderm differentiates into synovial membrane, capsule & ligaments

DEVELOPMENT OF MUSCLES

- All muscles develop from **MESODERM** EXCEPT muscles of iris (eyeball) and myoepithelial cells of mammary & sweat glands which develop from **ECTODERM**.
- **Cardiac muscles** develop from: splanchnic part of lateral mesoderm
- **Smooth muscles**:
 - In the wall of viscera develop from: splanchnic part of lateral mesoderm
 - In the wall of blood & lymphatic vessels develop from: somatic part of lateral mesoderm
- All **skeletal muscles** develop from myotomes of paraxial mesoderm EXCEPT some head & neck muscles which develop from mesoderm of pharyngeal arches.

Each myotome divides into:



QUESTION 1

☐ Which one of the following group of muscles are derivatives from epaxial division of myotomes?

1. Muscles of back ←
2. Muscles of limbs
3. Muscles of viscera
4. Cardiac muscles

QUESTION 2

☐ Which one of the following bones ossifies by intramembranous ossification?

1. Vertebra
2. Humerus
3. Ribs
4. Mandible ←

QUESTION 3

☐ Regarding the ossification of long bones, which one of the following statement is correct?

1. Primary ossification centre appears after birth.
2. Secondary ossification centre leads into ossification of diaphysis.
3. Long bones ossify by intramembranous ossification.
4. When epiphysis unites with diaphysis, growth of bone stops. ←

Thank you and Good luck =)