



THE FUNDAMENTALS OF HUMAN EMBRYOLOGY

Lecture #3 Bilaminar and trilaminar discs.



OBJECTIVES:

At the end of this lecture, the student should be able to describe:

- Changes in the **bilaminar germ disc** (embryonic plate).
- Formation of the secondary embryonic mesoderm (**intraembryonic mesoderm**).
- Formation of **trilaminar germ disc**.
- Formation of **primitive streak** and **notochord**.
- Differentiation of **intra-embryonic mesoderm**.

INTRODUCTION & *BILAMINAR DISC*

- Implantation of the blastocyst is completed by the end of **the 2nd week** .
- As this process occurs, changes occur in the embryoblast that produce bilaminar embryonic disc.
- The embryonic disc gives rise to the germ layers that form all tissues & organs of the embryo.
- Extraembryonic structures forming during the 2nd week are : **the amniotic cavity, amnion, yolk sac, and connecting stalk.**

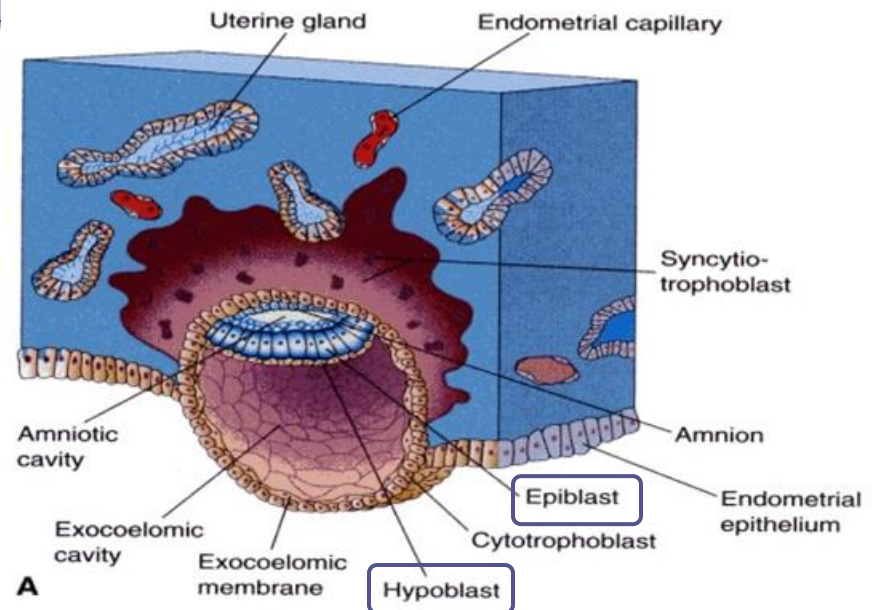
By the (8th) day:
The Inner Cell Mass
(Embryoblast) is differentiated
into a bilaminar plate of cells
composed of Two layers :

Epiblast

High columnar cells
adjacent to the amniotic
cavity.

Hypoblast (hypo=تحت)

Small cuboidal cells adjacent
to the blastocyst cavity (Yolk
Sac).



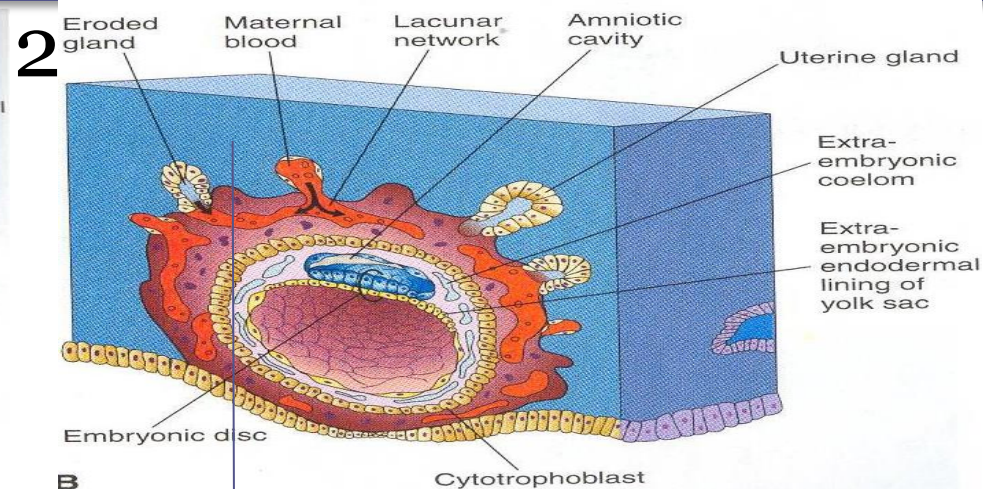
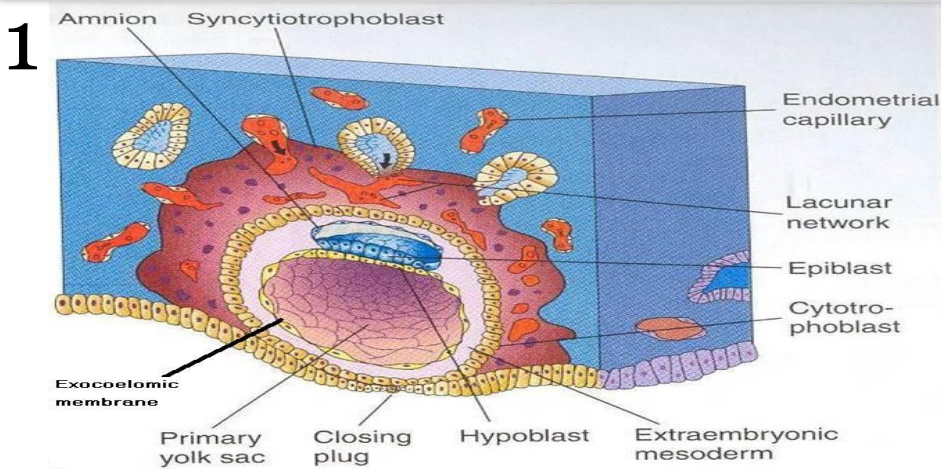
EXTRA EMBRYONIC STRUCTURES

1-EXTRA EMBRYONIC MESODERM

- A loose connective tissue, arises from the **yolk sac**.
- It fills all the space between the trophoblast externally and the exocoelomic membrane & amnion internally.
- It surrounds the amnion and yolk sac.

2-EXTRA EMBRYONIC COELOM

- Multiple spaces appear within the **Extraembryonic mesoderm**.
- These spaces fuse and form the **Extraembryonic Coelom**.
- It surrounds the amnion and yolk sac.



GASTRULATION

It is the process through which the **Bilaminar** embryonic disc is changed into a **Trilaminar disc**, as a new tissue (2ry or intraembryonic mesoderm)

Which appears between the ectoderm and endoderm.

TRILAMINAR DISC

Now the embryonic disc is formed of **3 layers**:

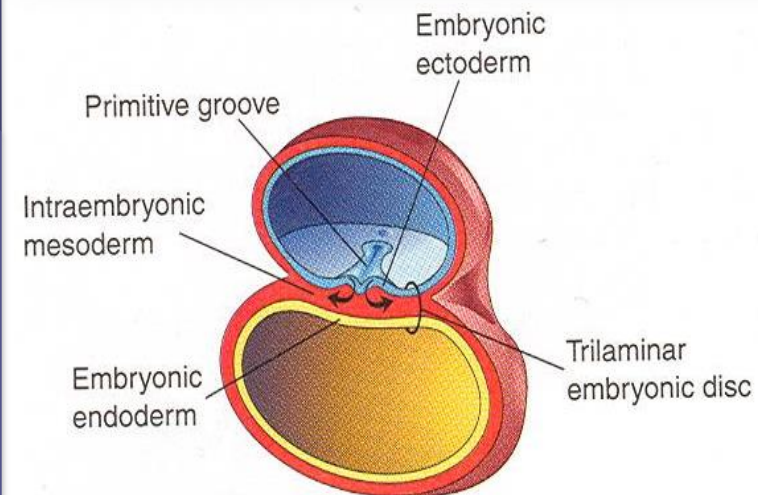
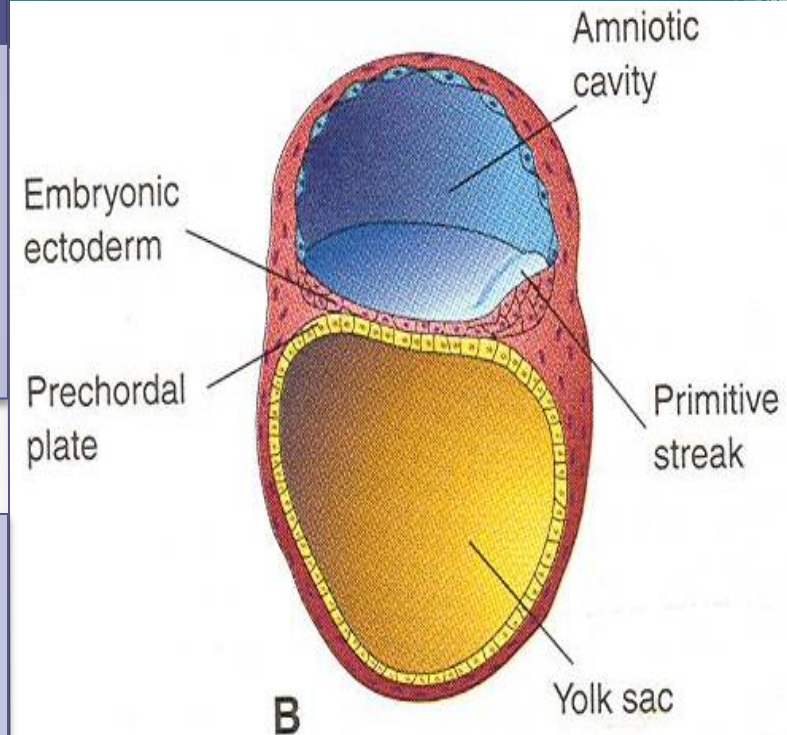
- a. Embryonic Ectoderm (outer layer)
- b. Intraembryonic Mesoderm.
- c. Embryonic Endoderm.(inner layer)

Cells in these layers will give rise to all tissues and organs of the embryo.

Rapid development of the embryonic disc occurs **during the 3rd week.**

It is characterized by:

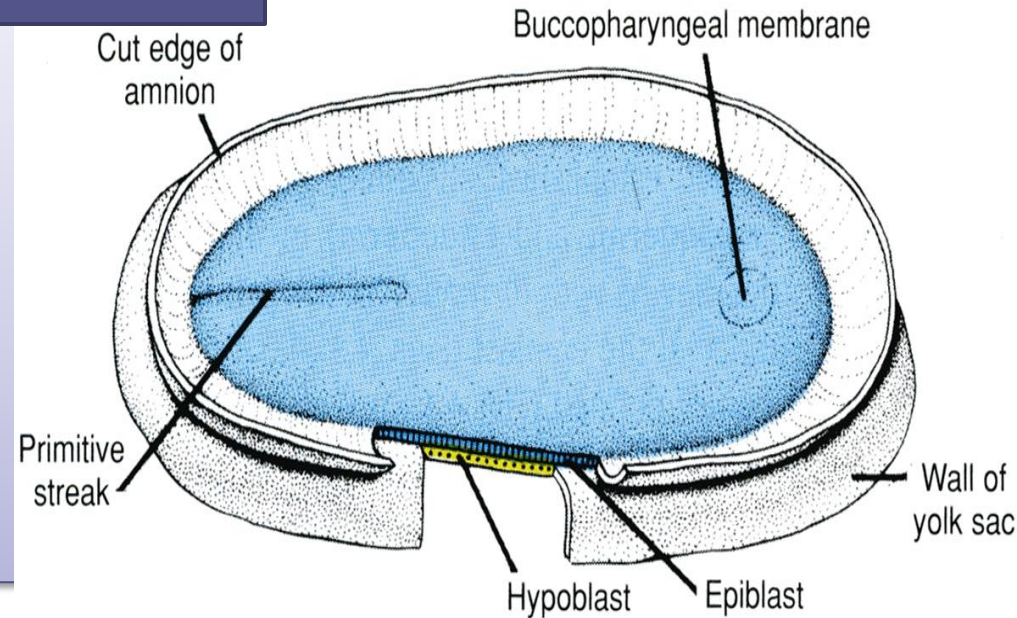
- 1-Appearance of primitive streak.
- 2-Development of the prechordal plate.
- 3-Differentiation of three germ layers.



Primitive Streak

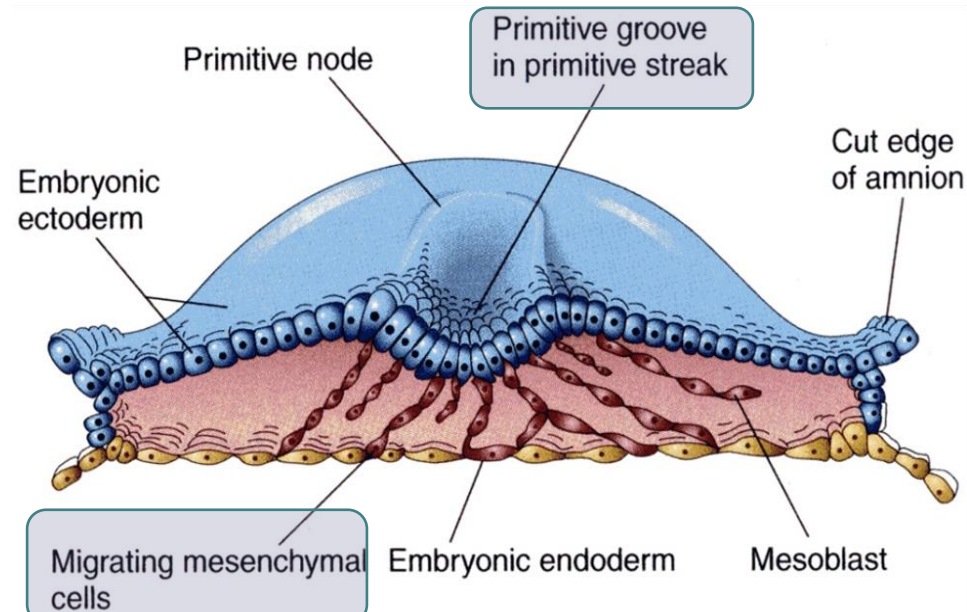
The first sign of Gastrulation is the appearance of “**primitive streak**” by (15-16 day).

It is a thickened band in the caudal part of the dorsal aspect of the **epiblast**.



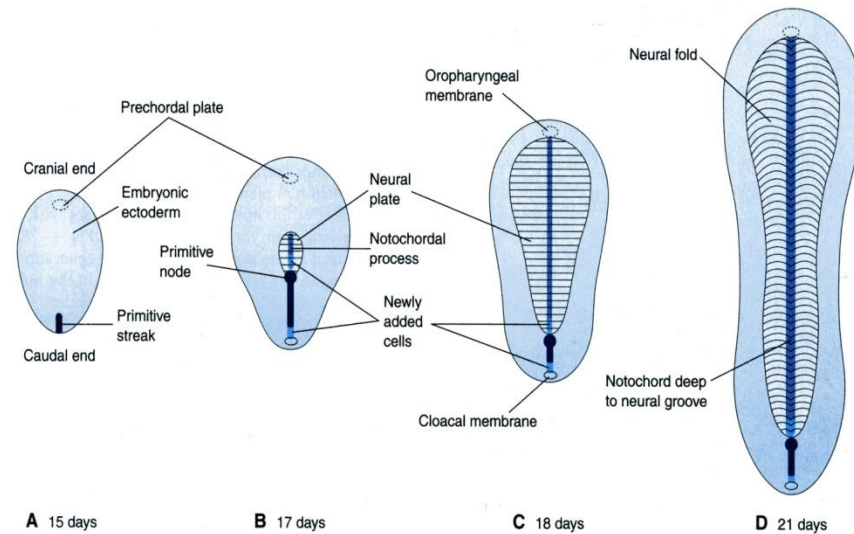
FUNCTIONS OF PRIMITIVE STREAK

- By the end of the **3rd week** the cells of Primitive Streak gives rise to:
- **Mesenchymal cells** that migrate between Epiblast & Hypoblast to form a third layer - **Intraembryonic Mesoderm**.
- end of the primitive streak proliferates form **primitive node**.



Fate of Primitive Streak

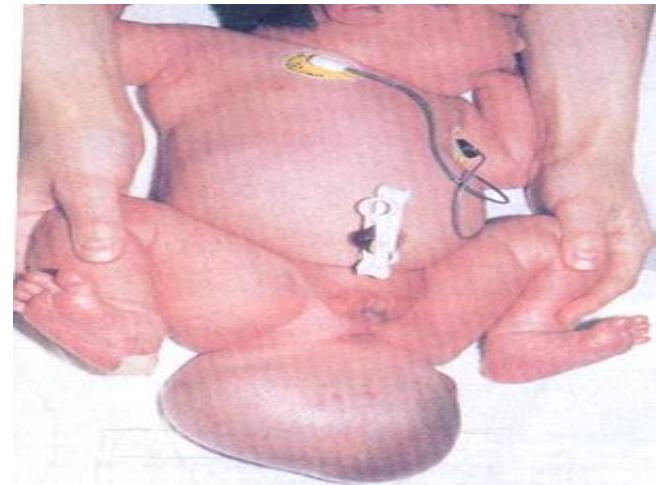
Primitive streak **actively forms mesoderm until the fourth week**, then it diminishes in size and becomes an **insignificant** structure in the **Sacrococcygeal** region of the embryo. Normally the primitive streak **undergoes degeneration and disappears by the end of the fourth week.**



SACROCOCCYGEAL TERATOMA

It is developed from remnants of primitive streak.

1. It is a benign tumor which contains elements of incomplete differentiated (3) germ layers.
2. infant mostly female.
3. It is usually diagnosed by ultrasonography.
4. It is removable by surgery and its prognosis is good



PRECHORDAL PLATE

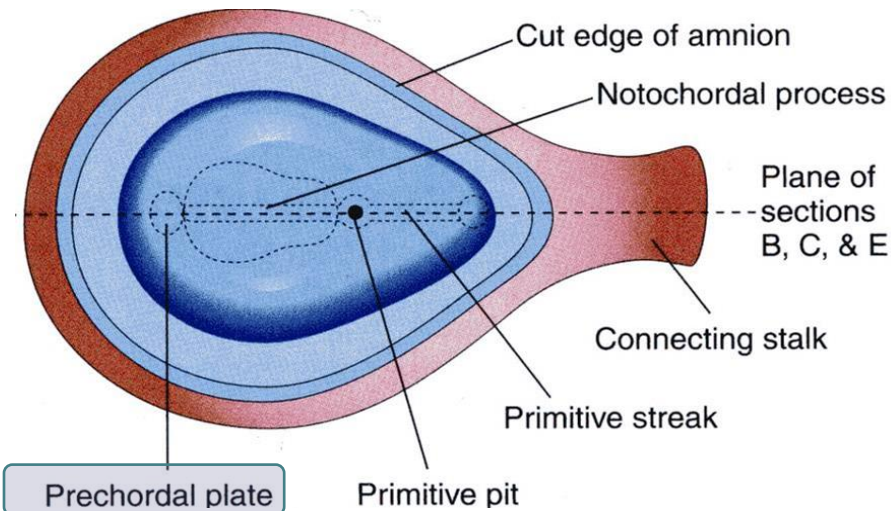
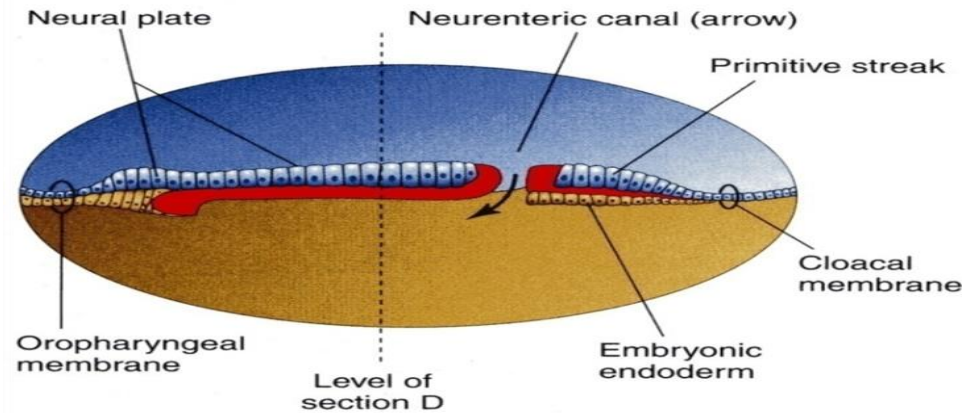
➤ It is a localised area of thickening of the Hypoblast(endoderm).

➤ It is the primordium of the oropharyngeal membrane,

➤ It indicates:

1. The future Cranial end of the embryo.
2. The future site of the mouth.
3. It is an important organiser of the Head.

➤ It is located at the future site of the oral cavity.



There is no mesoderm in this area.

NOTOCHORD

The notochord acts as a **temporary axial skeleton** for the embryo.

It is replaced later on by **vertebral column**.

Its **formation starts** by appearance of:

1. Prechordal plate.

2. Primitive streak.

3. Primitive node

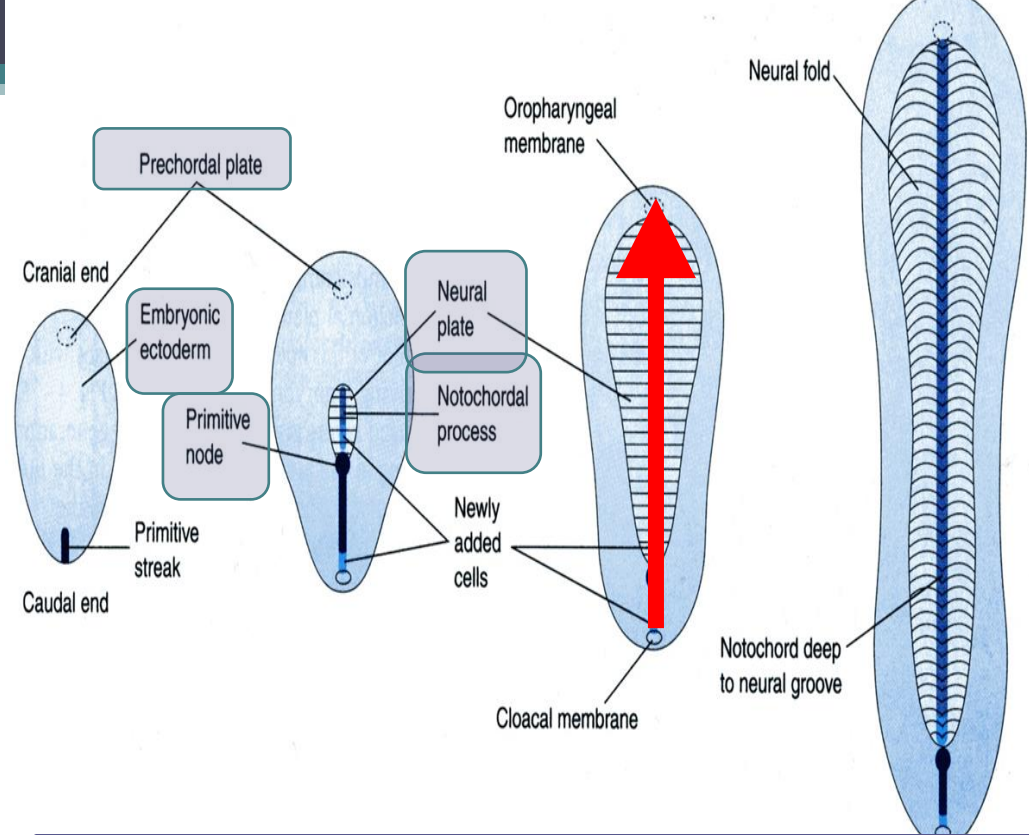
4. Notochordal process.

5. Notochordal canal.

6. Notochordal plate.

7. Notochord.

Notochordal process: It is an extension of cells from the primitive node to the oral cavity.



The notochord is a **temporary structure** around which the **vertebral column** forms.

It extends from the **primitive node** to the **oropharyngeal membrane**.

The notochord degenerates and disappears as the bodies of the vertebrae form, but it persists as **the nucleus pulposus** of each intervertebral disc.

The developing notochord **induces** the overlying ectoderm to thicken & form the neural plate, which will form the central nervous system (CNS).

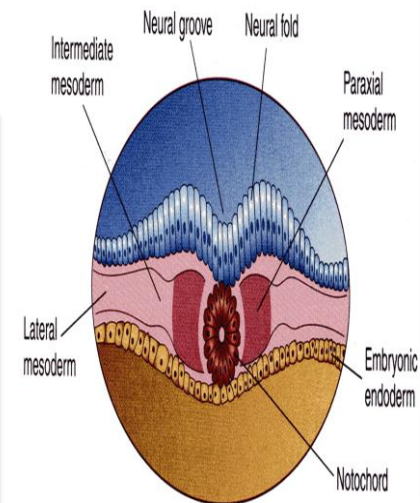
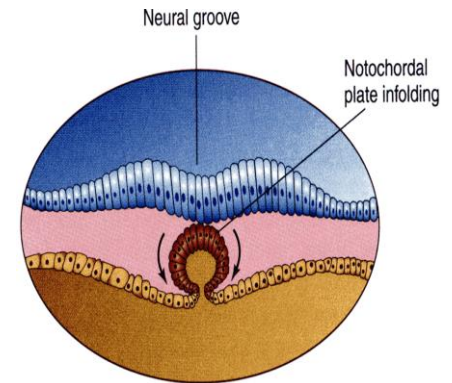
FUNCTIONS OF THE NOTOCHORD

2. Serves as the basis for the development of the axial skeleton.

1. Define the Primitive axis of the embryo and gives it some rigidity.

3. Indicates the future site of the vertebral bodies.

**4. Development of CNS by formation of the neuroectoderm.
(Neuroectoderm differentiated later into neural tube and neural crest cells)**



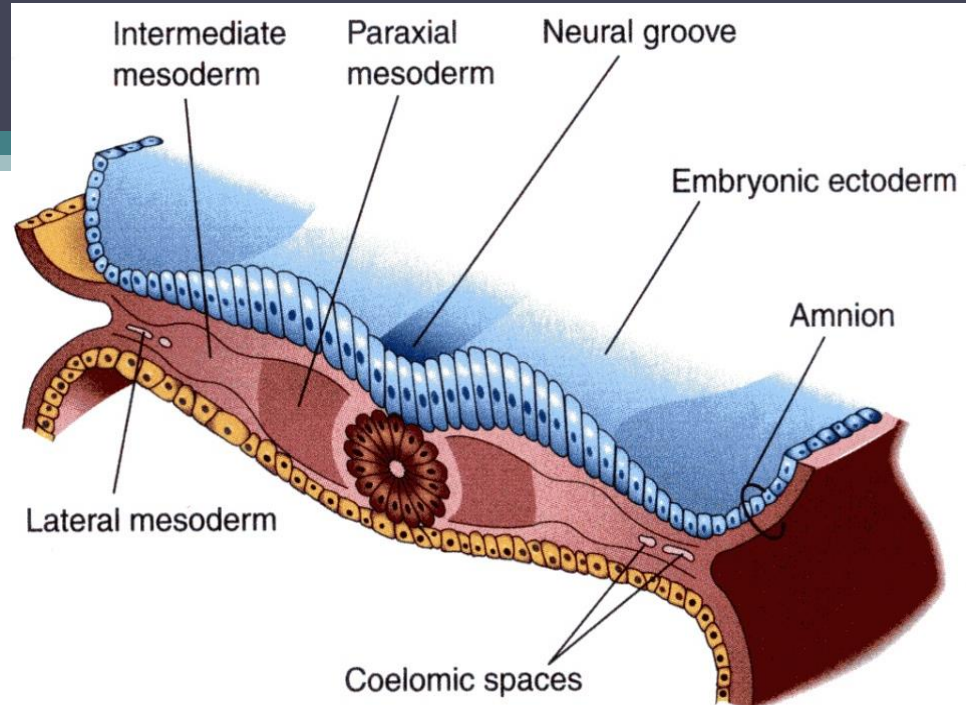
Diffrantion of the intraembryonic medsodermmm

1- Medial part
(**Paraxial Mesoderm**).

2- Middle part
(Intermediate mesoderm)
Or
nephrogenic mesoderm.

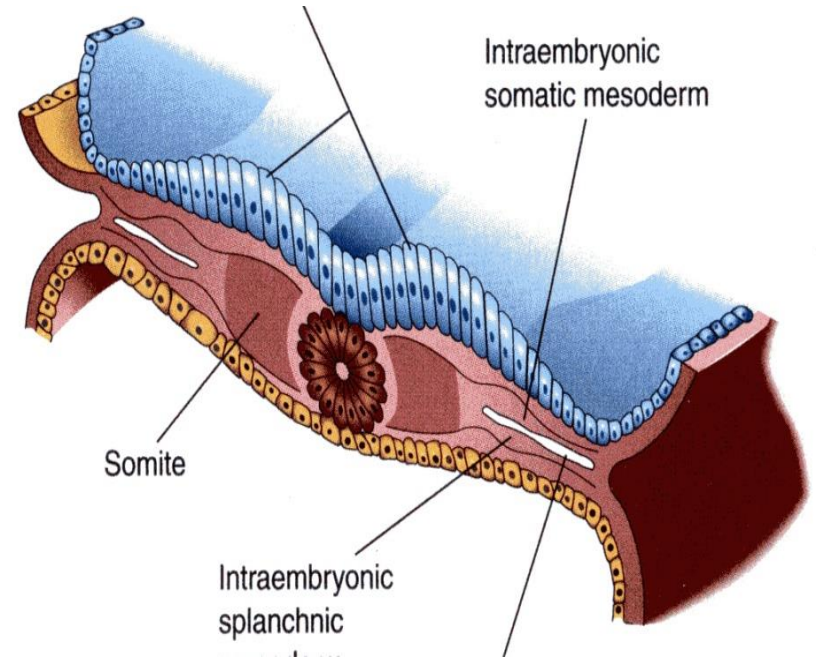
(nephrogenic = كلوي)
يعني يعطينا الكلية

3- lateral part
(Lateral mesoderm).



Somites :

End of the 3rd week: the **Paraxial mesoderm** begins to divide into paired cuboidal masses called **somites**. **And** the first pair of somites appears in the future occipital region, so they develop craniocaudally.



4th & 5th weeks:

Because the somites are so prominent, they are one of criteria for **determining an embryo's age**.

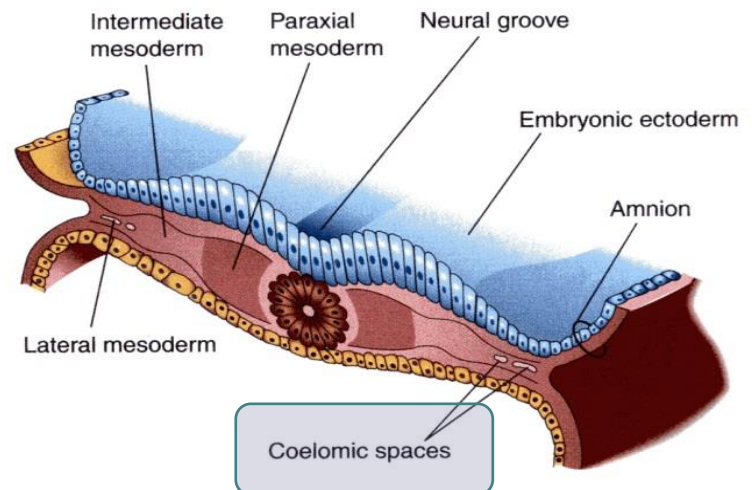
نقدر نحدد عمر الجنين بالاسبوع الرابع والخامس

End of the 5th week:
There are about **42-44** pairs of somites.

Development of Intraembryonic Coelom

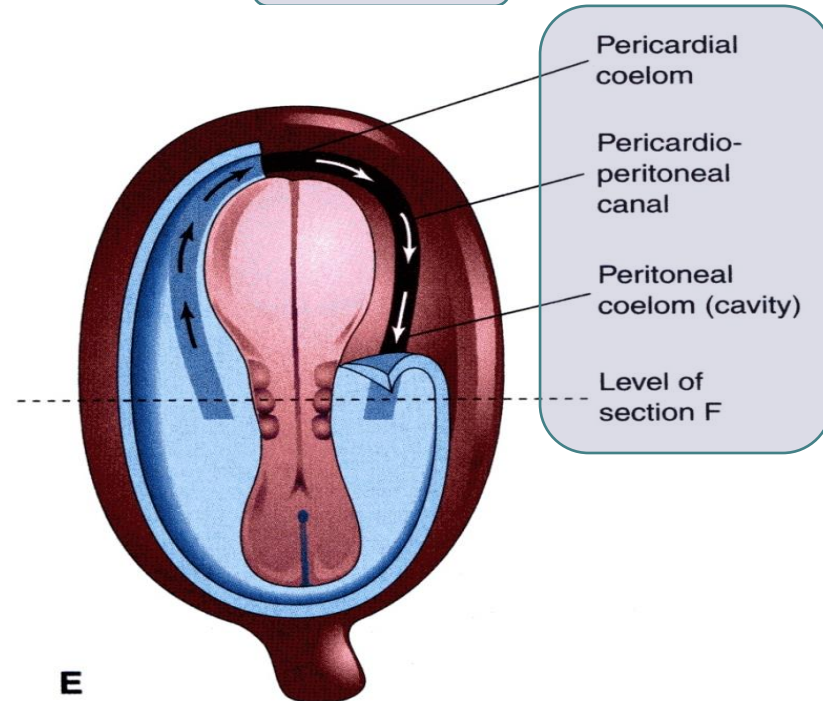
The primordium of the intraembryonic coelom appears as isolated spaces in the lateral mesoderm.

These spaces soon unite to form a single horseshoe-shaped cavity, the intraembryonic coelom.



During the second month, the intraembryonic coelom is divided into three body cavities:

1. pericardial cavity
2. pleural cavities
3. peritoneal cavity



Each of the three germ layers (ectoderm, mesoderm, and endoderm) gives rise to specific tissues and organs.

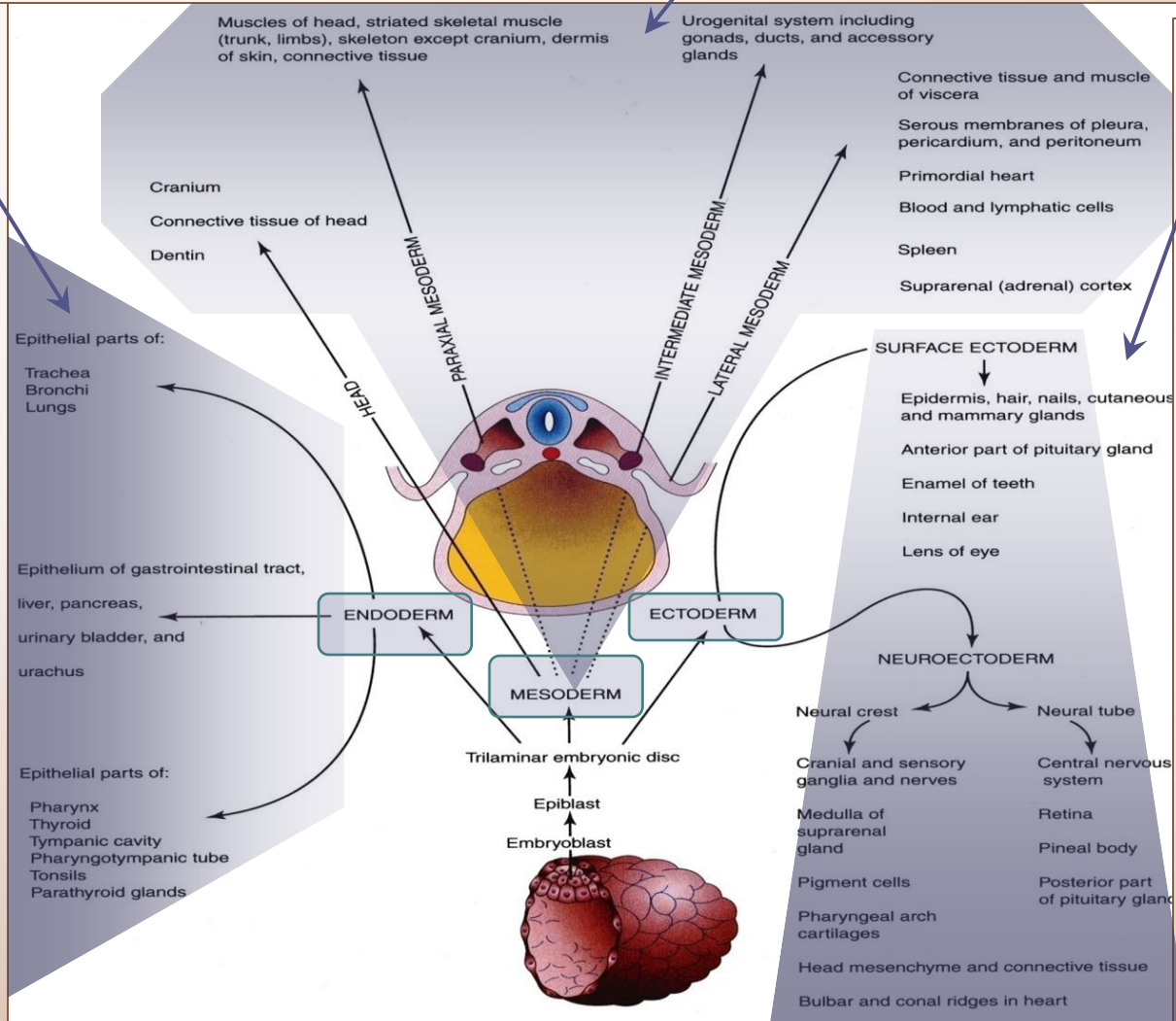
The embryonic mesoderm gives rise to :

- Paraaxial; Skeleton,(vertebral column) Striated muscle , dermis
- Intermediate; urogenital system
- Lateral plate; connective tissue and smooth muscle.

2

3

The embryonic endoderm is the source of the epithelial linings of the respiratory passages & gastrointestinal (GI) tract, including the glands opening into the GI tract & glandular cells of associated organs such as the liver and pancreas.



1 Embryonic ectoderm gives rise to

- 1.The surface ectoderm.
- 2.The neuroectoderm.

central & peripheral nervous systems

The **Inner Cell Mass (Embryoblast)** is differentiated into a **bilaminar plate** of cells composed of **Two layers** :

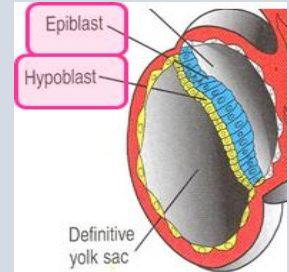
8th day

(A) **Epiblast**

High columnar cells adjacent to the amniotic cavity.

(B) **Hypoblast**

Small cuboidal cells adjacent to the blastocyst cavity (Yolk Sac).



during the 2nd
week

Extraembryonic structures forming are : the amniotic cavity, amnion, yolk sac, and connecting stalk.

end of the 2nd
week

Implantation of the **blastocyst** is **completed**.

15 – 16 day (the
beginning of the
3rd week)

appearance of “**primitive streak**” which is **The first sign** of **Gastrulation**

During the 3rd
week

Rapid development of the **embryonic disc** occurs.

By the end of 3rd
week

End of the 3rd week: the **Paraxial mesoderm** begins to **divide into** paired cuboidal masses called somites

By the end of 3rd week **the first pair of somites appears** in the future occipital region, so they develop craniocaudally

The end of the 3rd week the cells of Primitive Streak gives rise to: **Mesenchymal cells** that migrate between Epiblast & Hypoblast to form a third layer - **Intraembryonic Mesoderm.**

until the 4th week **Primitive streak** actively forms **mesoderm**, then it diminishes in size and becomes an insignificant structure in **the sacrococcygeal region** of the embryo.

the end of the 4th week Normally the **primitive streak** undergoes **degeneration and disappears.**

4th & 5th weeks Because the somites are so prominent, they are one of criteria for **determining an embryo's age.**

End of the 5th week There are about **42-44** pairs of somites

During the 2nd month The **intraembryonic coelom** is divided into 3 body cavities: **1-Pericardial cavity. 2-Pleural cavities. 3-Peritoneal cavity.**

MCQ'S

-implantation of the blastocyst is completed by the end of :

- A. Second day
- B. Second *week*
- C. Second month

-which process in the third week of the development converts the embryonic disc into the trilaminar embryo

- A. Gastrulation
- B. Placentation
- C. Neuralation

-primitive streak degenerates at :

- A. The end of the second week
- B. The end of *the five* week
- C. The end of the 4th week

<https://www.onlineexambuilder.com/bilaminar-trilaminar-discs/exam-9353>



Quizzes for all the 3 lectures: Test your understanding in Embryology.

Gametogenesis & Female Cycles 1

<https://www.onlineexambuilder.com/site/index.php?r=exam/quiz&language=en>

Gametogenesis & Female Cycles 2

<https://www.onlineexambuilder.com/site/index.php?r=exam/quiz&language=en>

Fertilization and implantation

<http://www.onlineexambuilder.com/fertilizationand-implantation/exam-8467>



GOOD LUCK<3

THE FUNDAMENTALS OF HUMAN EMBRYOLOGY

Embryology heroes:

Girls:

Raghda Alqassim.

Razan Alsabti.

Suha Alenezi.

Amal Alomran.

Rawan aldhuwayhi.

Mai Alageel.

Demah Alrajhi.

Afnan Almalki.

Boys:

Helmi M. Al Sweirki.

Nasser AlMujaiwel.

Saeed AlShehry.

Gassan AlMeqbel.

Mohammed AlQarny.

Naif AlZiyadi.

Fares AlAmmary.



Embryology435@gmail.com