

# EMBRYOLOGY

LECTURE

#3

## BILAMINAR-TRILAMINAR DISCS & THEIR DERIVATIVES





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# OBJECTIVES

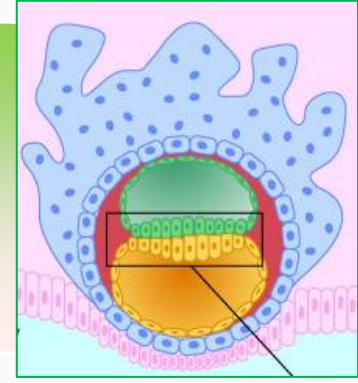
*By the end of the lecture, you should be able to:*

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



# INTRODUCTION & BILAMINAR DISC

- Implantation of the blastocyst is completed by the end of the **2<sup>nd</sup> 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**.



bilaminar embryonic disc.

8<sup>th</sup> Day

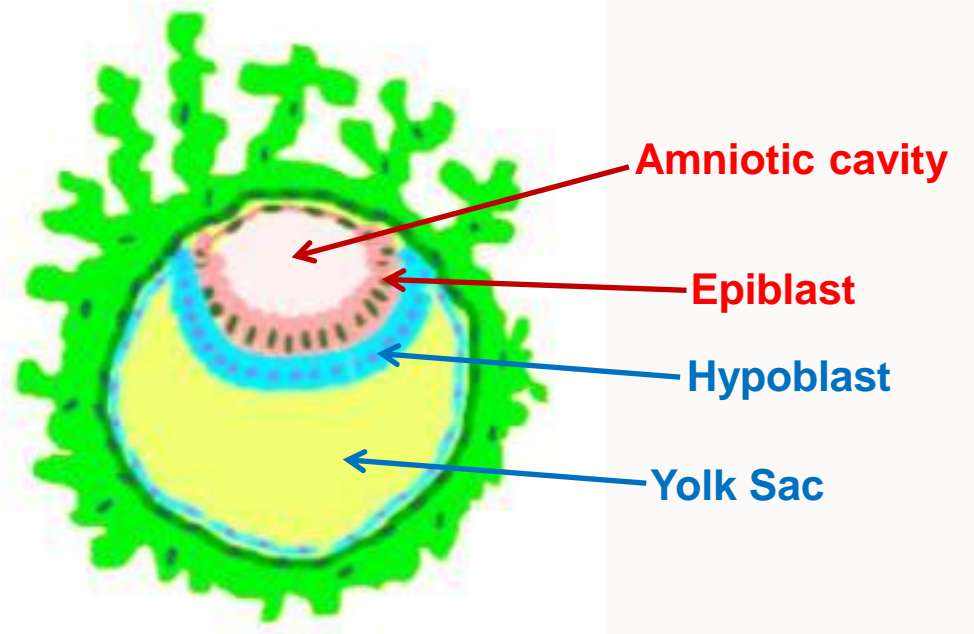
*The Inner Cell Mass (Embryoblast) is differentiated into a bilaminar plate of cells composed of Two layers :*

**Epiblast**

*High columnar cells adjacent to the amniotic cavity.*

**Hypoblast**

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



**YouTube** For Further explanation  
<http://www.youtube.com/watch?v=BPUdOqSPZYQ>

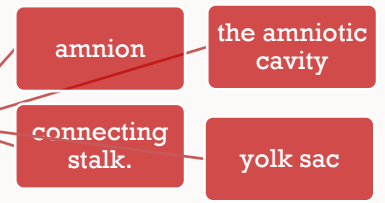
Nice video made by KSU med students explains the whole lecture



# EXTRAEMBRYONIC STRUCTURES

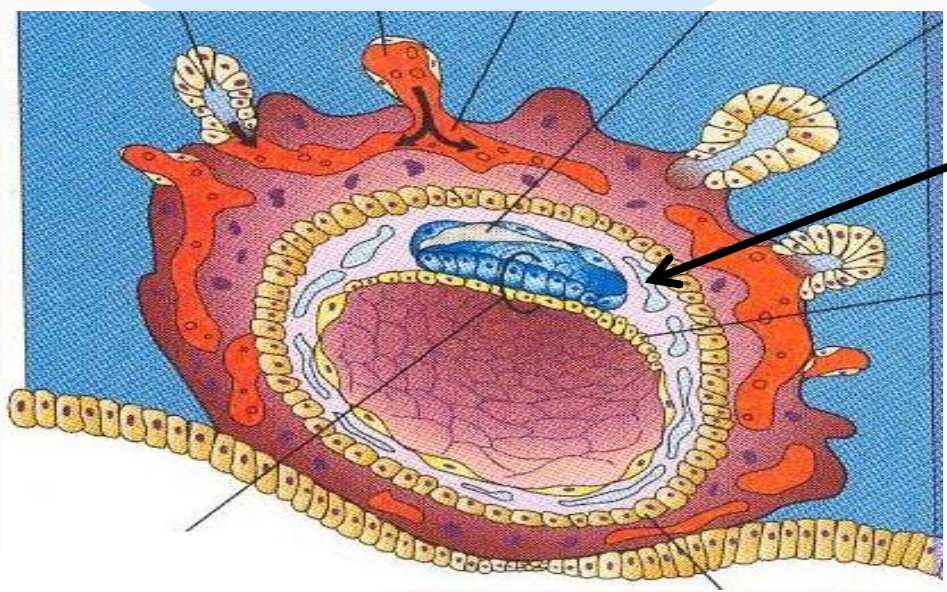
2<sup>nd</sup> week

## Extraembryonic structures

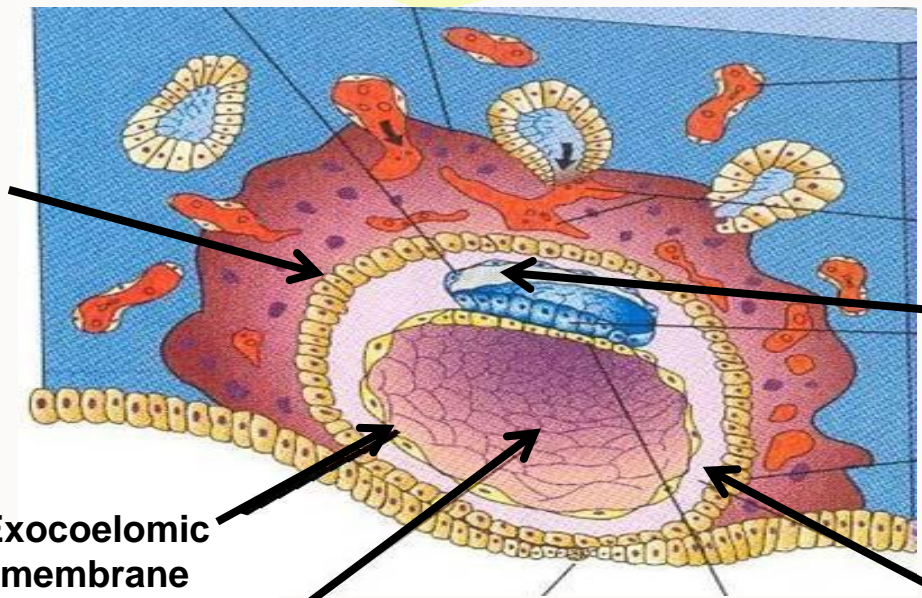


**EXTRA EMBRYONIC COELOM**  
\* Multiple spaces appear within the Extraembryonic mesoderm.  
\* These spaces fuse and form the Extraembryonic Coelom.  
Surrounded the Amnion and Yolk sac

**EXTRAEMBRYONIC MESODERM**  
\* It is a loose connective tissue.  
\* Arises from the Yolk sac.  
• It fills all the space between the  
• Trophoblast > externally  
• Exocoelomic membrane & amnion > internally.  
Surrounded the Amnion and Yolk sac



Extraembryonic Coelom



Trophoblast

Amnion

Exocoelomic membrane

Yolk Sac

Extraembryonic mesoderm

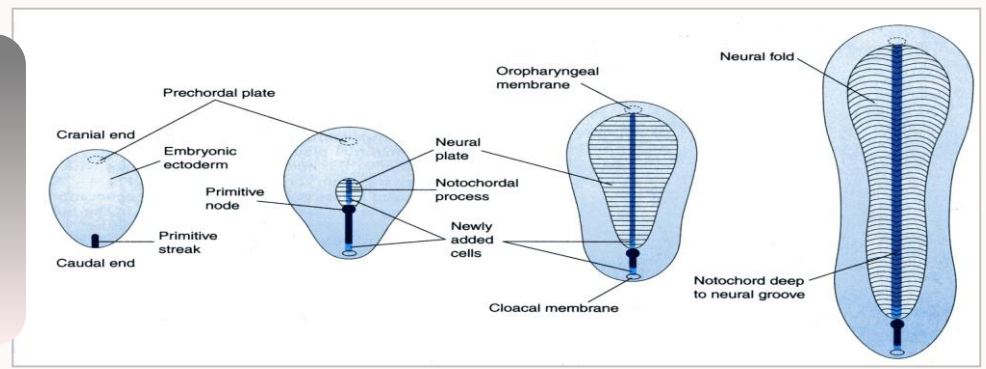


# GASTRULATION

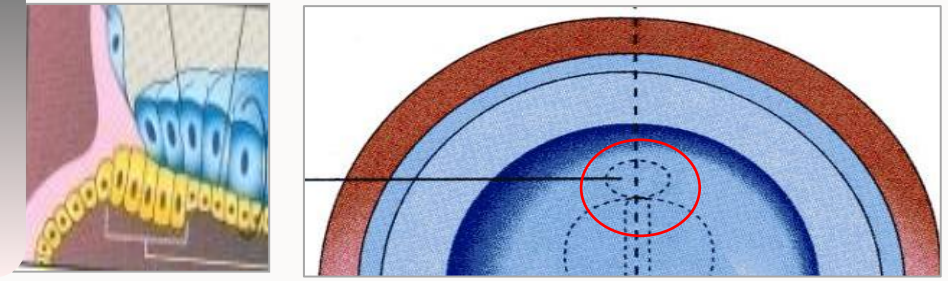
3<sup>rd</sup> week Rapid development of the embryonic disc

It is characterized by:

Appearance of **Primitive Streak**



Development of the **Prechordal Plate**



Differentiation of **3 germ layers**



YouTube For Further explanation  
<http://www.youtube.com/watch?v=3AOoikTEfeo>



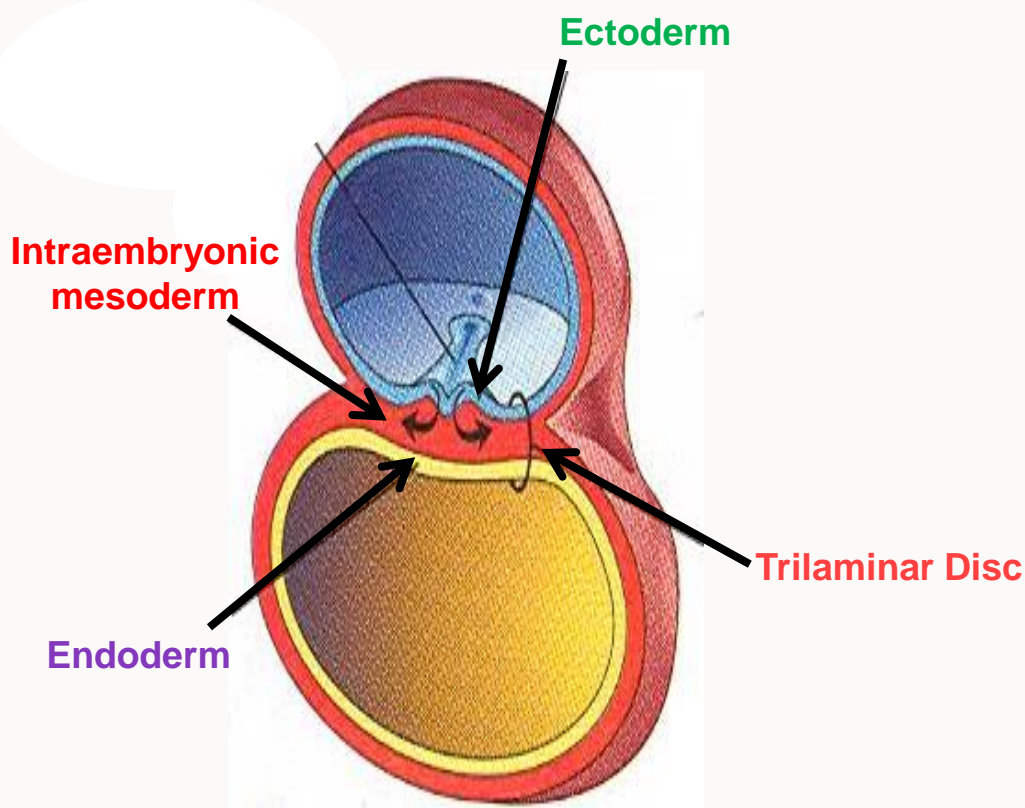
# GASTRULATION . . . TRILAMINAR DISC

**Definition :**

It is the process through which the **Bilaminar embryonic disc** is changed into a **Trilaminar disc**, as a new tissue.

(2ry or **Intraembryonic mesoderm :** Appears between the Ectoderm and Endoderm

Ectoderm = Epiblast  
Endoderm = Hypoblast



**Trilaminar Disc:**

Now the embryonic disc is formed of 3 layers:

- 1) Embryonic Ectoderm
- 2) Intraembryonic Mesoderm.
- 3) Embryonic Endoderm.

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



# GASTRULATION . . . PRIMITIVE STREAK

First sign of Gastrulation

15<sup>th</sup> -16<sup>th</sup> Day

## Primitive Streak

What it is?

A thickened band in the caudal part of the dorsal

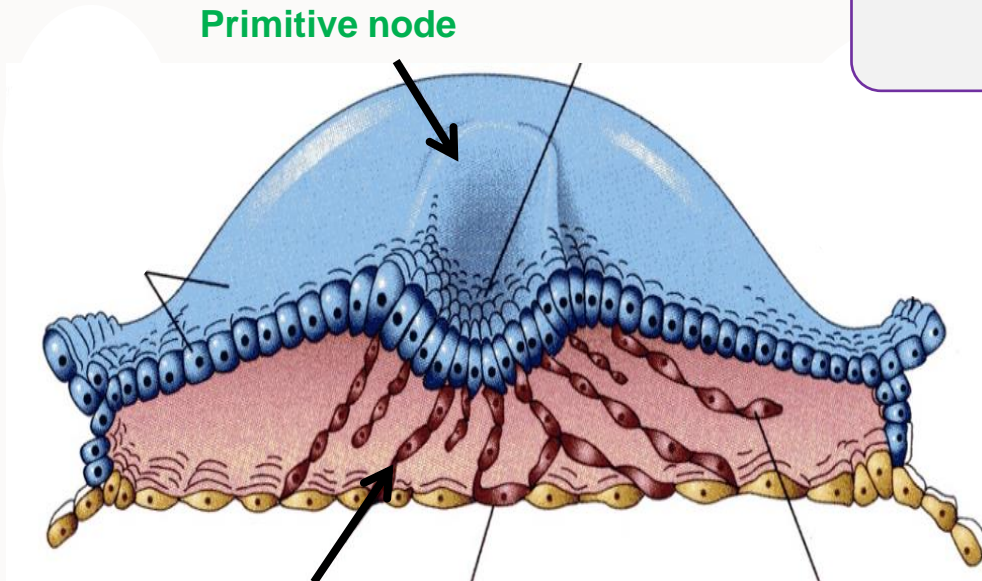
The anterior end of the primitive streak is called **primitive node**.

Primitive Streak gives rise to:

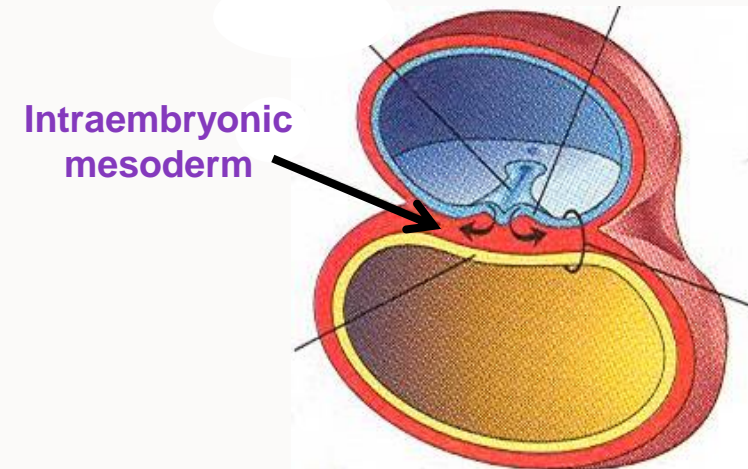
End of 3<sup>rd</sup> week

**Mesenchymal cells** that migrate between Epiblast & Hypoblast to form a third layer:

**Intraembryonic Mesoderm.**



Mesenchymal cells



Intraembryonic mesoderm

# GASTRULATION . . . PRIMITIVE STREAK

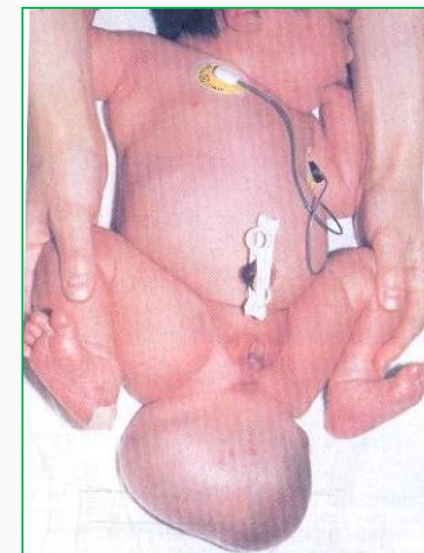
4<sup>th</sup> week

## 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

- development from remnants of primitive streak.
- it is benign tumor which contains elements of incomplete differentiated (3) germ layers.
- most common in female newborn
- it is removable by surgery.







# GASTRULATION . . . PRECHORDAL PLATE

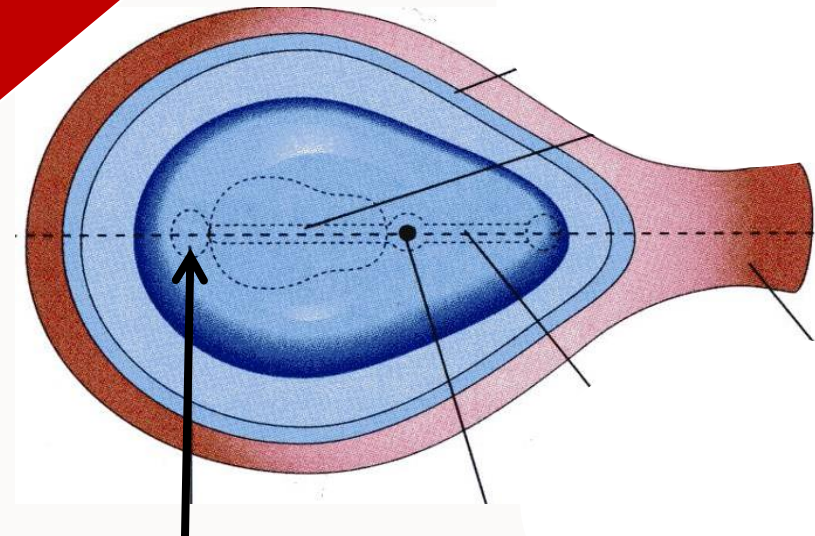
## What is it?

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

## What does it indicate?

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

There is no mesoderm in this area



Prechordal plate



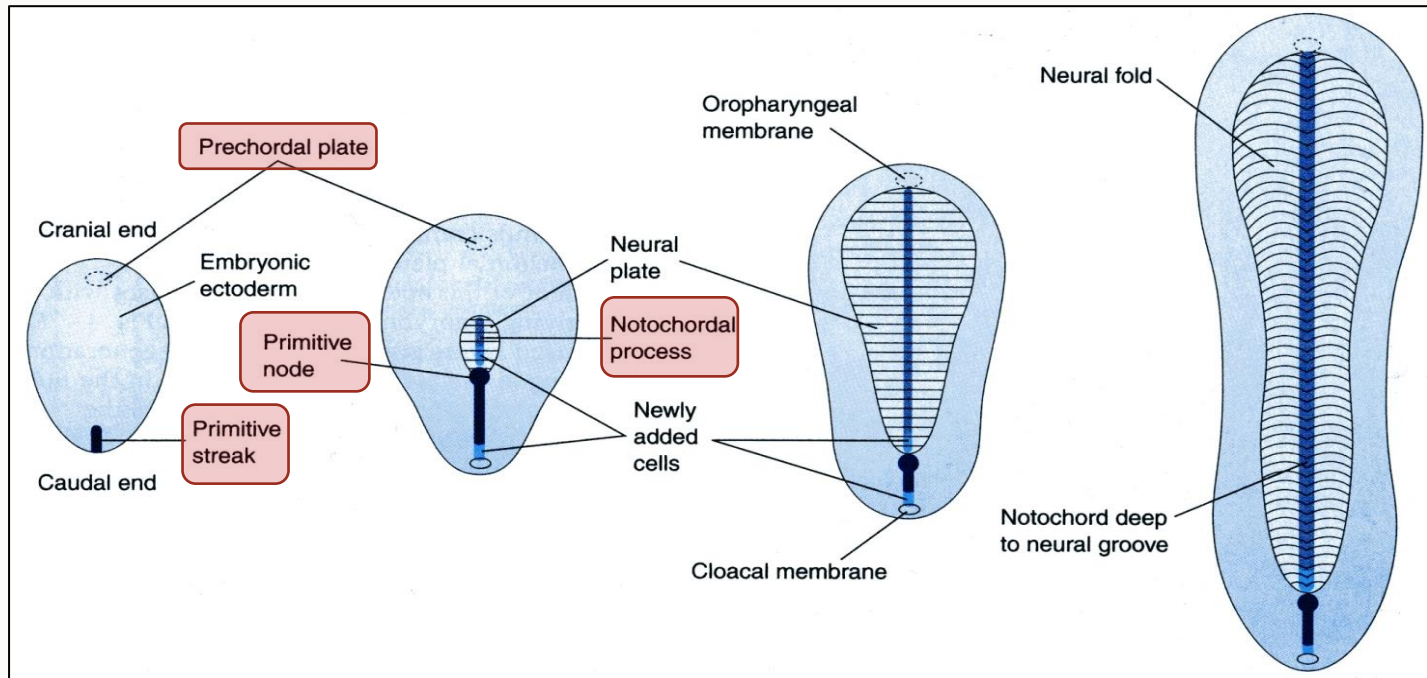
# NOTOCHORD

•The notochord acts as a temporary axial skeleton for the embryo around which the vertebral column forms.

Its formation starts by appearance of:



Note: only know the underlined ones.



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

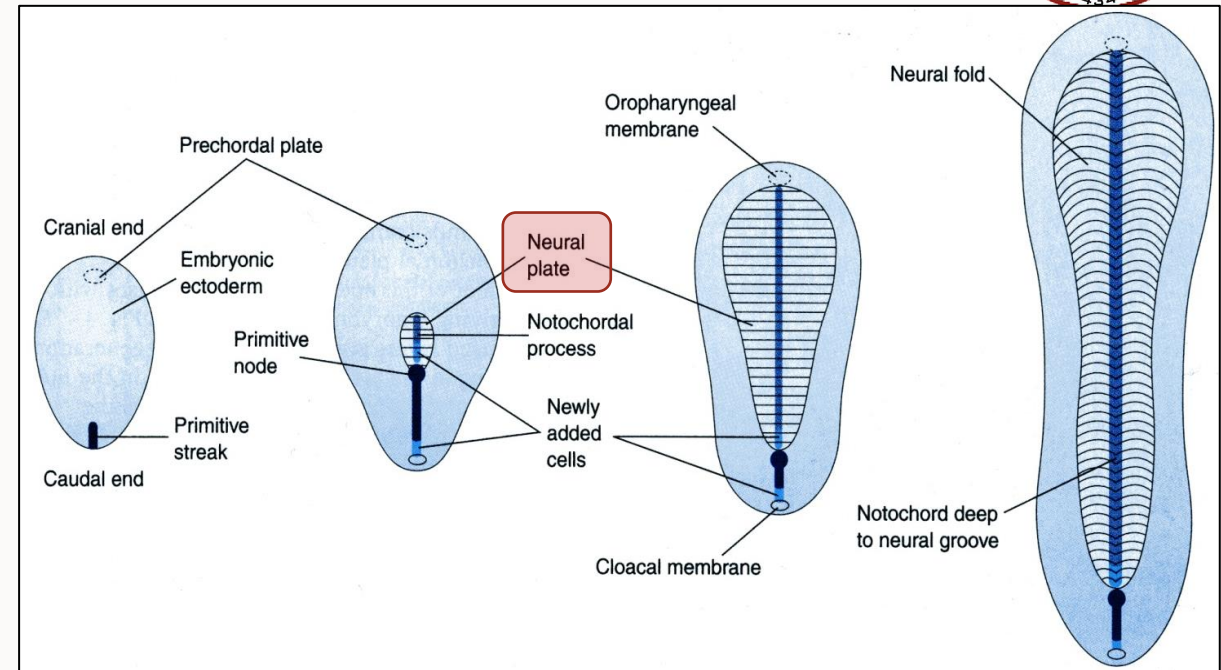
# NOTOCHORD



- 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 Notochord

- 1- Define the Primitive axis of the embryo and gives it some rigidity.
- 2- Serves as the basis for the development of the axial skeleton.
- 3- Indicates the future site of the vertebral bodies
- 4- Induction of development of the CNS. By formation of the neuroectoderm that differentiated later into neural tube and neural crest cells



**You Tube For Further explanation**

[http://www.youtube.com/watch?v=G2HvEGUYwAU&feature=youtube\\_gdata\\_player](http://www.youtube.com/watch?v=G2HvEGUYwAU&feature=youtube_gdata_player)

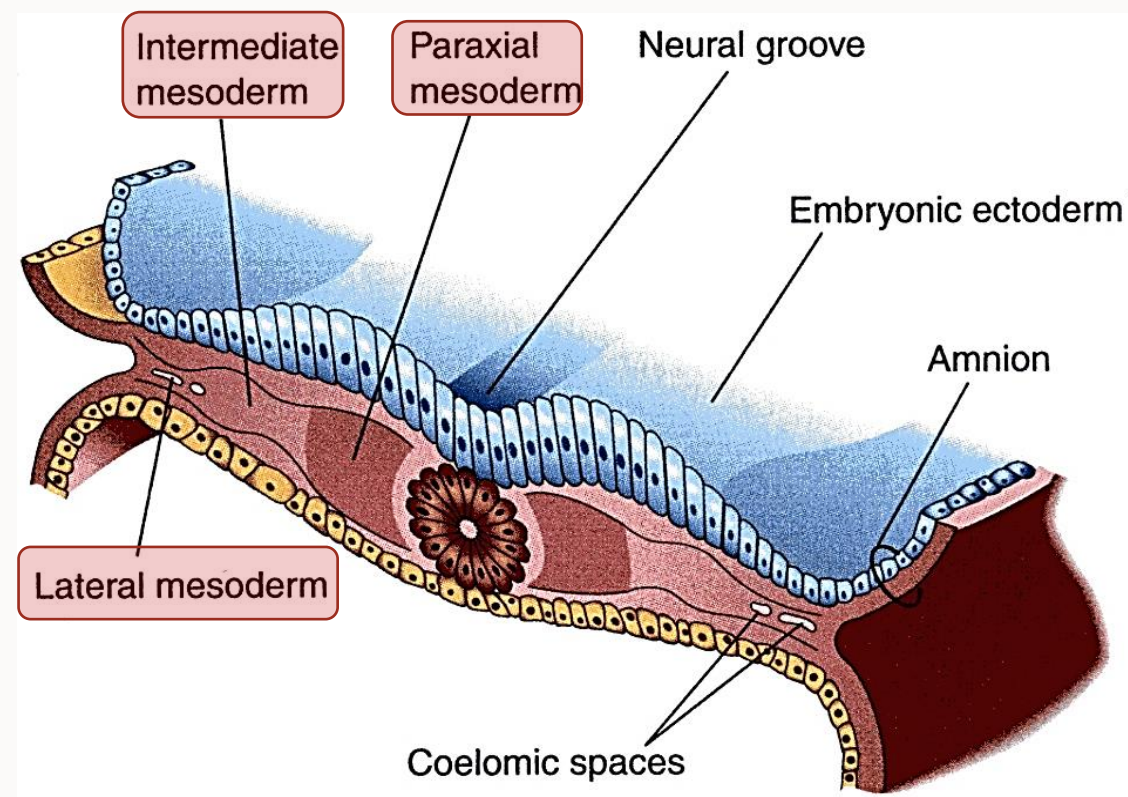
# DIFFERENTIATION OF THE INTRAEMBRYONIC MESODERM

It is divided into: (3)

1- Medial part  
(Paraxial Mesoderm).

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

3- lateral part  
(Lateral mesoderm).



# SOMITES



## Definition:

paired cuboidal masses appear in the paraxial mesoderm by end of 3rd week

the first pair of somites appears in the future occipital region, so they develop craniocaudally.

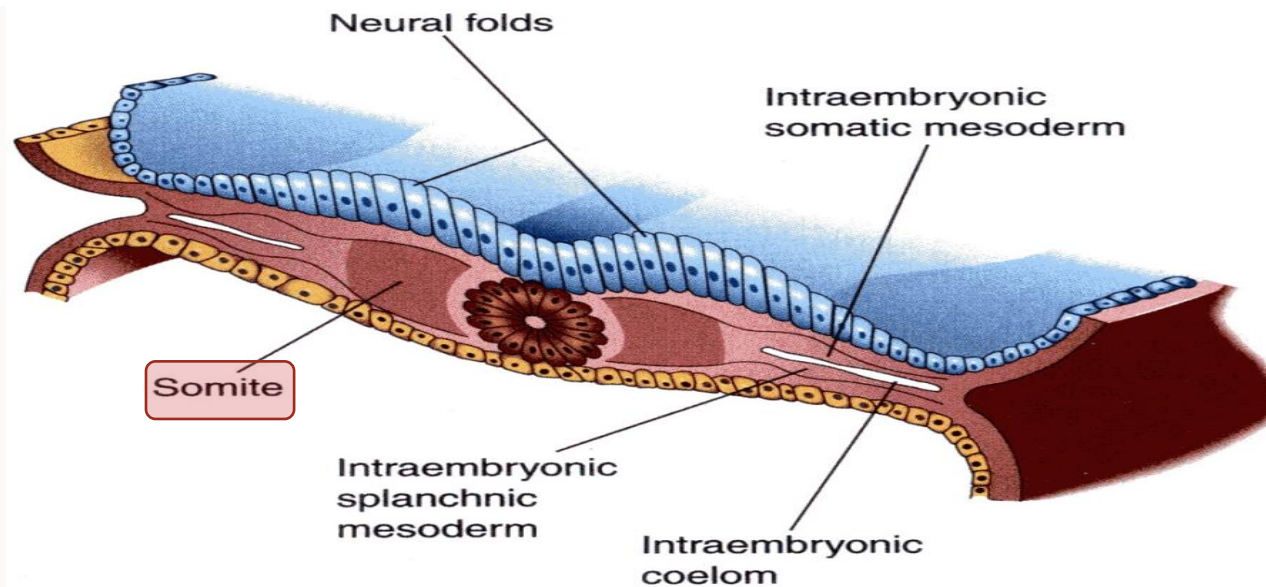
End of 3<sup>rd</sup> week

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

4<sup>th</sup> & 5<sup>th</sup> week

There are about 42-44 pairs of somites.

End of 5<sup>th</sup> week





# 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**.

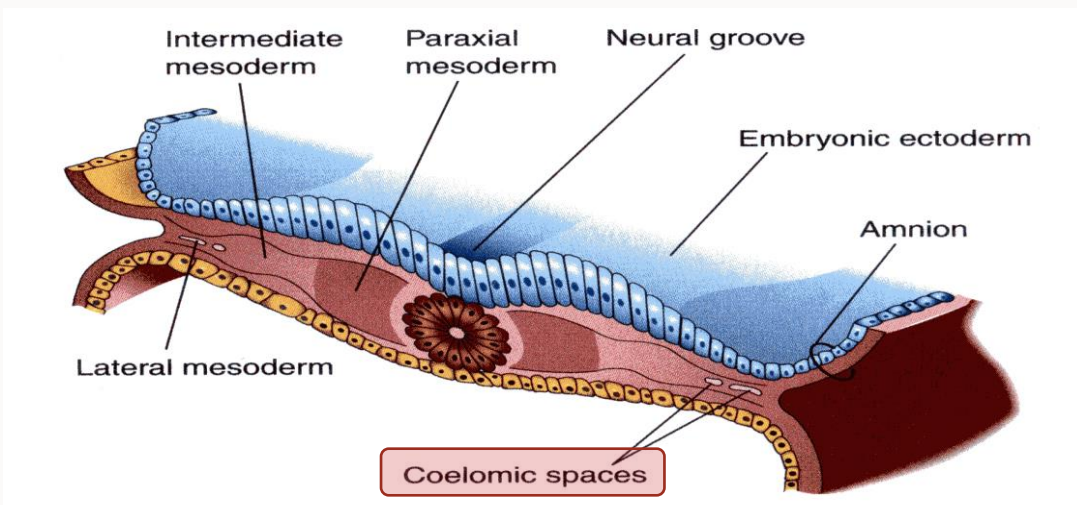
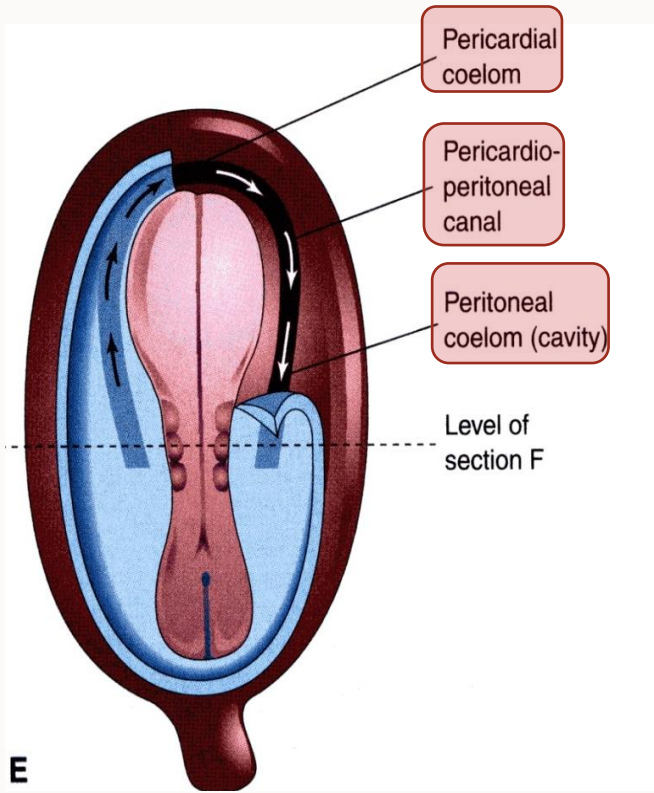
2<sup>nd</sup> month

the intraembryonic coelom is divided into three body cavities:

*Pericardial cavity*

*Pleural cavities*

*Peritoneal cavity*





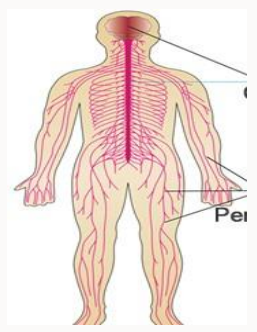
# THREE GERM LAYERS FATE

Each germ layers gives rise to specific tissues and organs.

**Embryonic Ectoderm**

The surface ectoderm

The neuroectoderm



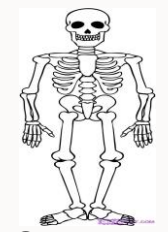
Central nervous system & peripheral nervous system

**Embryonic Mesoderm**

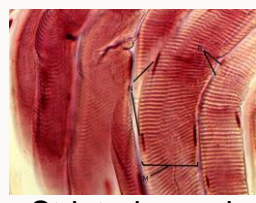
Paraxial

Intermediate

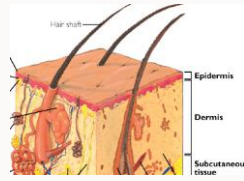
Lateral plate



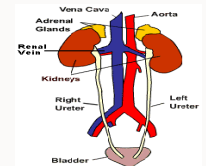
Skeleton



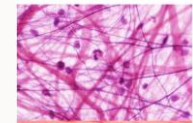
Striated muscle



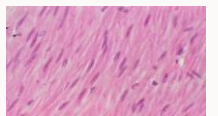
Dermis



Urogenital system



Connective tissue



Smooth muscle

**Embryonic Endoderm**

is the source of the epithelial linings of :

- Respiratory passages
- Gastrointestinal (GI) tract
- Glands opening into the GI tract

Glandular cells of associated organs such as:



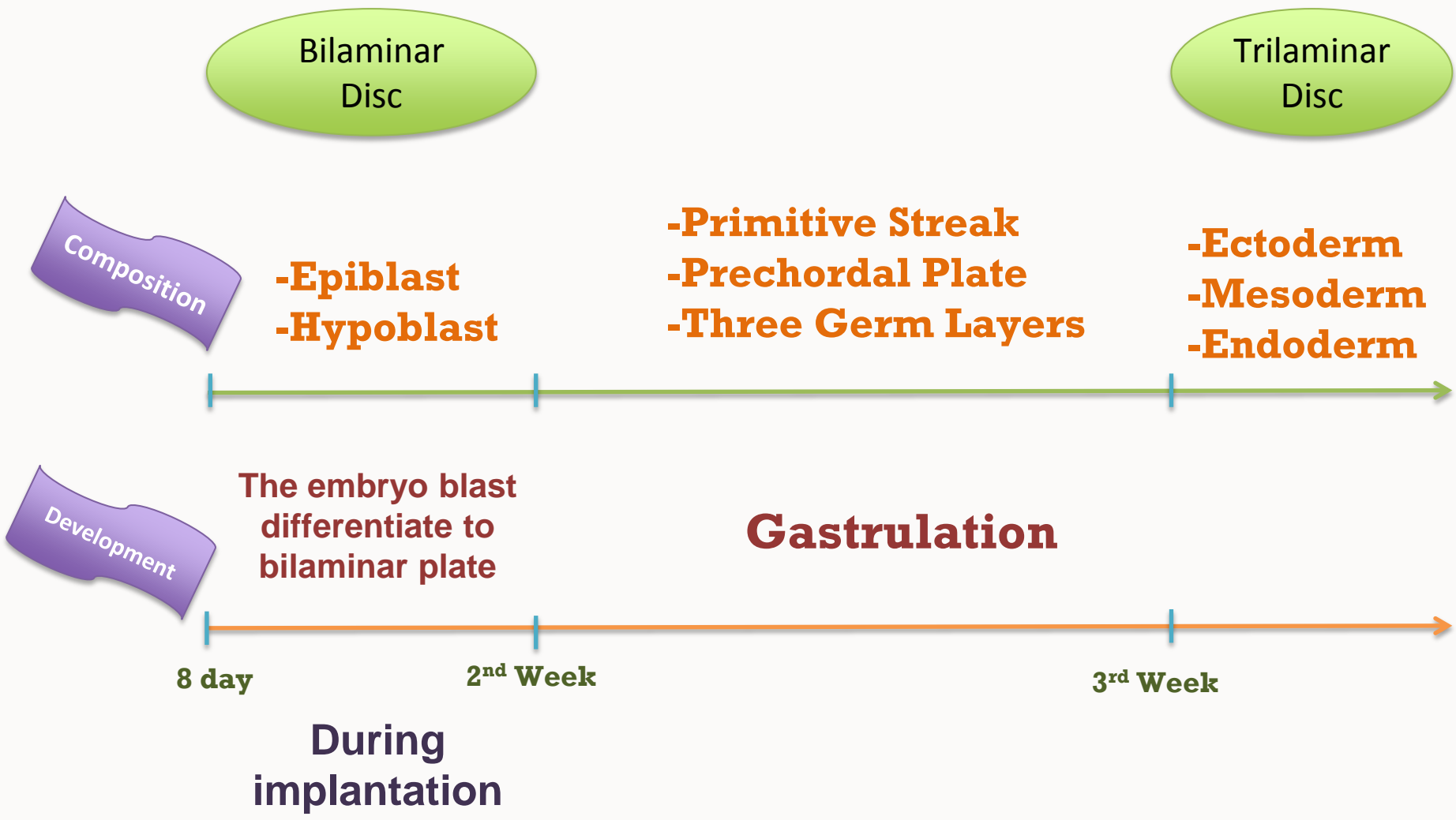
Liver



Pancreas



# HELPING TIMELINE







# MULTIPLE CHOICES QUESTIONS

- **The first sign of gastrulation is the appearance of :**

- Ectoderm.
- Endoderm.
- Intraembryonic mesoderm.
- Extraembryonic mesoderm.

- **Primitive streak degenerates at :**

- The first week.
- The second week.
- The end of 3rd week.
- The end of 4th week.

- **Prechordal plate :**

- Is the future site of mouth.
- Is the future site of anus.
- Has mesodermal layer.
- Is the thickening of epiblast.



## QUIZ LINK!

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

# ADDITIONAL FLASHCARDS

By the 8<sup>th</sup> day:  
 The embryoblast (inner mass cell) is differentiated into two layers:

- 1) Epi-blast: high columnar cells.
- 2) Hypo-blast: small cuboidal cells.

Extraembryonic Mesoderm:  
 loose connective tissue arises from yolk sac.

Extraembryonic Coelom:  
 Multiple spaces appear within the extraembryonic mesoderm fuse and form the extraembryonic coelom.

\*\*\* The process through which the bilaminar embryonic disc is changed into a Trilaminar disc is called Gastrulation

ectoderm } Trilaminar embryonic disc  
 mesoderm }  
 endoderm }

ect = epi  
 endo = hypo

**Primitive Streak.** (10) (11)

- The first sign of gastrulation is the appearance of "Primitive Streak."
- By (15-16) day
- Thickened band → caudal part of the dorsal aspect of the epiblast.

**Functions of the Primitive Streak!**

By the end of the 3<sup>rd</sup> week Primitive cells give rise to:

- Mesenchymal cells → migrate between epiblast & hypo blast to form 3<sup>rd</sup> layer
- Anterior end of the primitive streak is called Primitive node

**intraembryonic mesoderm**

**Fate of Primitive Streak** (12)

- Actively forms mesoderm → until 4<sup>th</sup> week

↓

Diminishes in size & becomes an insignificant structure in the Sacrococcygeal region of the embryo

**Normally the Primitive Streak undergoes Degeneration & disappears by the end of the 4<sup>th</sup> Week.**

**Sacrococcygeal Teratoma** (13)

Development? From remnants of Primitive Streak

It's a benign tumor which contains elements of Incomplete differentiated (3) germ layers.

most Common tumor in newborn infants → mostly female

- How is it usually diagnosed? ultrasonography
- removable by surgery & its prognosis is good

# ADDITIONAL FLASHCARDS

## Prechordal plate. (4)

- localised area of thickening of the hypoblast (endoderm)
- Primordium of the oropharyngeal membrane located at the future site of the Oral Cavity.

Indicates:

- future cranial end of the embryo
  - future site of the mouth
  - important organiser of the head
- NO MESODERM IN THIS AREA**

## Notochord (15)

- Temporary axial skeleton for the embryo
  - replaced later on by the vertebral column
- Formation starts by the appearance of:

1. Prechordal Plate
2. Primitive node
3. Notochordal Plate
4. Notochordal Process
5. Notochordal Core
6. Primitive Streak
7. Notochord

## Notochordal Process.

Extension of cells from the primitive node to the oral cavity

The notochord is a temporary structure around which the vertebral column forms. (6)

- The notochord degenerates & disappears as the bodies of the vertebrae form → it extends from the primitive node → oropharyngeal membrane → it persists as the nucleus pulposus of each intervertebral disc.
- Includes the overlying ectoderm to thicken & form the neural plate ⇒ which will form the Central Nervous System (CNS)

## Functions of the notochord. (17)

1. Define the primitive axis of the embryo & gives it some rigidity
2. Serves as the basis for the development of the axial skeleton
3. Indicates the future site of the vertebral bodies.
3. Indication of the development of the CNS. By the formation of the neuroectoderm that differentiated later into neural tube & neuro crest cells.

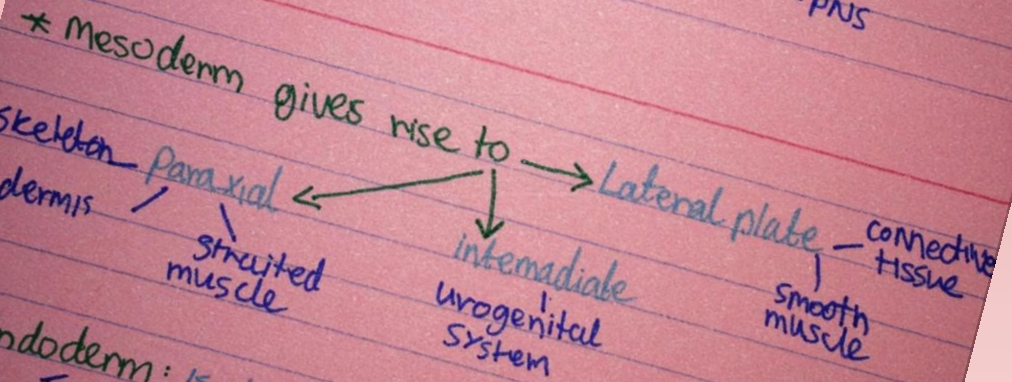
# ADDITIONAL FLASHCARDS

\* During the second month the intraembryonic coelom is divided into 3 body cavities:

- 1) Pericardial cavity.
- 2) Pleural cavity.
- 3) Peritoneal cavity.

- NOTE THAT: \* Ectoderm gives rise to surface ectoderm and the neuroectoderm

- ↳ CNS
- ↳ PNS



\* Endoderm: is the source of the epithelial lining of:  
of: The respiratory & GI tract.

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