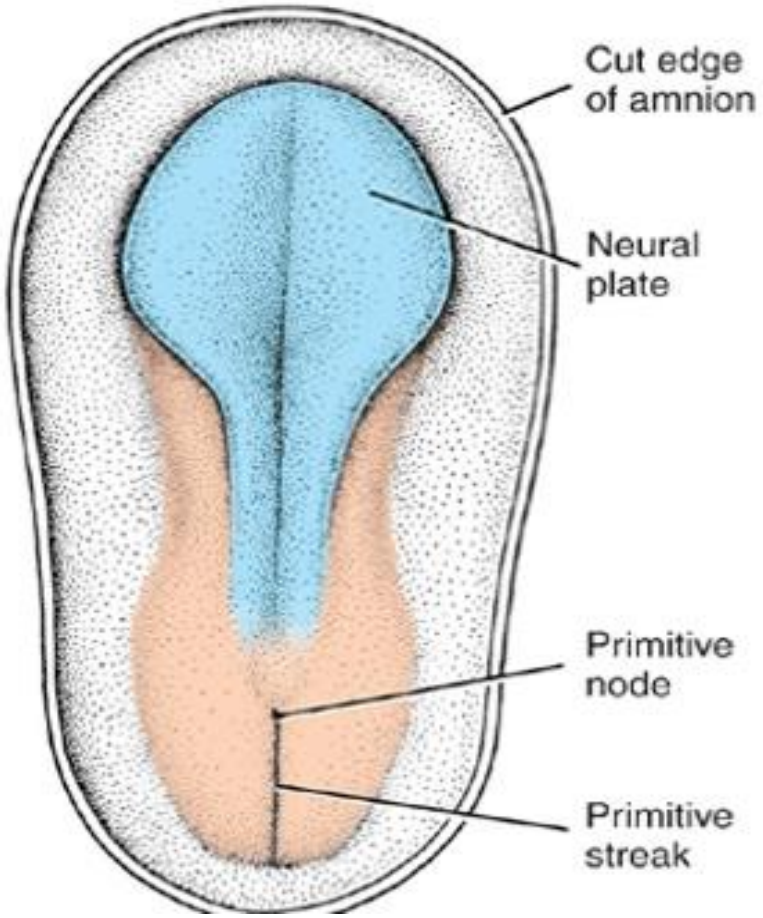
DERIVATIVES OF THE ECTODERMAL GERM LAYER

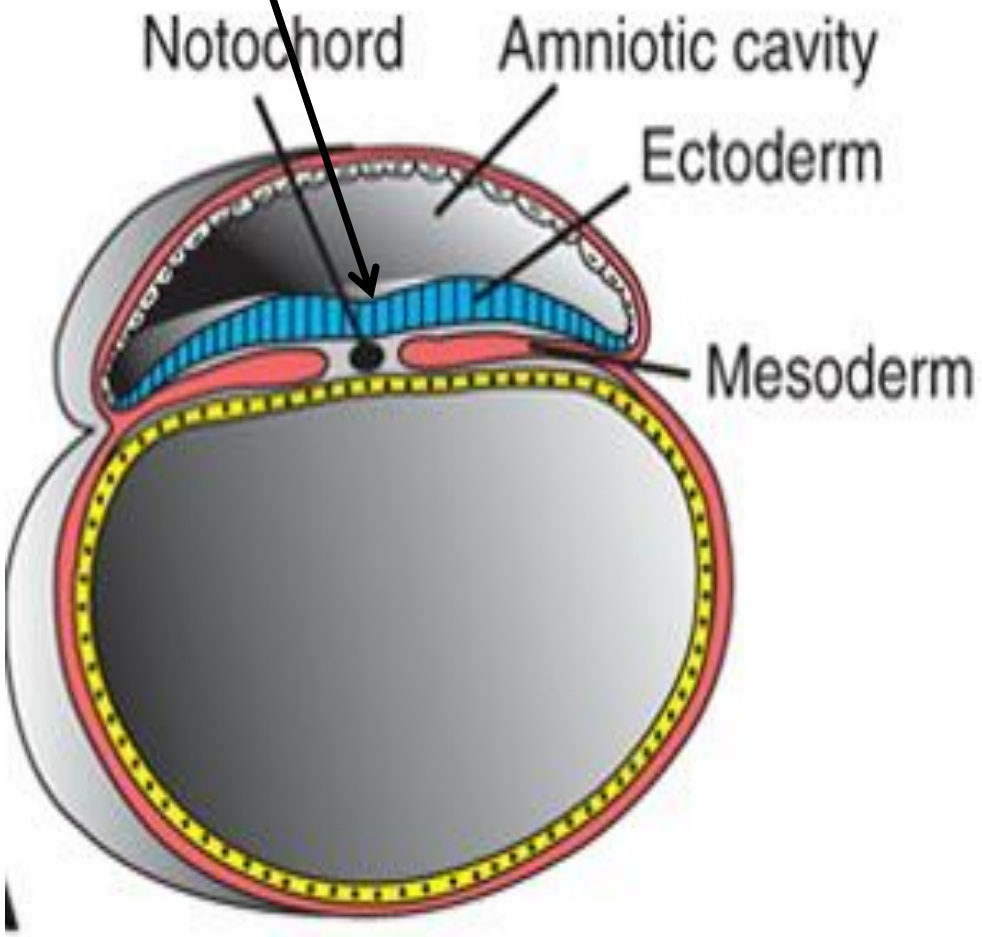
Development of the neural tube

At the middle of the epiblast another swelling called

1- <u>neural plate appears</u>

The neural plate replaces the receding primitive streak and closes the pore formed before



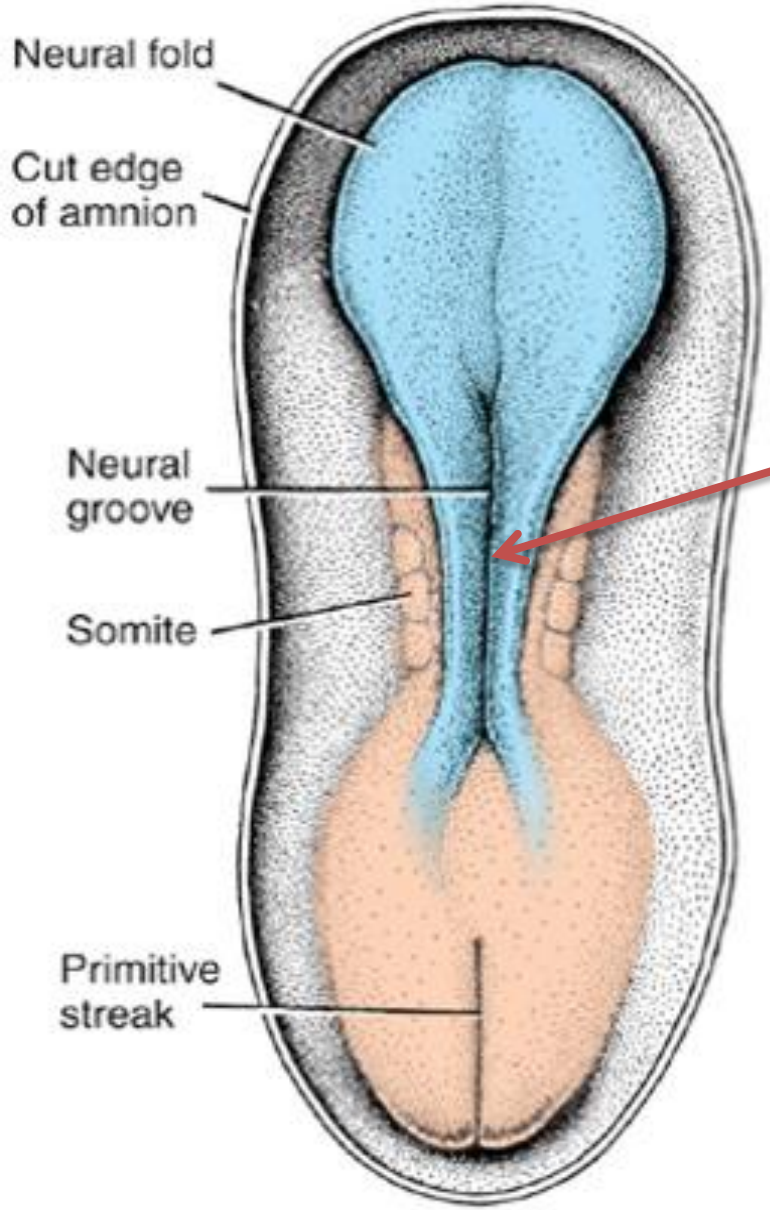


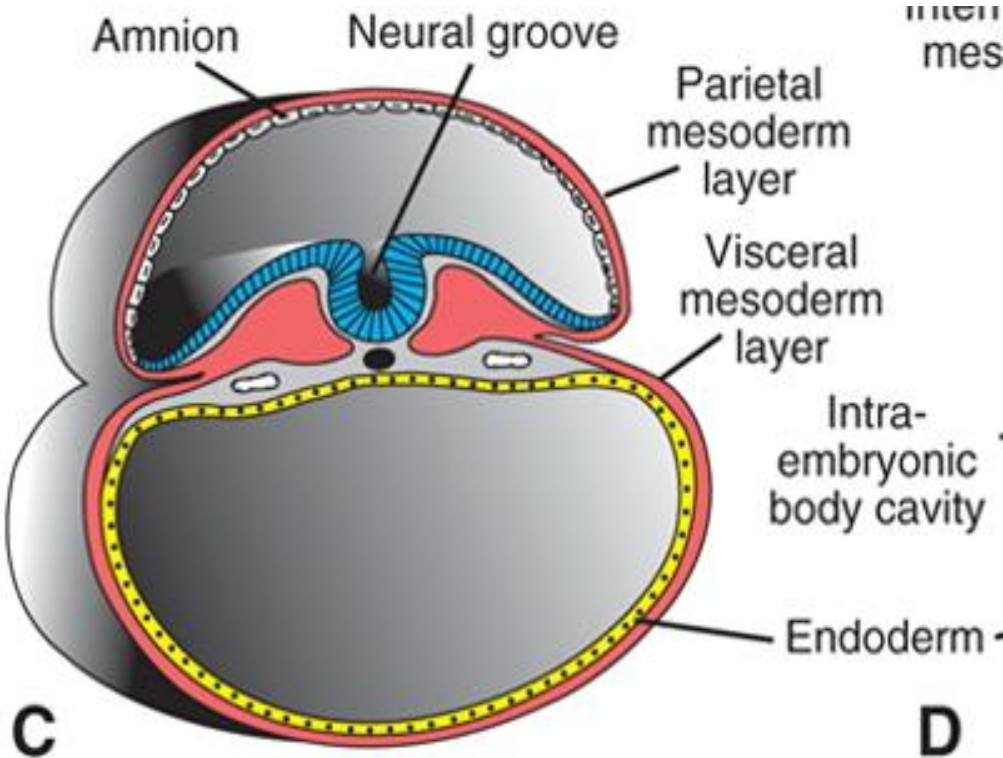
By the end of the third week,
the lateral edges of the neural plate become more elevated to form

neural folds

the depressed midregion forms the

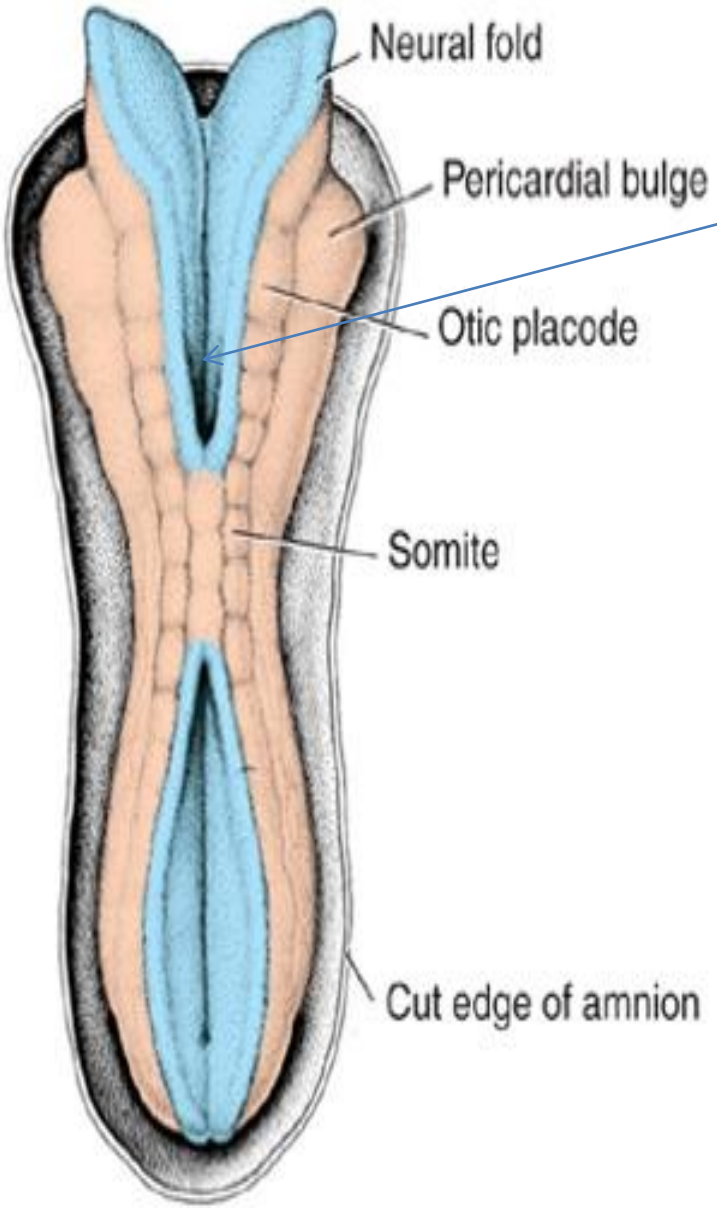
2-Neural groove

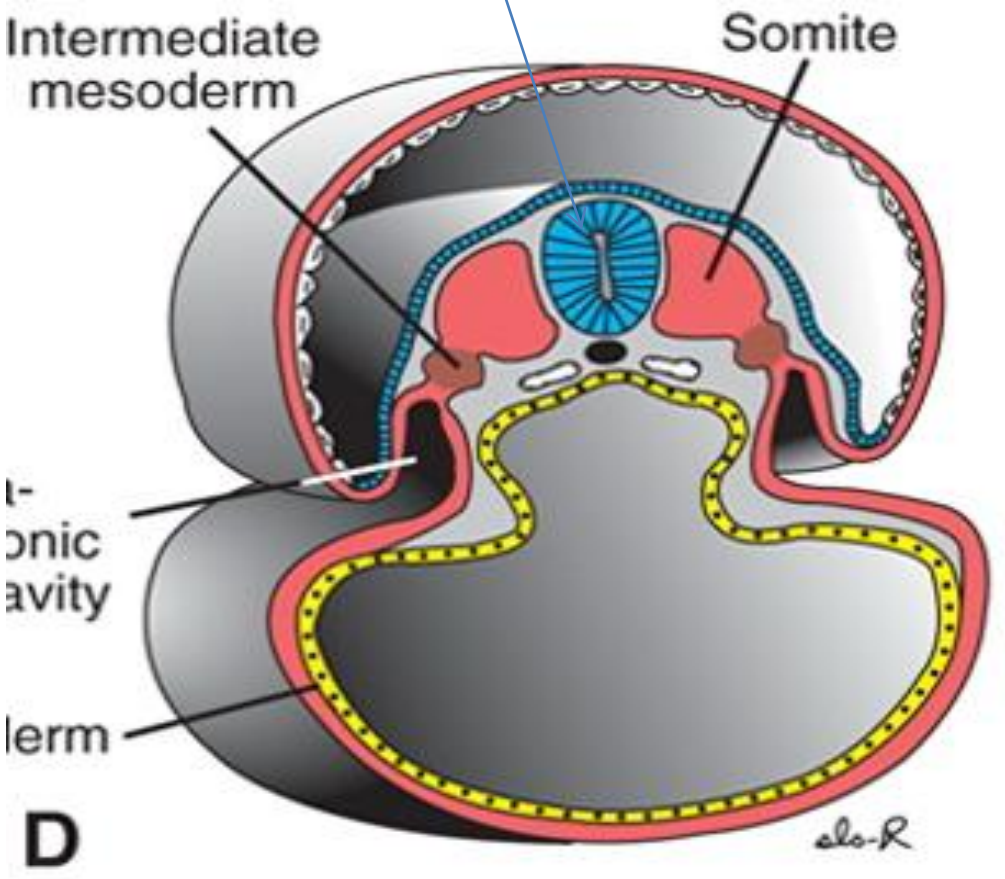




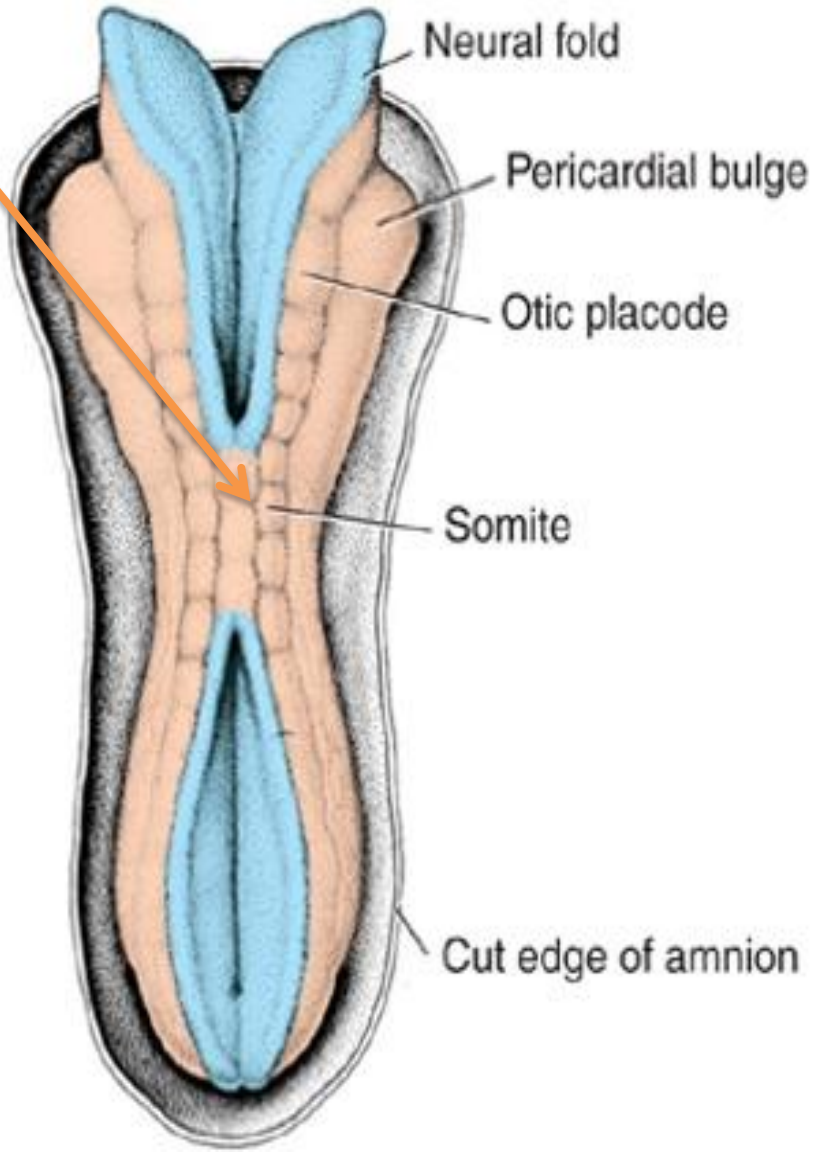
Gradually, the neural folds approach each other in the midline, where they fuse and form:

3-Neural tube



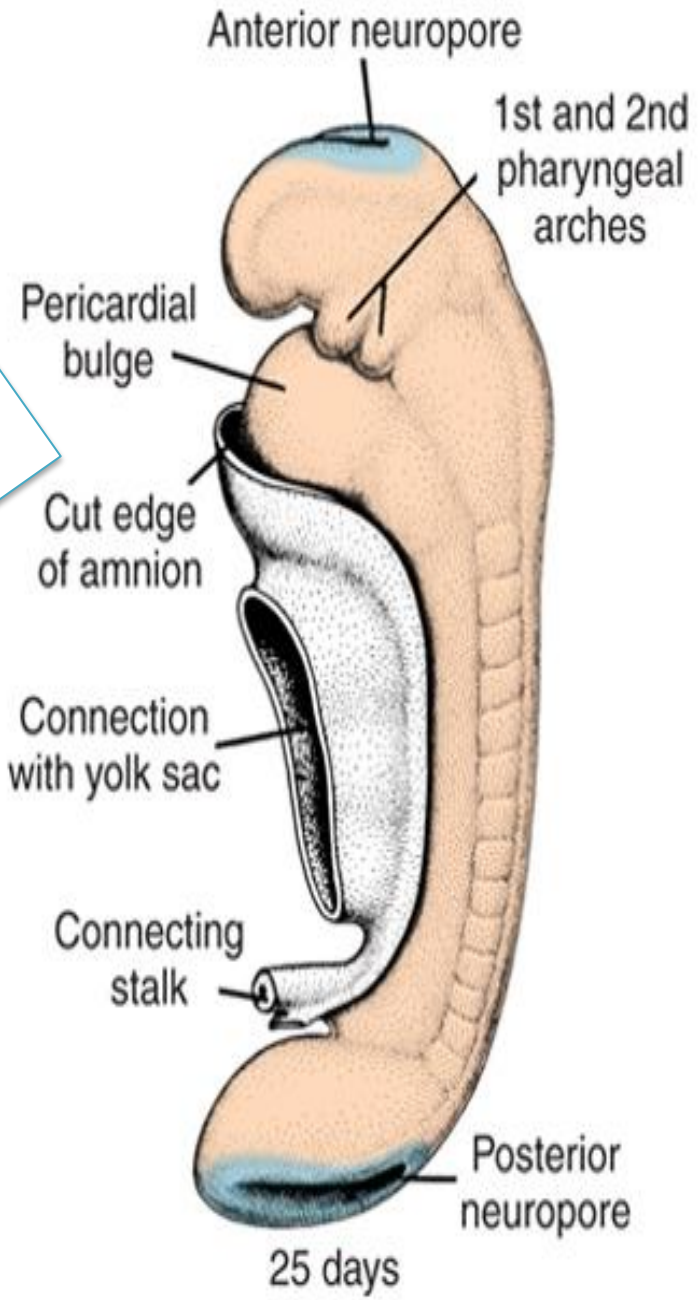


Fusion begins in the cervical region
(fifth somite)
and proceeds cranially and caudally As a result the **neural tube is formed.**



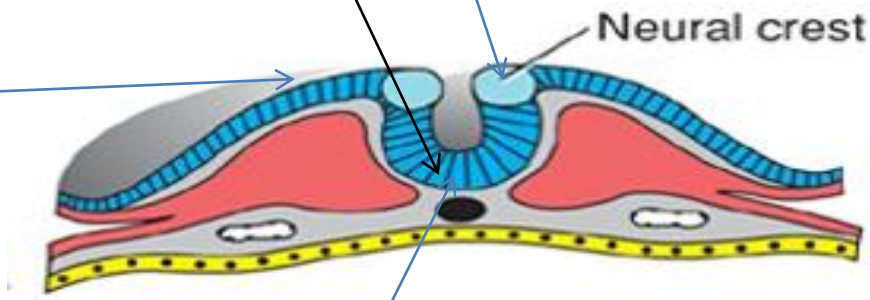
Until fusion is complete
the cephalic and caudal ends
of the neural tube
communicate with the amniotic cavity
by way of
the **cranial and caudal neuropores**

Closure of
the **cranial neuropore**
occurs at approximately
day **25**
whereas the **posterior neuropore** closes at
day **27**



Parts of the neural tube

1-neural crest
2-alar plate
3-basal plate



alar plate

basal plate

THE NERVOUS SYSTEM IS FORMED FROM THE ECTODERM (THE NEURAL TUBE)

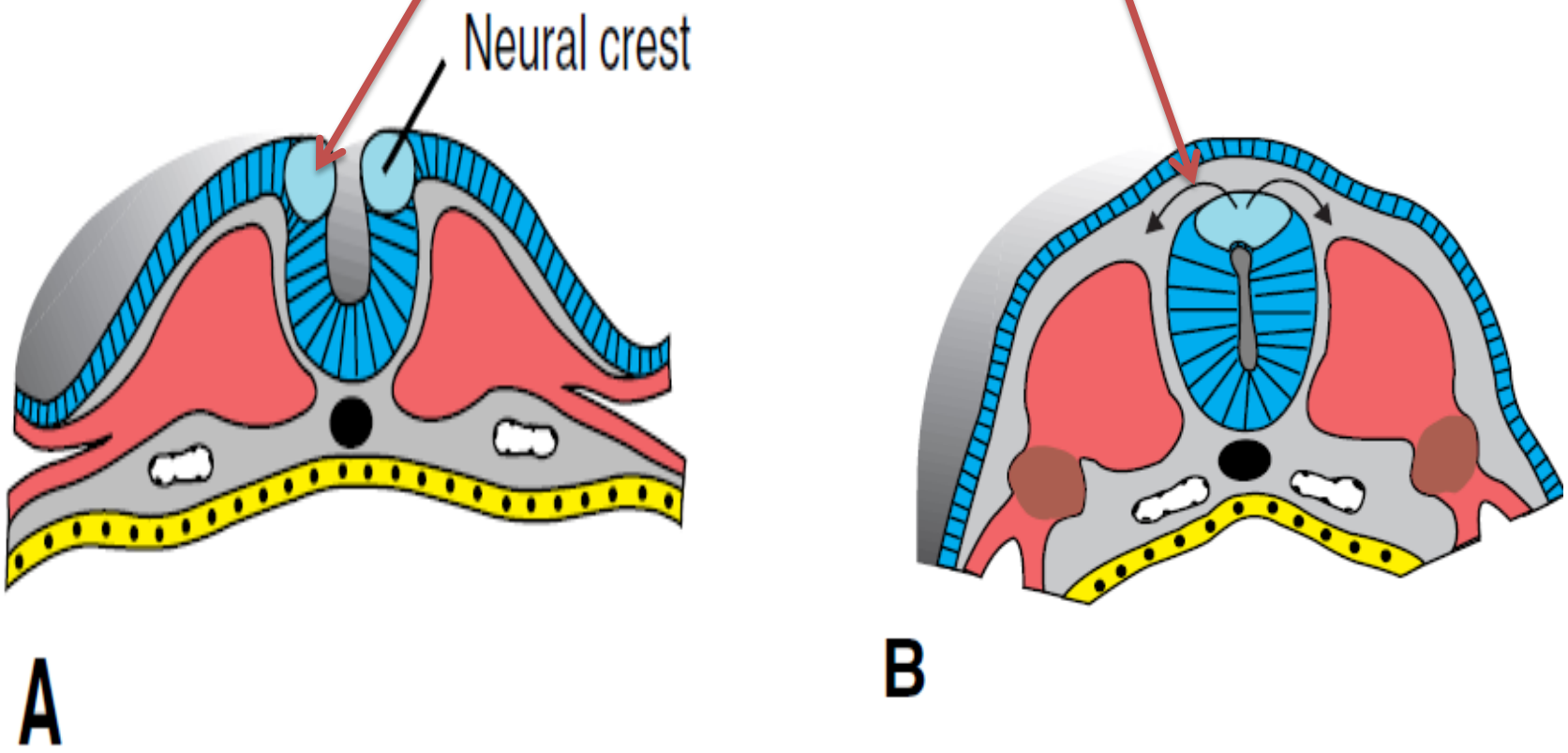
The neural crest gives rise to the ganglia

The alar plate gives rise to the sensory part of the nervous system

The basal plate gives rise to the motor part of the nervous system

NEURAL CREST

<u>Cells at the lateral border</u> or crest of the neuroectoderm begin to dissociate from their neighbors AND **undergo an epithelial-to-mesenchymal transition as it leaves the neuroectoderm by active migration and displacement to enter the underlying mesoderm**



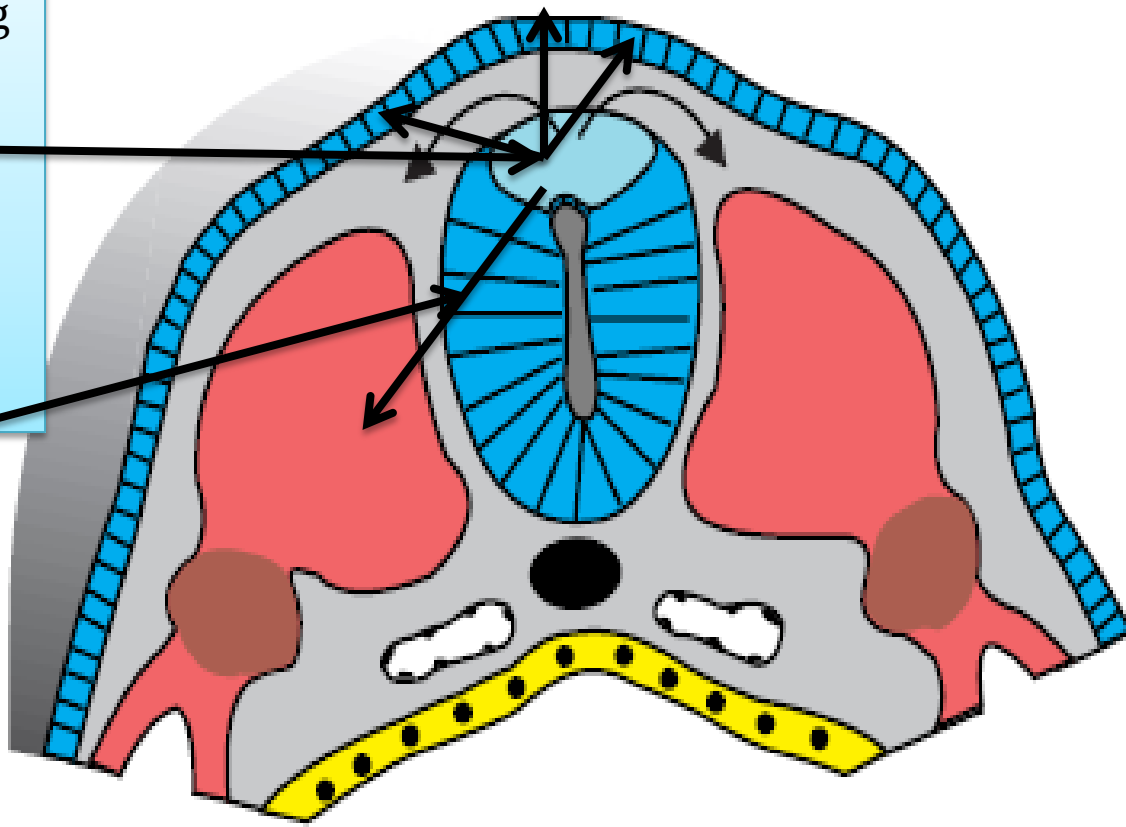
NEURAL CREST cells migrate along one of two pathways:

1) a dorsal pathway through the dermis, where they will enter the ectoderm to form

melanocytes

In the skin and hair follicles

2) a ventral pathway through the anterior half of each somite to become **sensory ganglia, sympathetic and enteric neurons , Schwann cells, and cells of the adrenal medulla**



B

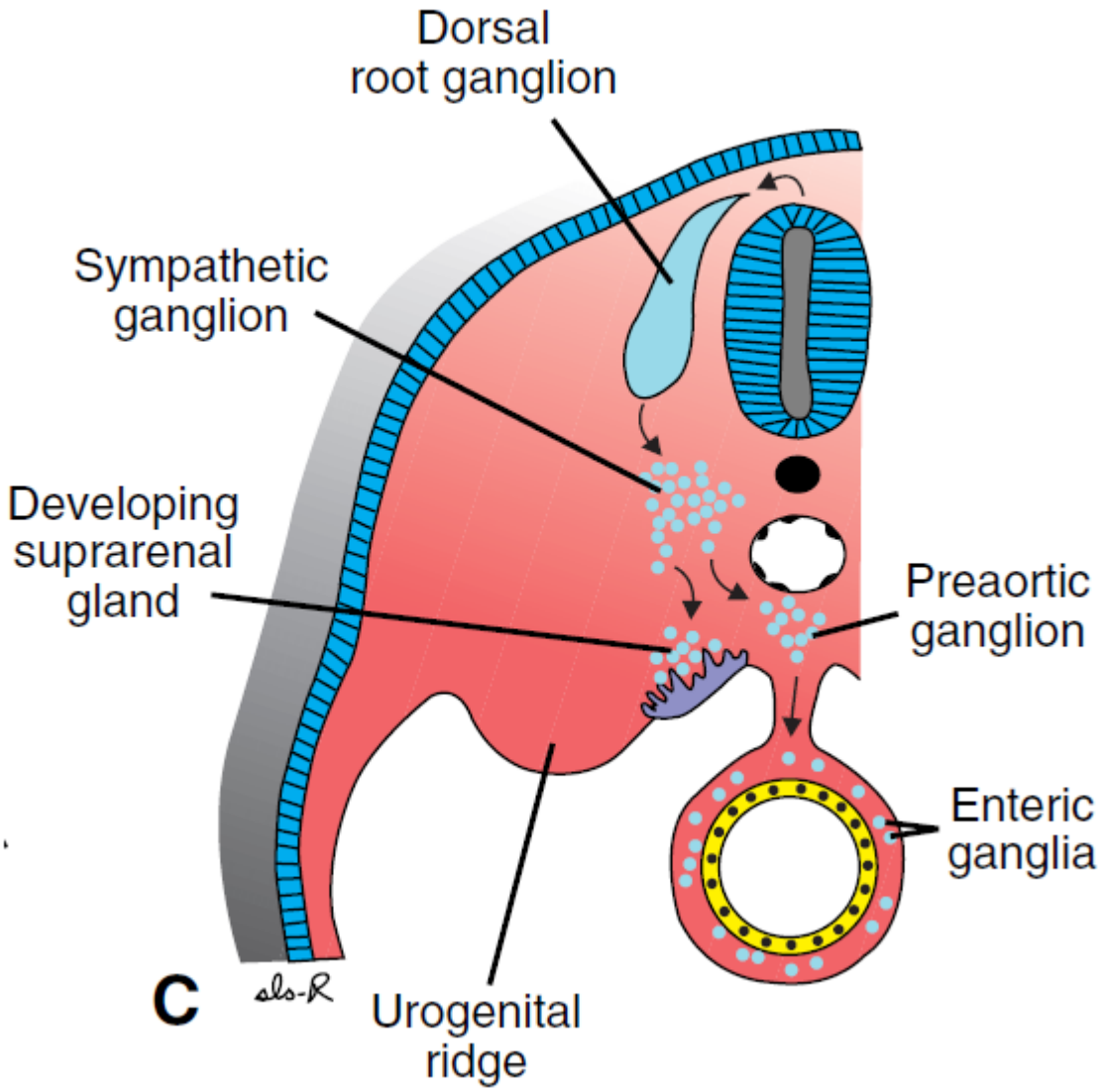
Neural crest cells

also

form and migrate from

cranial neural folds,

leaving the neural tube before closure in this region These cells contribute to the **craniofacial skeleton as well as neurons for cranial ganglia**



Neural Crest Derivatives

1-Connective tissue and ***bones of the face and skull***
2-Cranial nerve ganglia
3-C cells of the thyroid gland
4-Conotruncal septum in the heart
5-Odontoblasts
6-Dermis in face and neck
7-Spinal (dorsal root) ganglia
8-Sympathetic chain and preaortic ganglia
9-Parasympathetic ganglia of the gastrointestinal tract
10-Adrenal medulla
11-Schwann cells
12-Glial cells
13-Arachnoid and pia mater (leptomeninges)
14-**Melanocytes**

In general terms, the ectodermal germ layer
gives rise to organs and structures
that maintain contact with the outside world:

(a) the central nervous

(b) the peripheral nervous system

c) the sensory epithelium of the ear, nose, and eye

(d) the epidermis, including the hair and nails

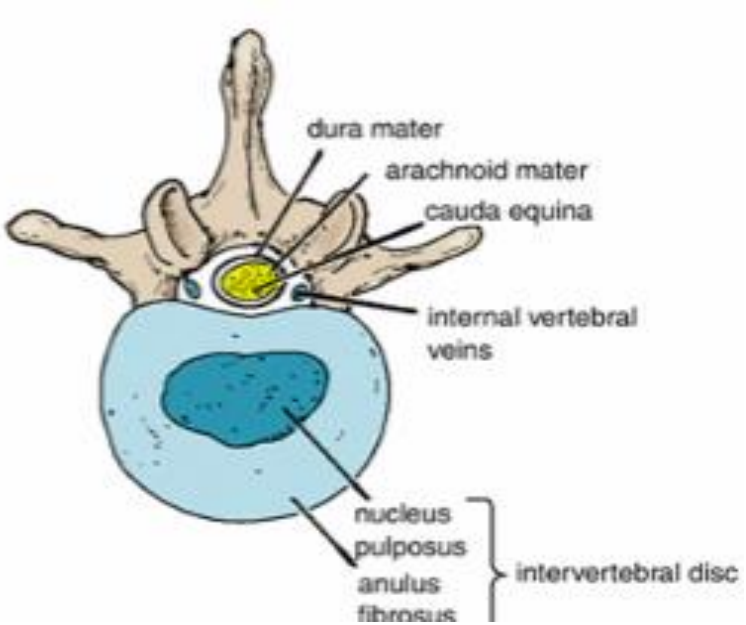
In addition,
it gives rise to subcutaneous glands,
the mammary glands,
the pituitary
gland,
and enamel of the teeth.

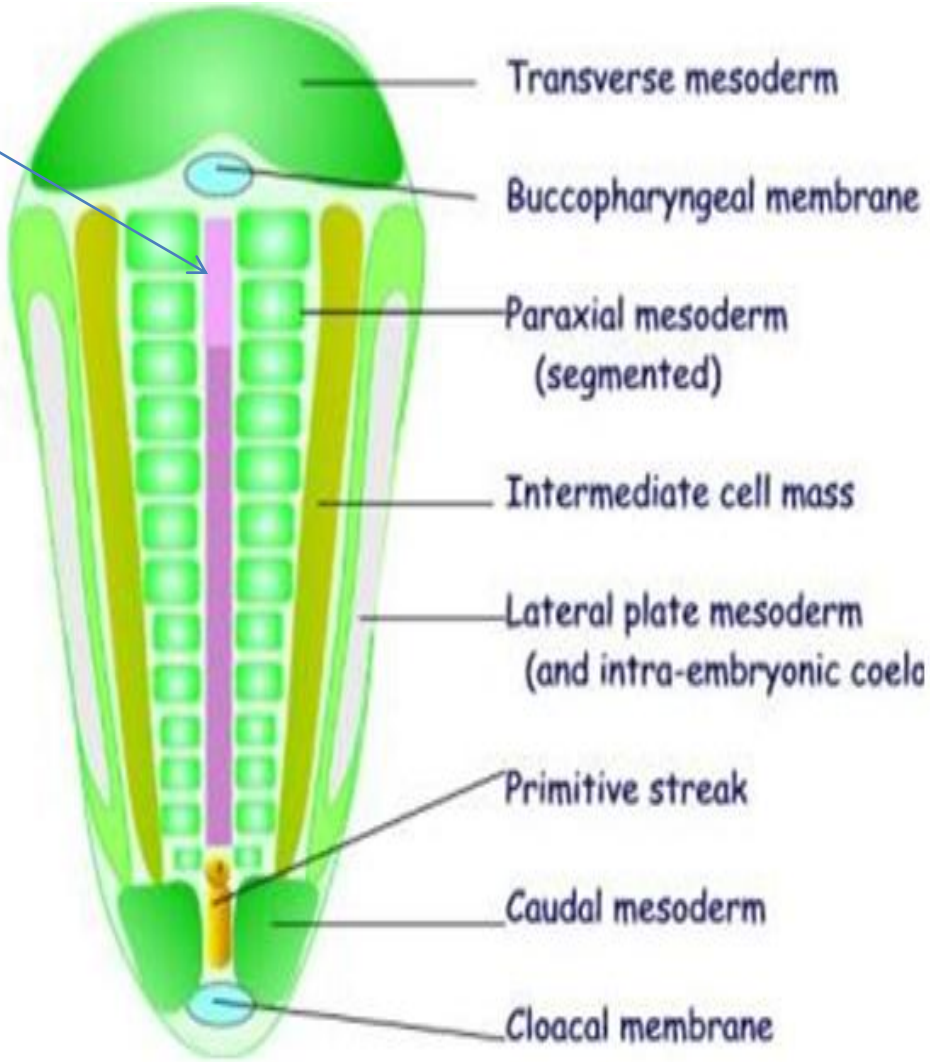
The notochord

gives rise to the

Nucleus pulpous

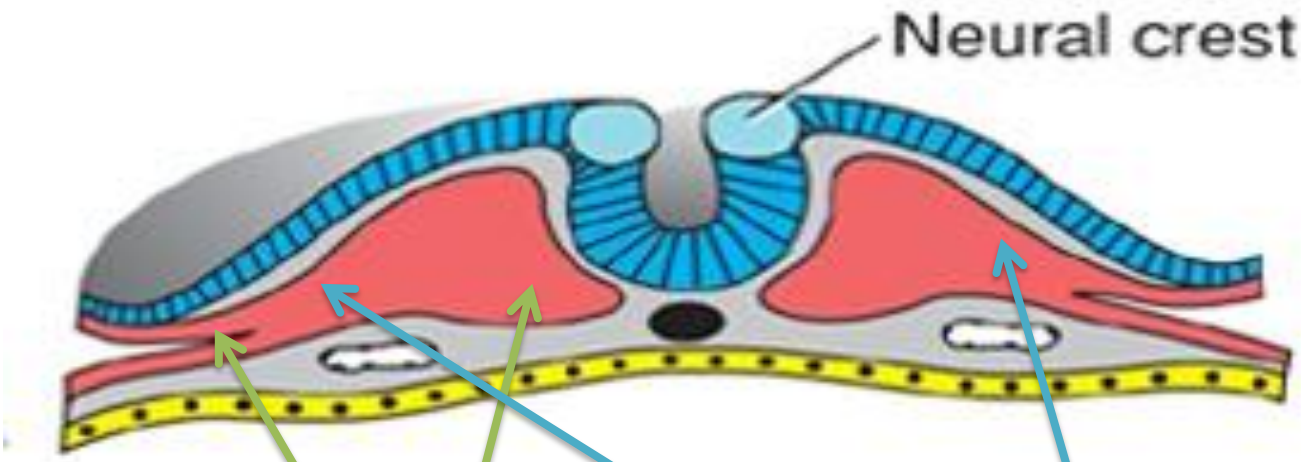
Of the intervertebral disk





DERIVATIVES OF THE MESODERMAL GERM LAYER

Paraxial mesoderm



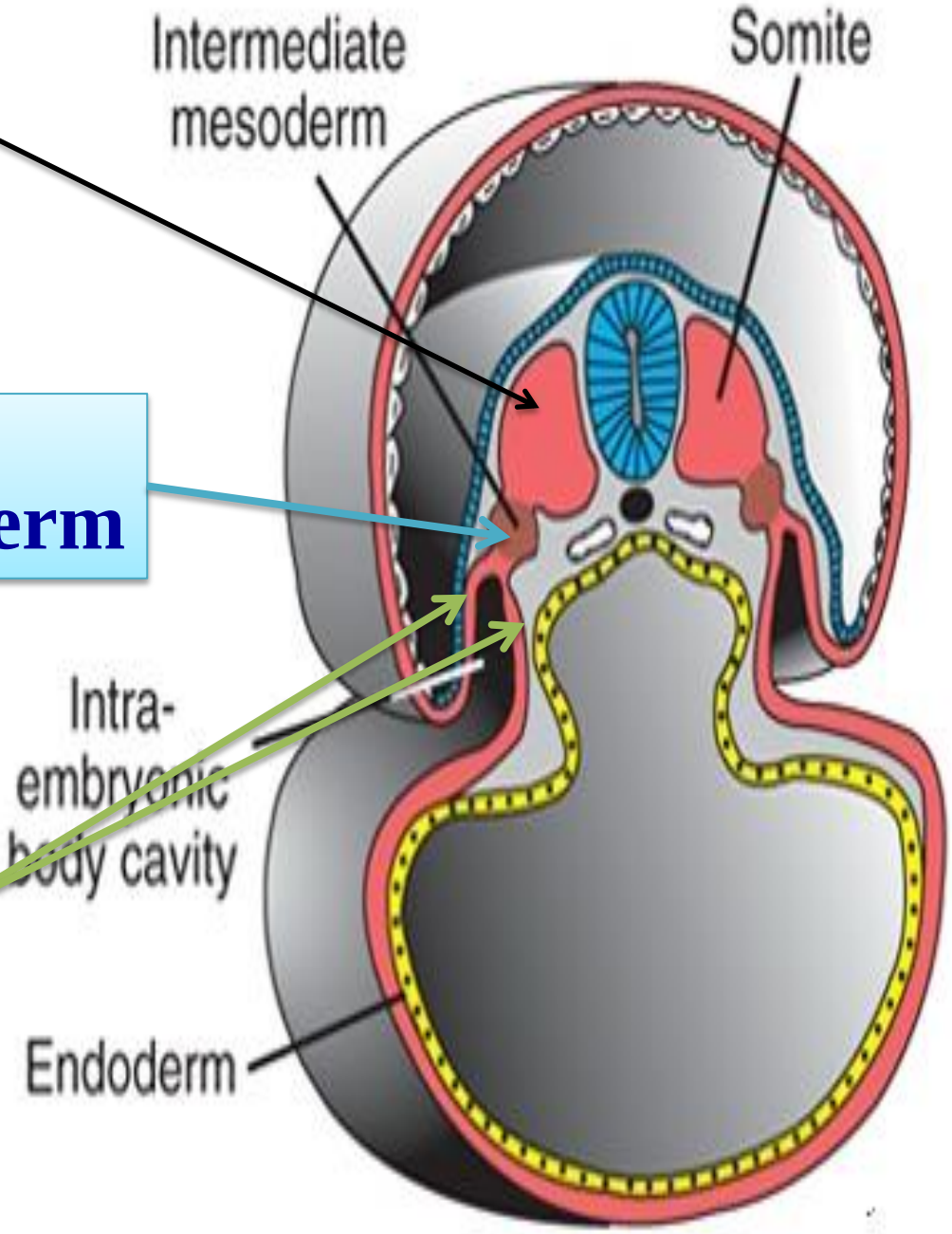
It develops into
TWO PERIPHERAL MASSES
and **a constriction in the middle**

Called:

1-Medail mesoderm

2-Intermediate mesoderm

3-lateral mesoderm

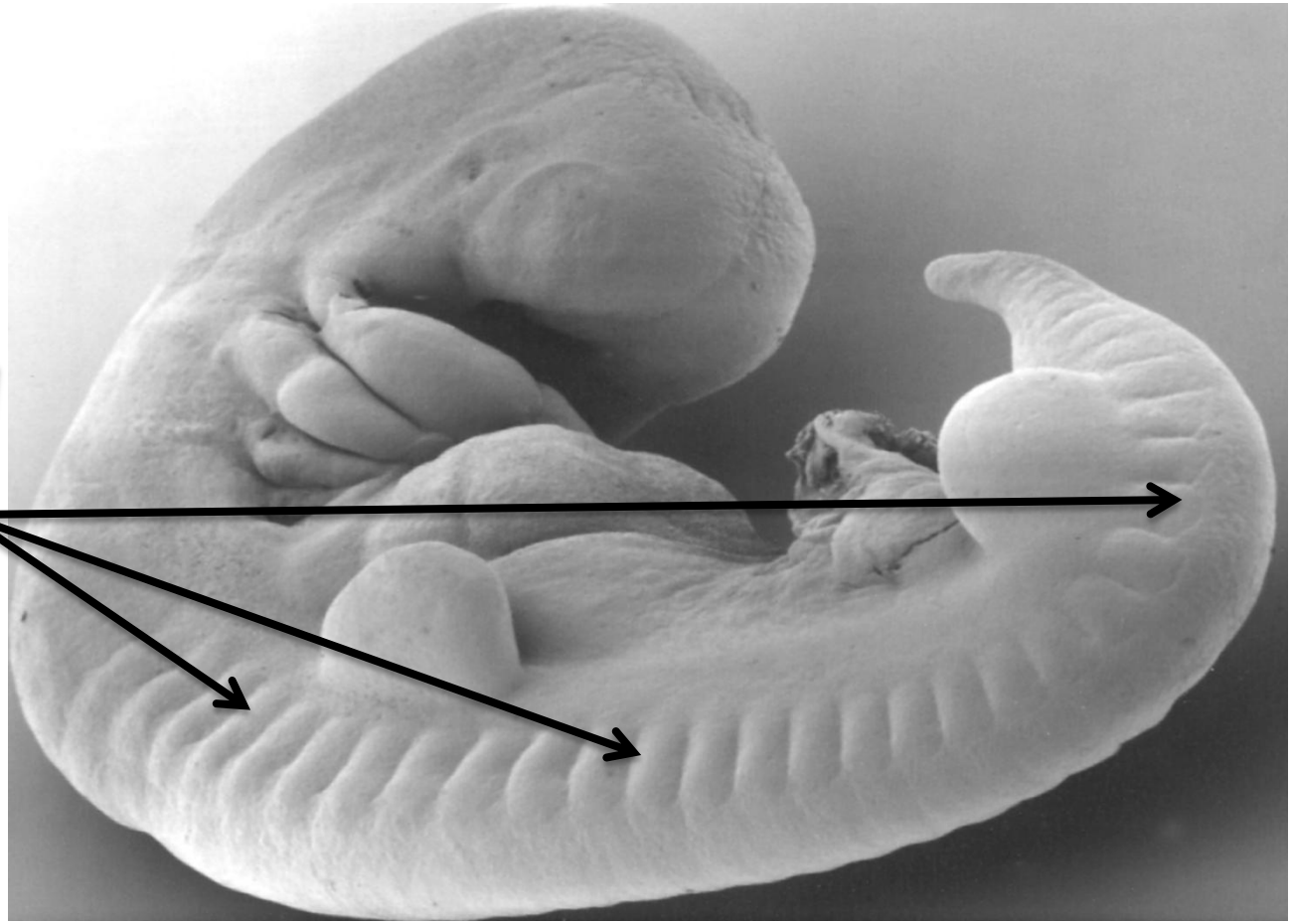


Medial mesoderm

•The medial mesoderm enlarges pushing the ectoderm upwards to give the **somites**

➢As the embryo develops the number of the somites Increases from one to reach about 44-45 somites

➢ when the embryo is completely developed



About 10 somites vanish when the tail of the embryo is lost

❖**<u>The first pair</u>** of somites arises in the **<u>occipital region</u>** of the embryo at approximately the 20th day of development

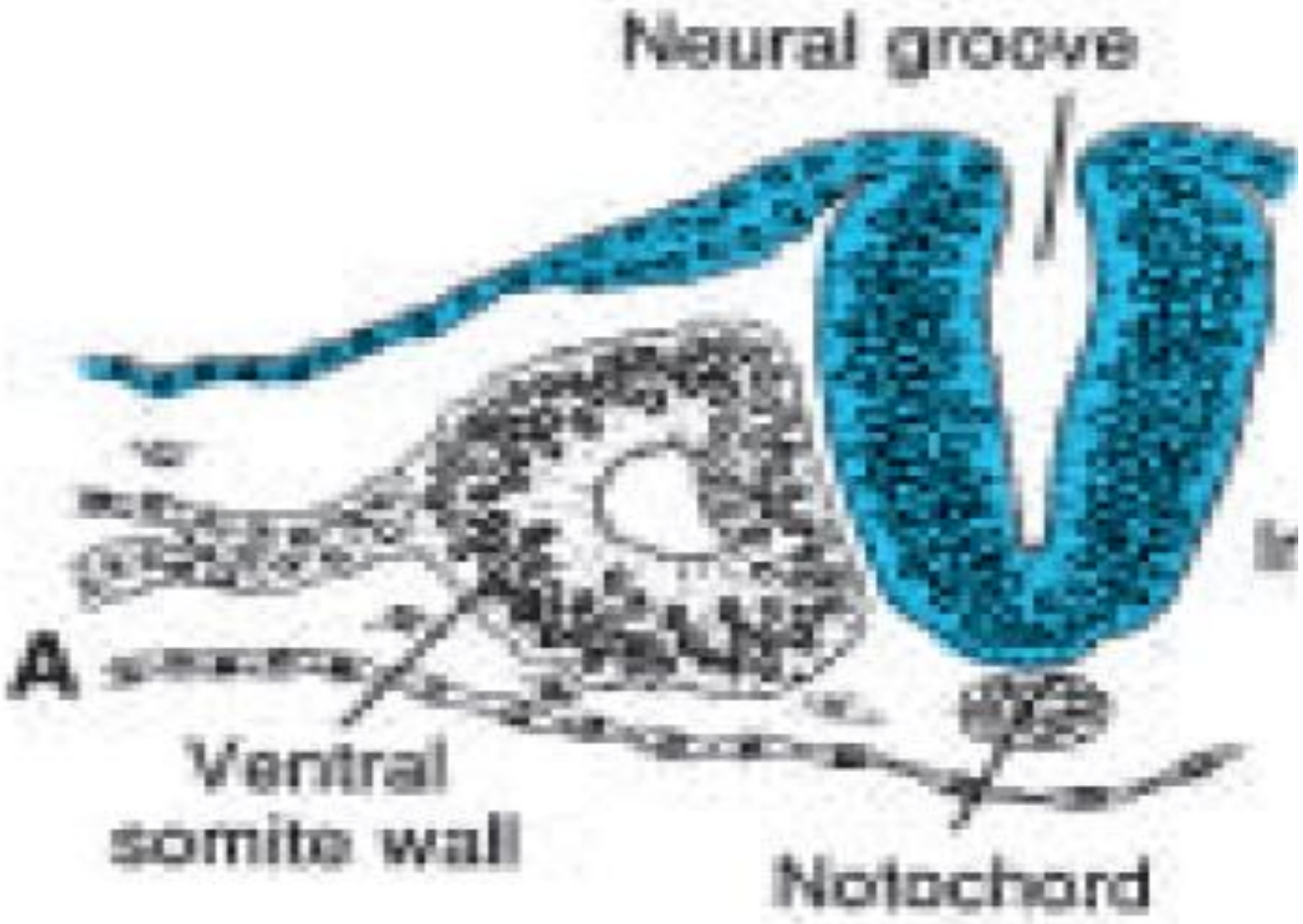
❖From here, new somites appear in craniocaudal sequence at a rate of approximately three pairs per day until the end ***<u>of the fifth week</u>***,

<u>There are:</u>

four occipital
eight cervical
12 thoracic
five lumbar
five sacral,
and eight to 10 coccygeal pairs.

The
first occipital and the last five to seven coccygeal somites later disappear

WHAT IS THE destiny OF EACH SOMITE?

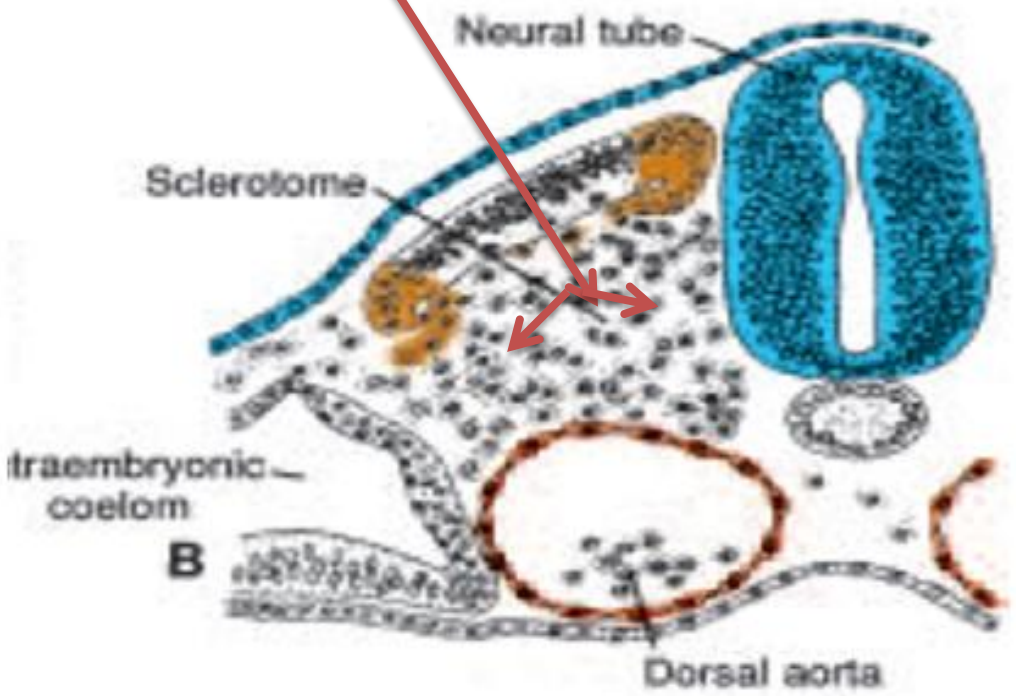


By the beginning of the fourth week
cells forming the ***ventral and medial walls of the somite***
lose their compact organization,
and shift their position to surround the notochord
These cells, collectively known as

THE SCLEROTOME

They will surround the spinal cord and notochord to form

the vertebral column

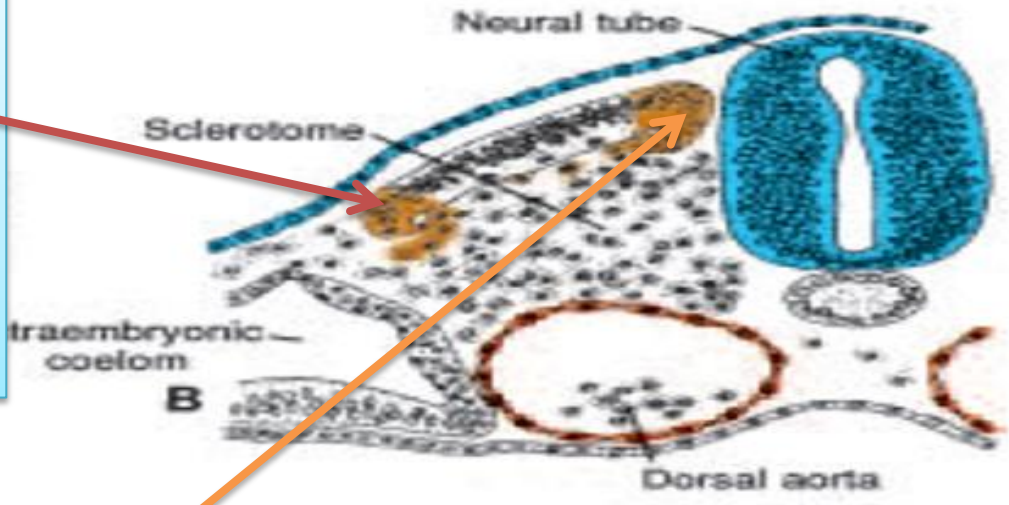


Cells at the dorsolateral portion of the somite also migrate as precursors of the

<u>limb and body wall</u>

musculature

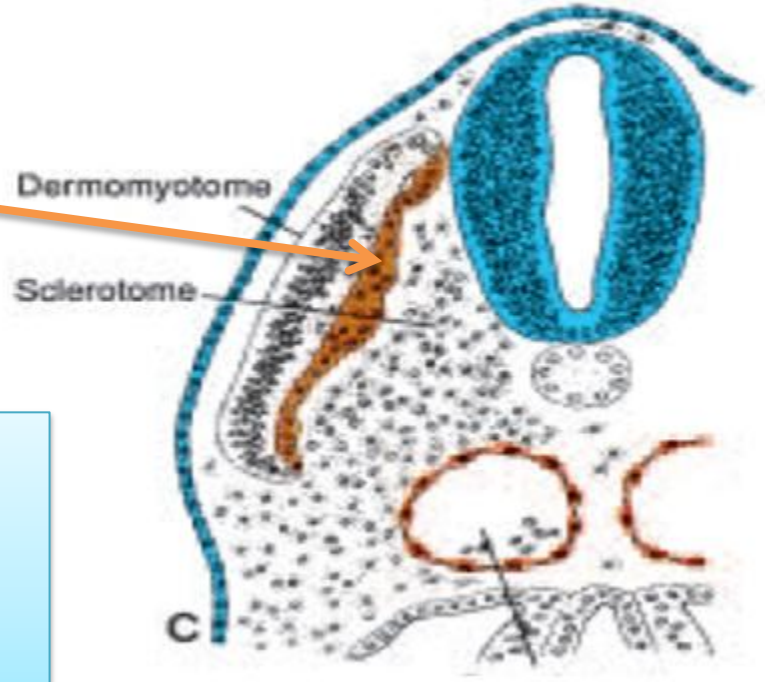
(hypomeric) musculature



After migration of these muscle cells and cells of the sclerotome,

<u>Cells at the dorsomedial</u> portion of the somite proliferate and migrate to form a new layer

THE MYOTOME



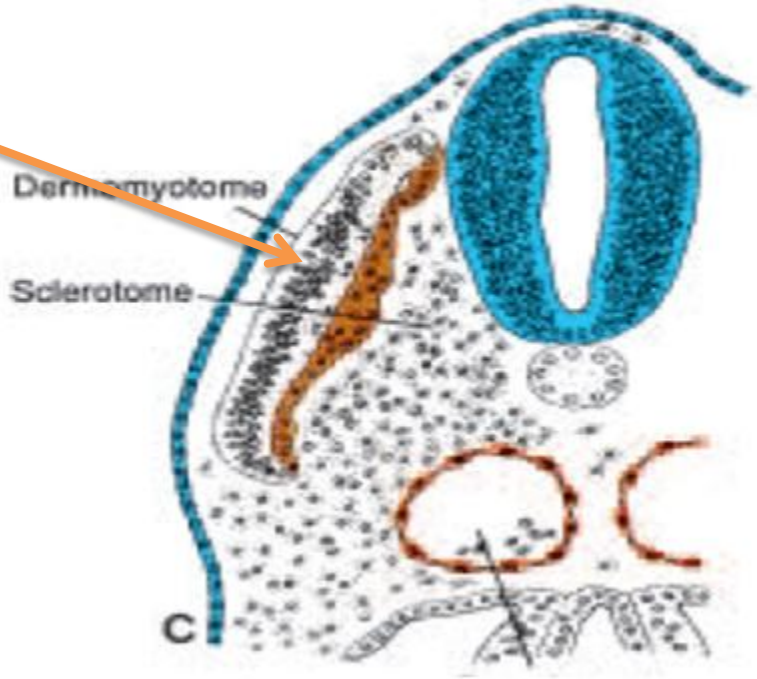
myotome contributes to muscles of the back (epaxial musculature)

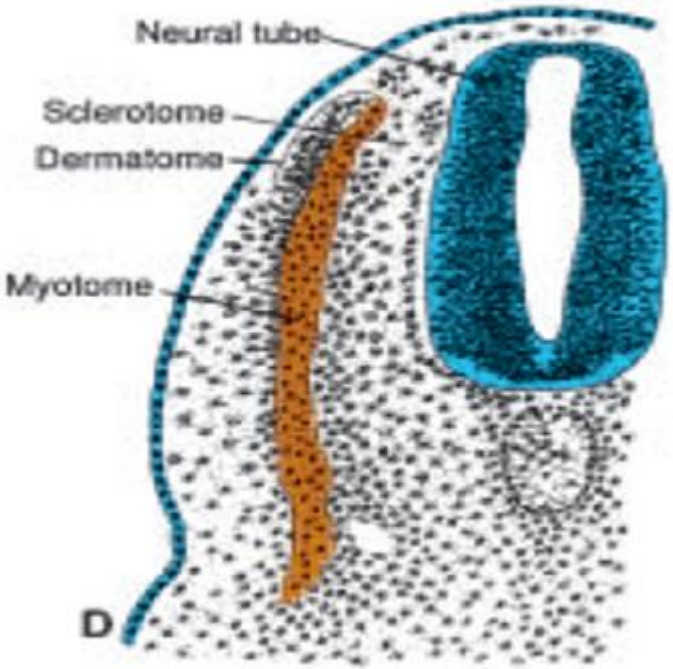
<u>or epimeric musculature</u>

the **extensor muscles of the vertebral** column

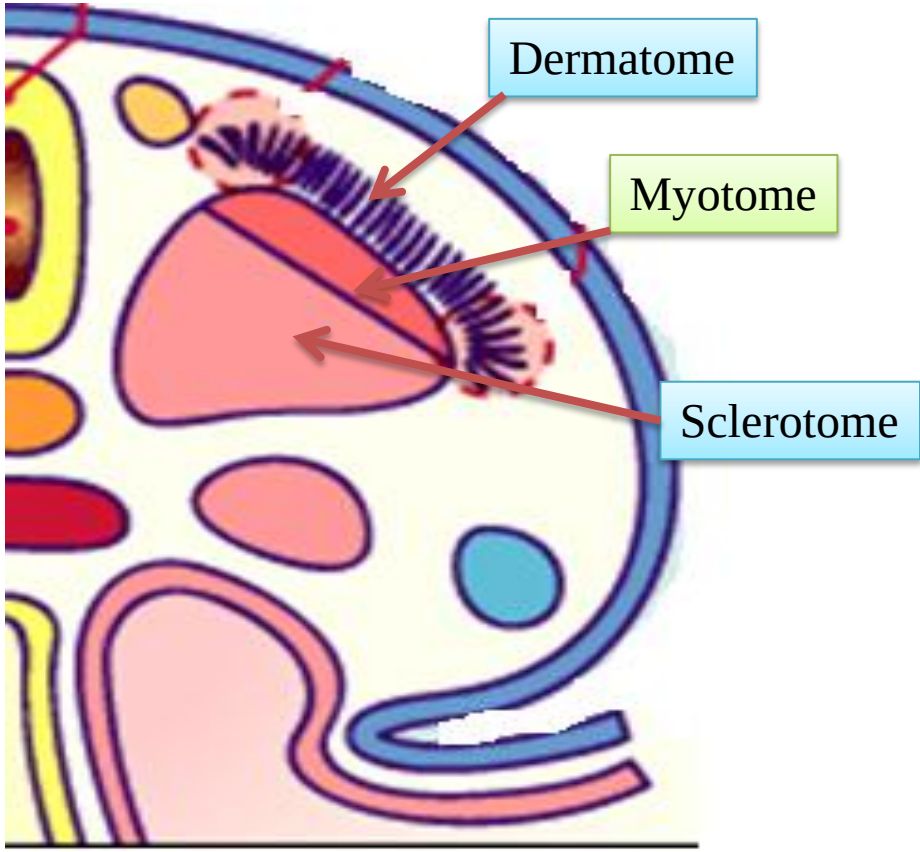
The remaining dorsal epithelium
forms the dermatome

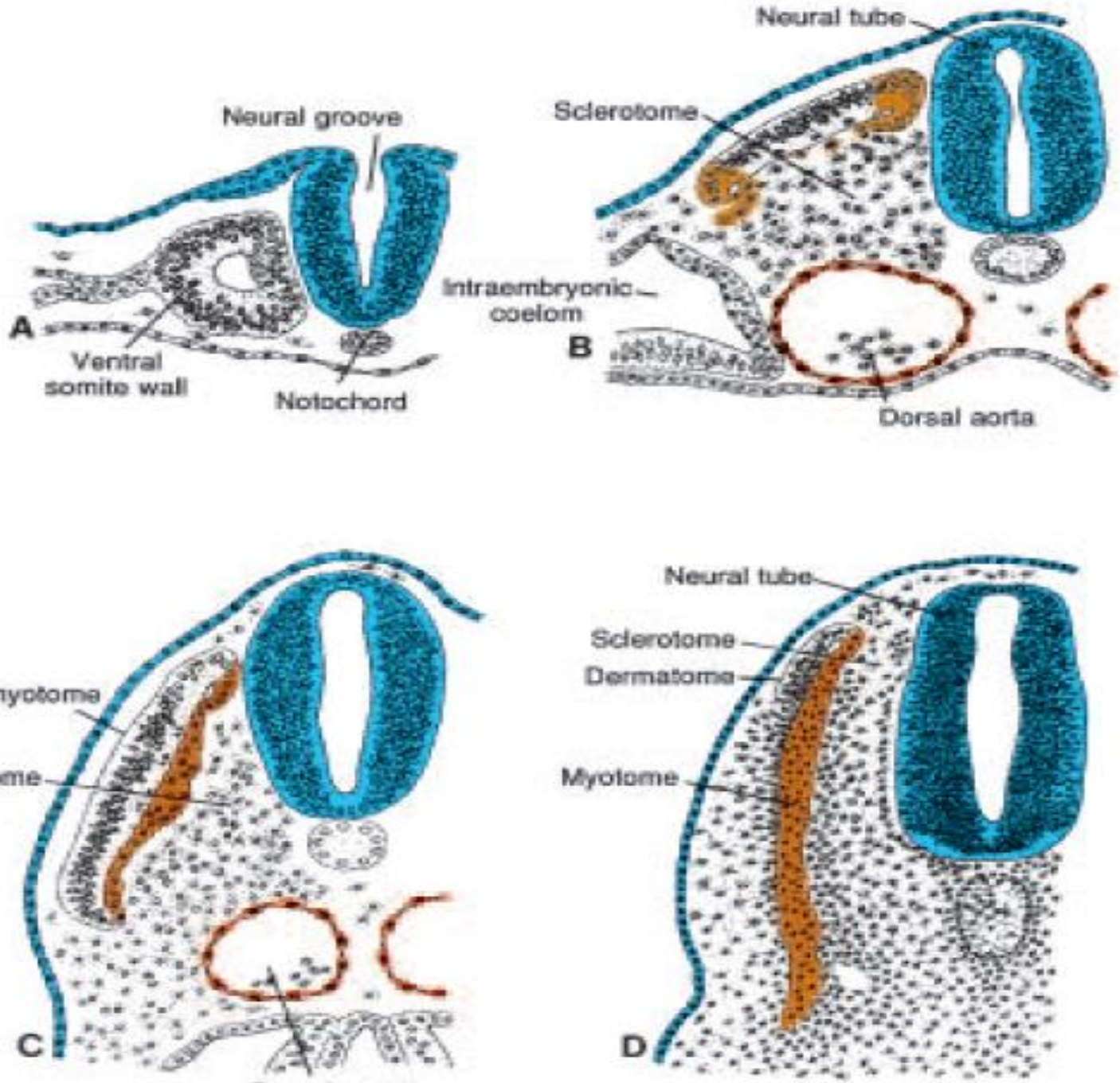
dermatomes form
the dermis and subcutaneous tissue of the skin





a transversal section through the embryo at level A is displayed. The somites have released themselves and form *dermatomes, myotomes and sclerotomes*.



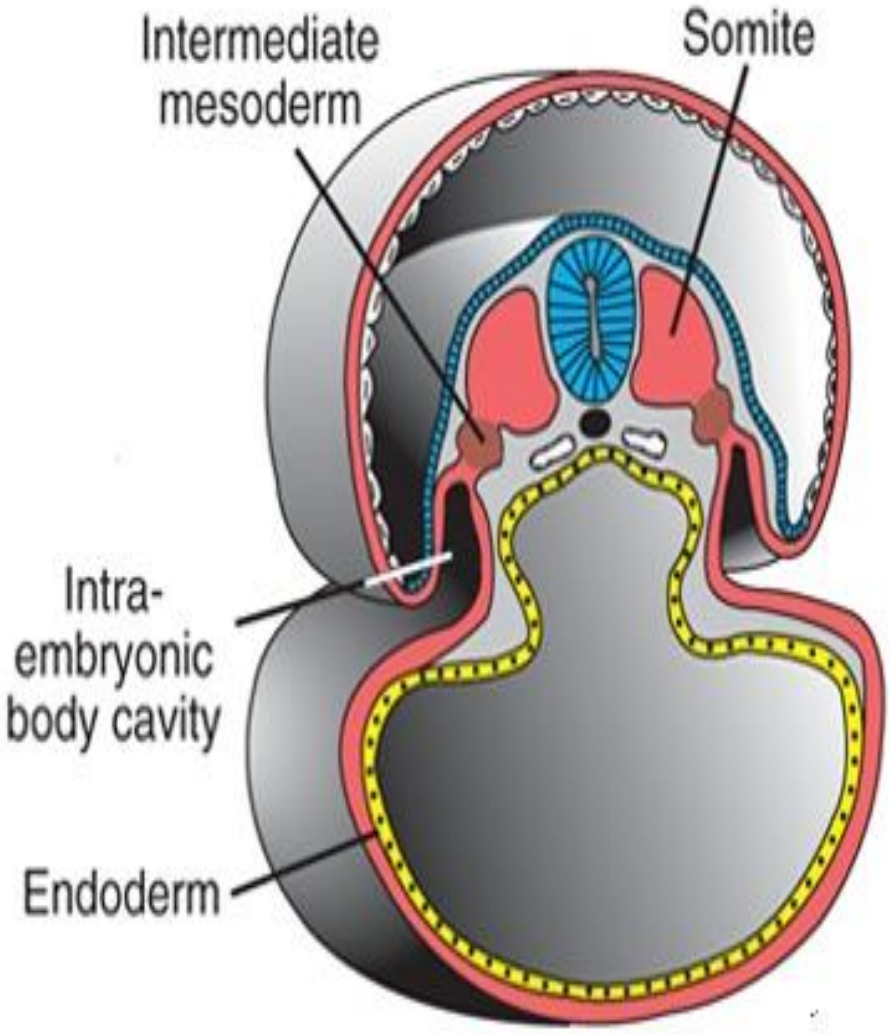

Neural groove
A
Ventral somite wall
Notochord
Neural tube
Sclerotome
Intraembryonic coelom
B
Dorsal aorta
Dermomyotome
Sclerotome
C
Neural tube
Sclerotome
Dermatome
Myotome
D

DERIVATIVES OF THE INTERMEDIATE MESODERM

It gives off:

1- Urine performing tubule (Kidney and ureter)

2-internal genitalia in males and femals (part of it not all)



WHY the embryo folds?

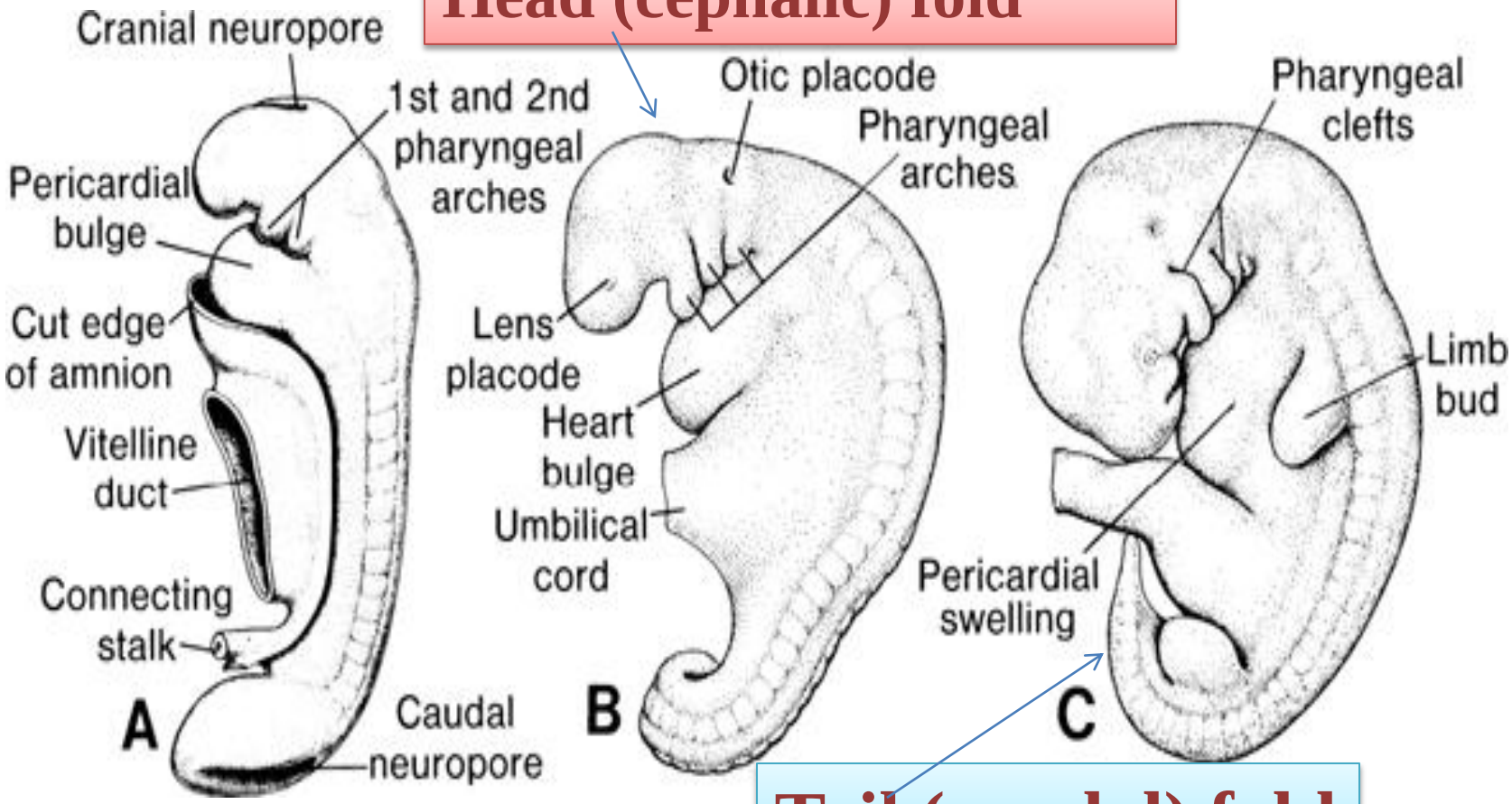
1- Extensive and rapid growth of the cranial end of the neural tube

2- The faster growth of the axial part of the embryonic disc than its periphery

3- Enlargement of the amnion

Folding of the embryo
Cephalocaudally and Laterally

Head (cephalic) fold

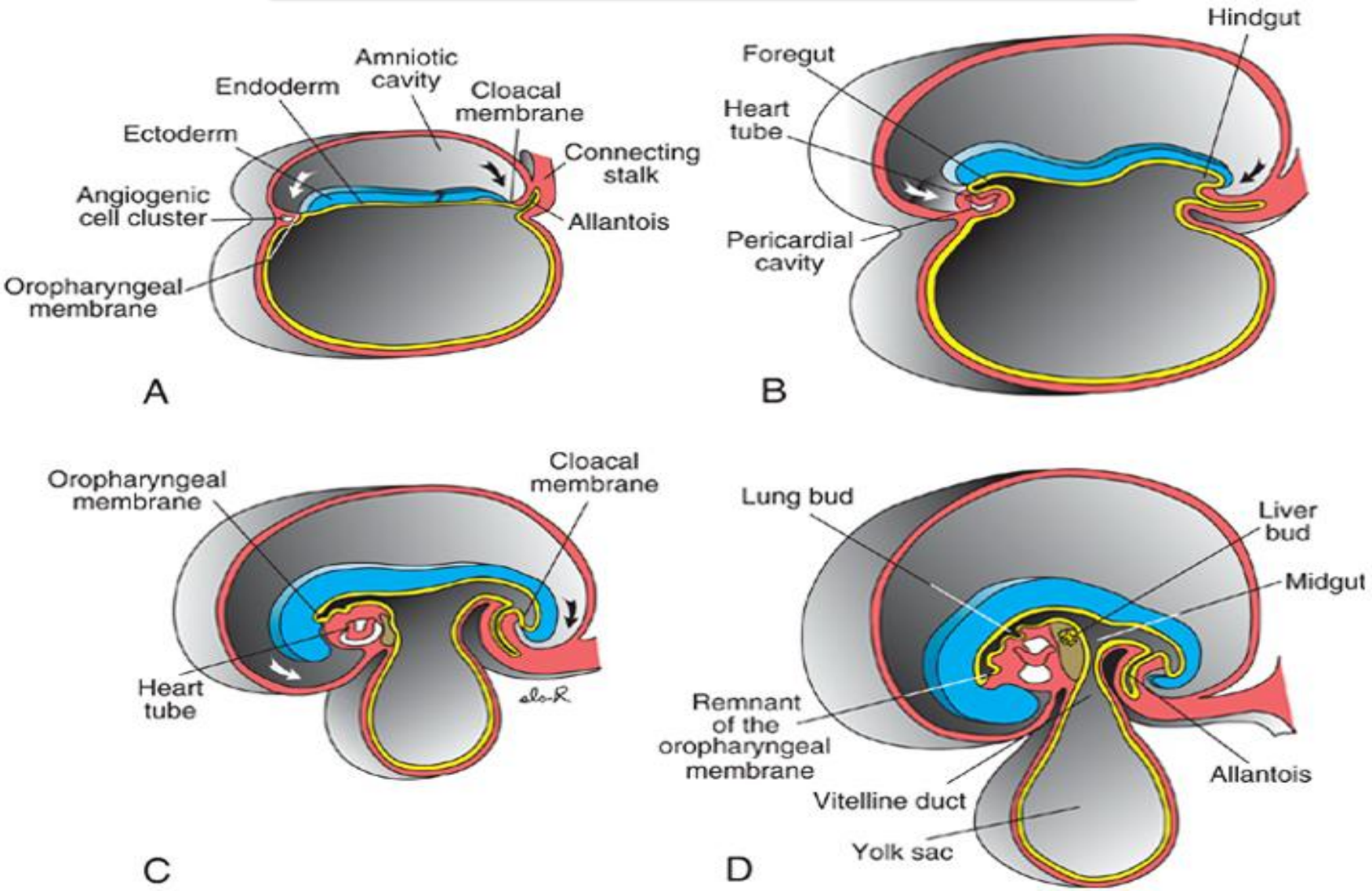


Tail (caudal) fold

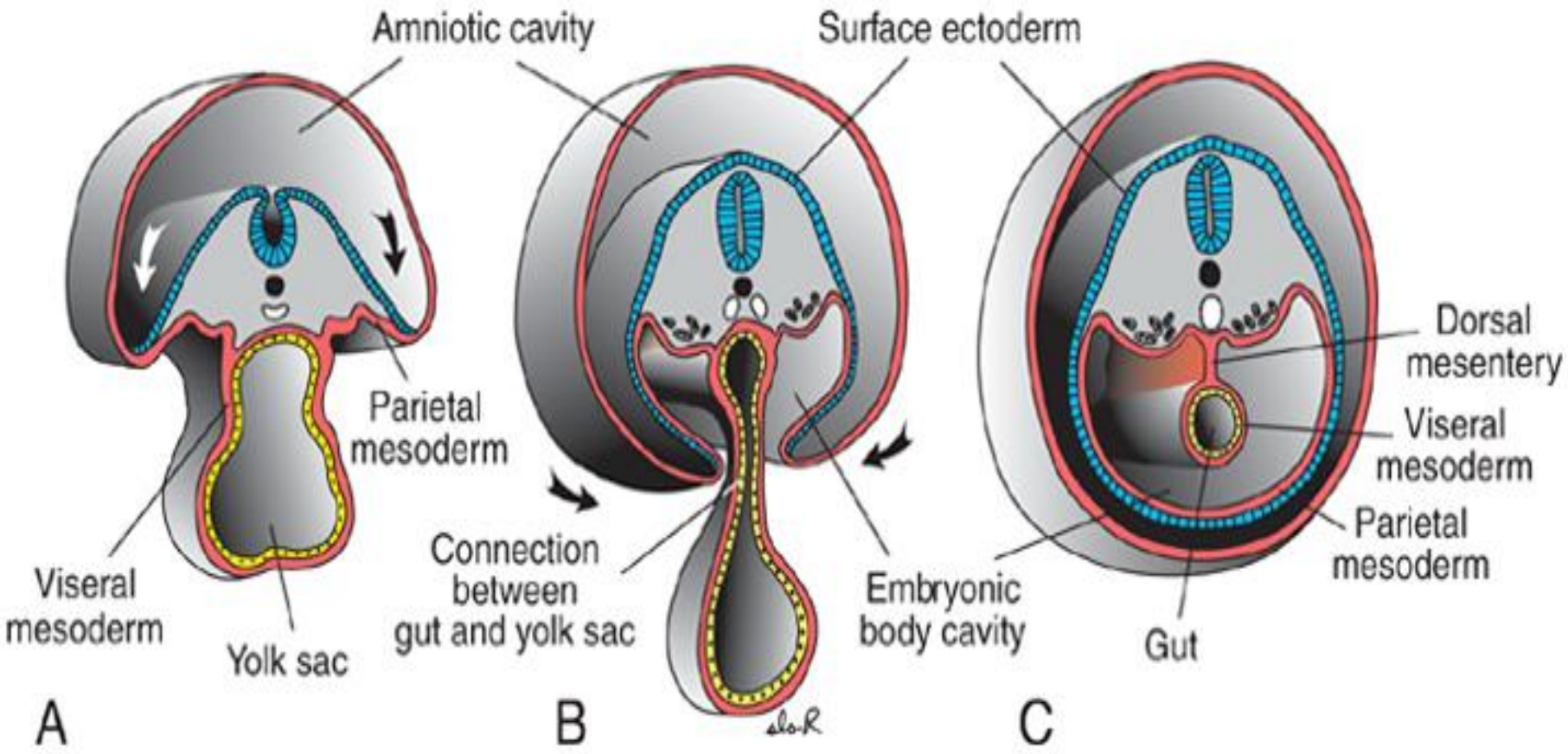
The embryonic disc begins to bulge into the amniotic cavity and to fold

Cephalocaudally

Folding of the embryo
Cephalocaudally

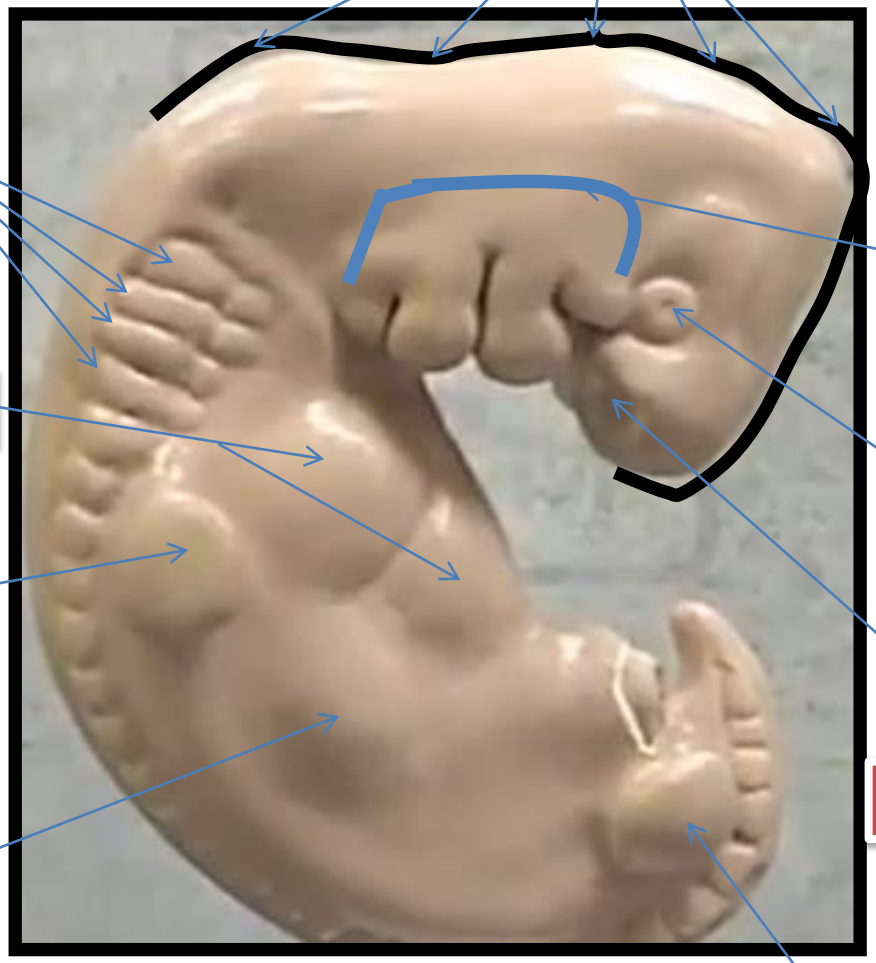


Folding of the embryo Laterally



WEEK 4 EMBRYO

General features



Primordia of the brain

Somites

Branchial arches

Primordia of the heart

Primordia of the eye

Upper limbs bud

Primordia of the nose

Primordia of the liver

Lower limbs bud

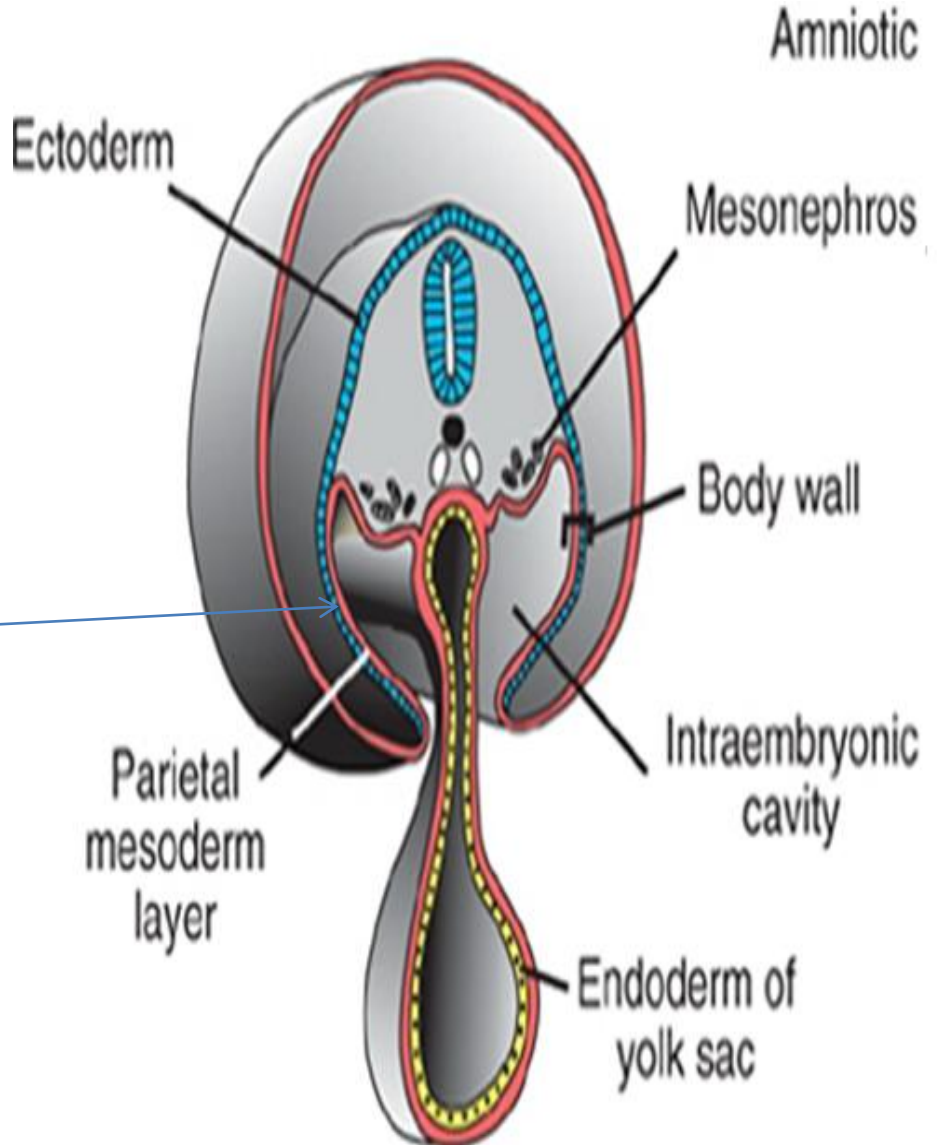
DERIVATIVES OF THE LATERAL MESODERM

Lateral mesoderm splits into two layers:

1- **Parietal (somatic)**

2- **Visceral (splanchnic)**

- Mesoderm from **the parietal layer**, together with **overlying ectoderm**, forms **the lateral body wall folds**
- These folds, together with the head (cephalic) and tail (caudal) folds, **close the ventral body wall**



1-The parietal layer
of lateral mesoderm forms:

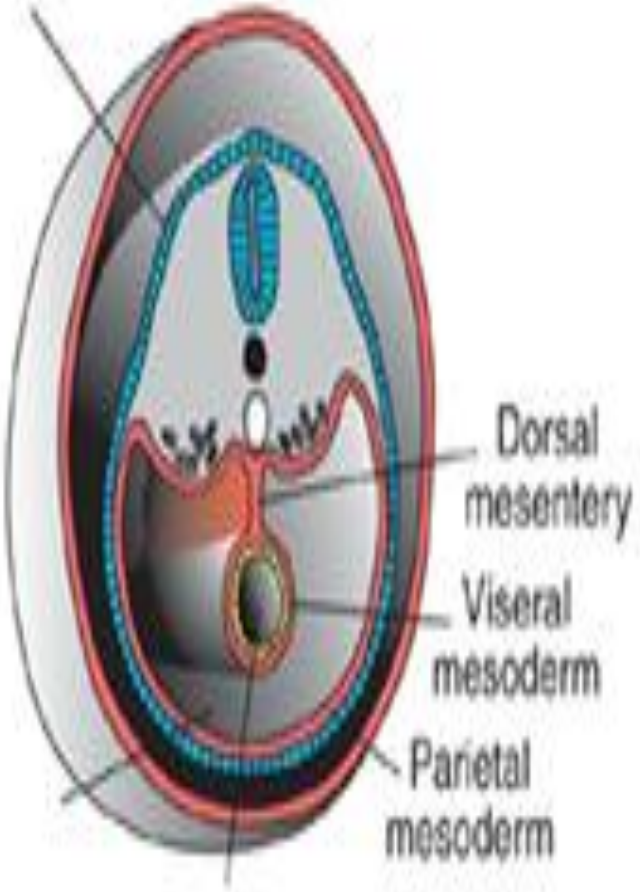
A) The dermis of the skin in the body wall and limbs

B) The bones and connective tissue of the limbs

C) The sternum

D) Mesoderm cells of the parietal layer surrounding the intraembryonic cavity form thin membranes, the mesothelial membranes**, or serous membranes, which will line the**
1-peritoneal
2- pleural 3- pericardial cavities

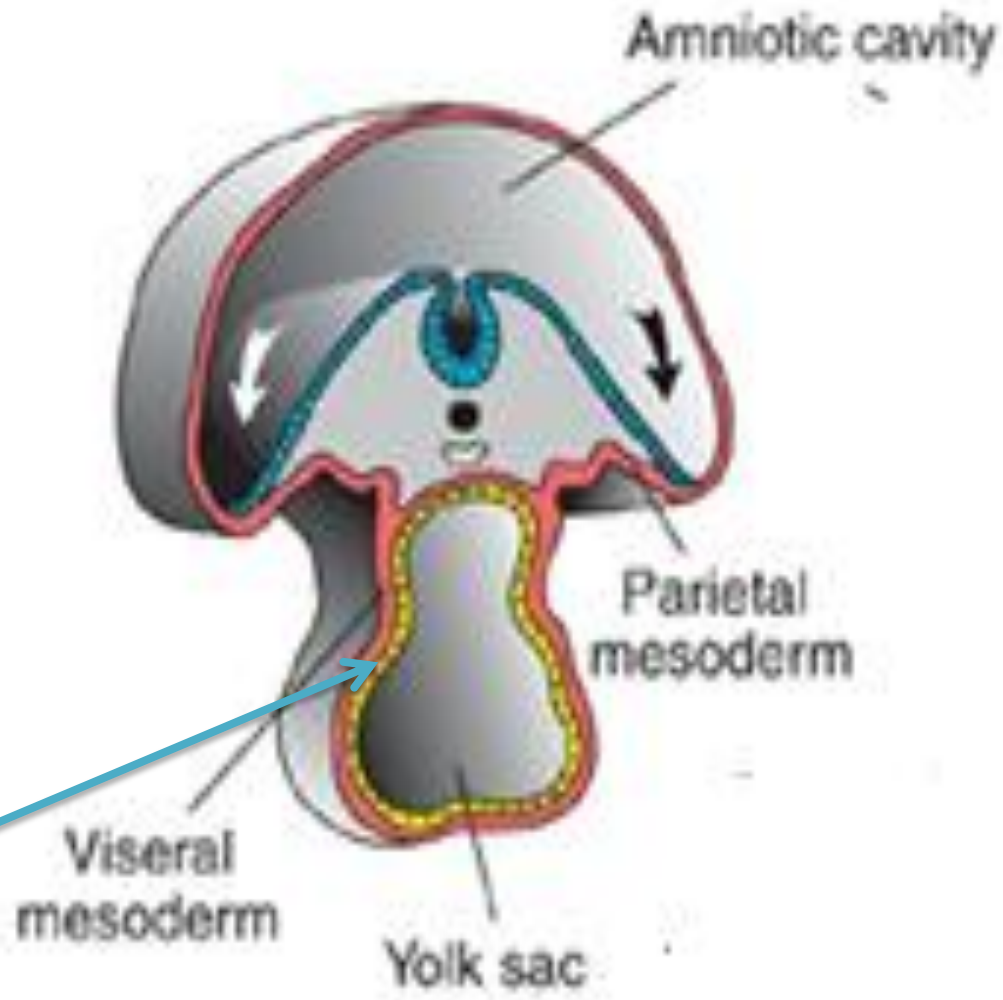
E) In addition, sclerotome and muscle precursor cells that migrate into the parietal layer of lateral plate mesoderm form
the costal cartilages,
limb muscles,
and most of the body wall muscles



2-The visceral layer of lateral mesoderm

Surrounds the primitive gut and **together with embryonic endoderm, forms**

THE WALL OF THE GUT TUBE



Mesoderm also gives rise to the **vascular system, that is, the heart, arteries,** veins, lymph vessels, and all blood and lymph cells

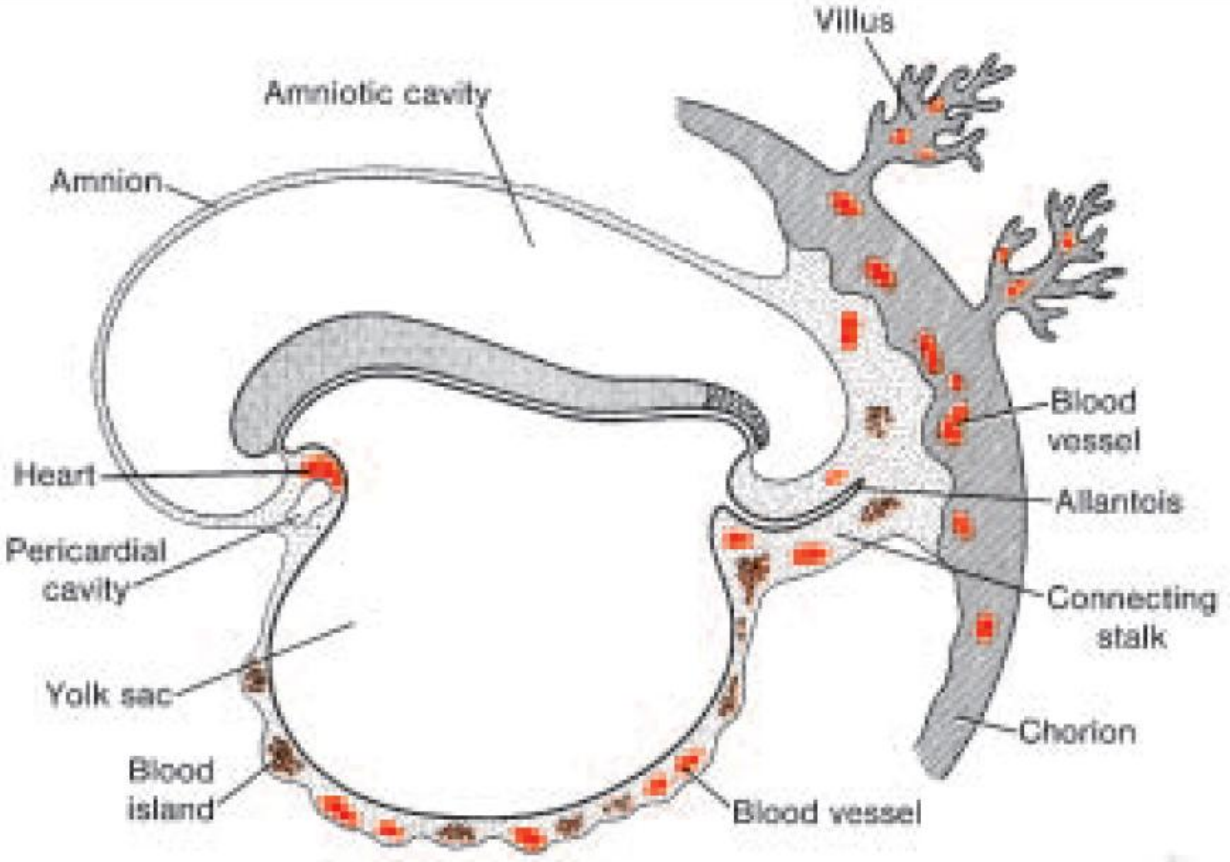
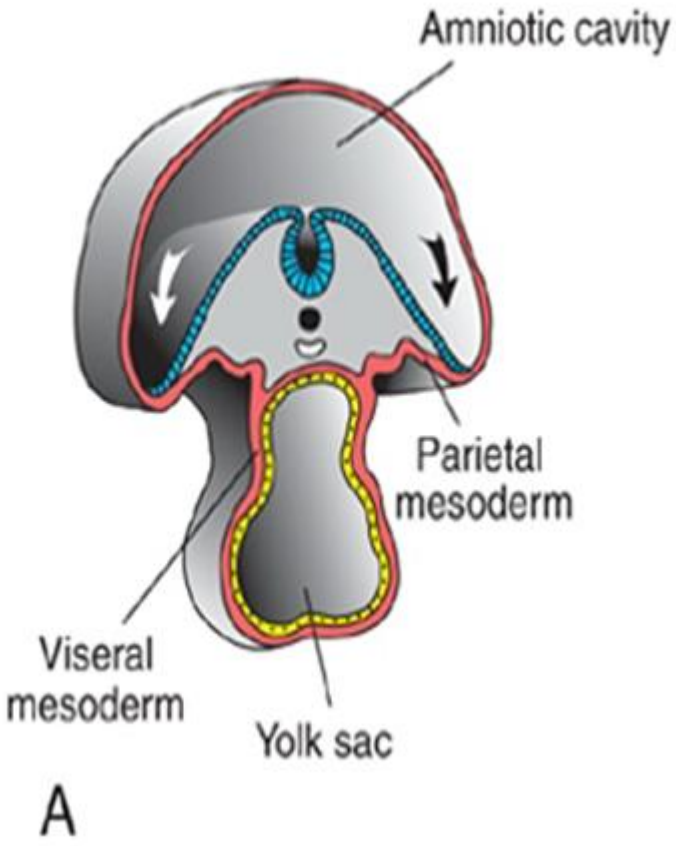


Figure 5.15 Extraembryonic blood vessel formation in the villi, chorion, connecting stalk, and wall of the yolk sac in a presomite embryo of approximately 19 days.

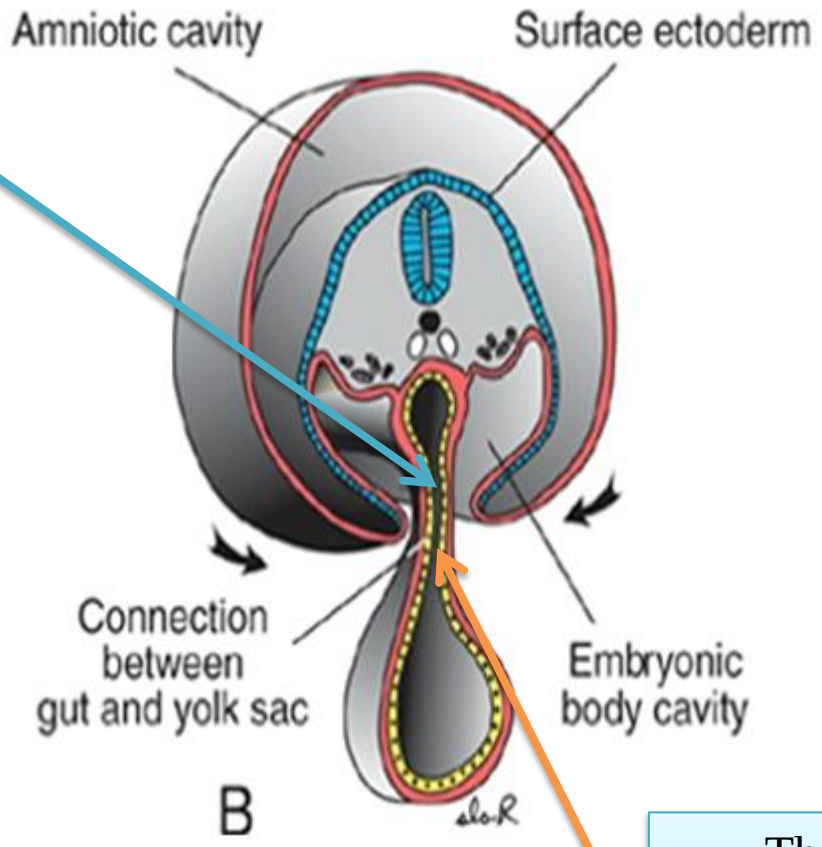
DERIVATIVES OF THE ENDODERMAL GERM LAYER

➢**The gastrointestinal tract is the main organ system derived from the endodermal germ layer**

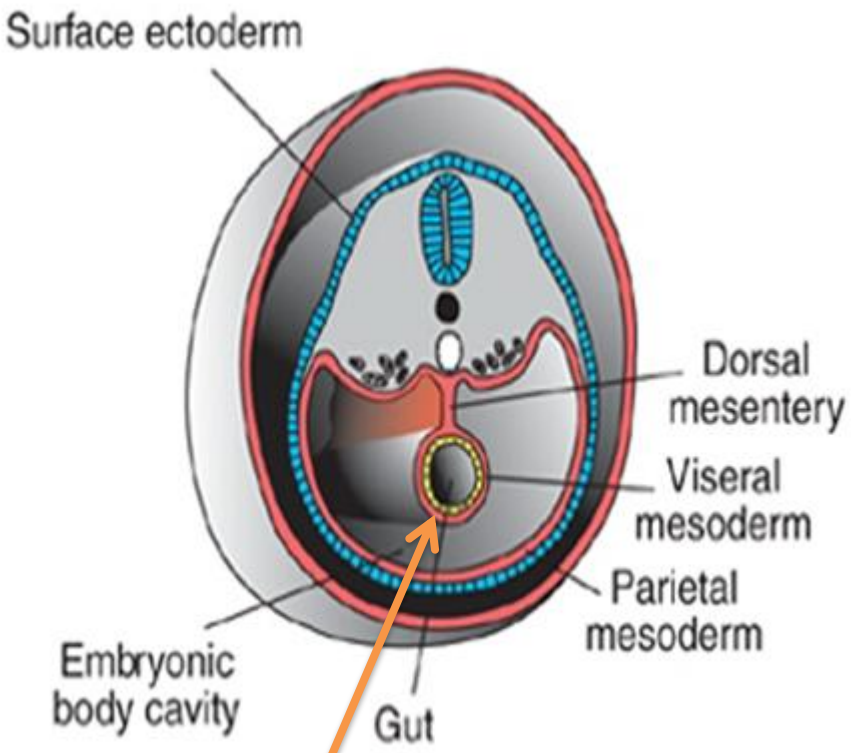
➢***With development the embryonic disc begins to bulge into the amniotic cavity and to fold cephalocaudally and Lateral folds also form and move ventrally to assist in body wall closure***

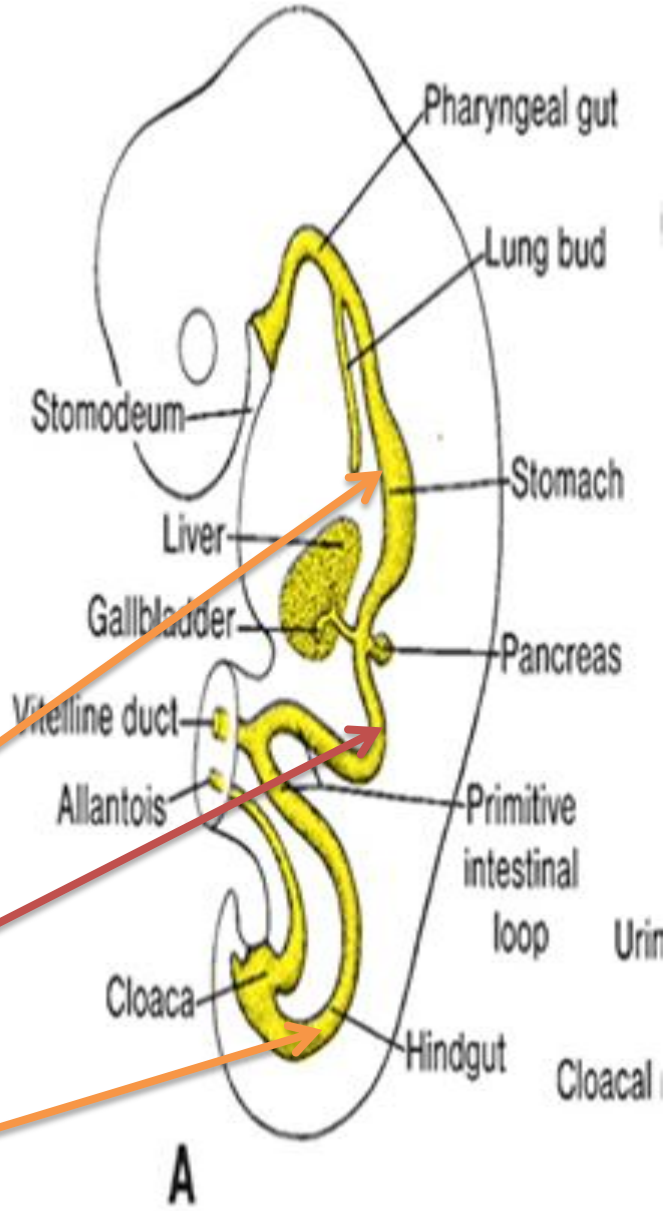


As a result of cephalocaudal folding, a continuously **larger portion of the endodermal germ layer is incorporated into the body of the embryo to form the gut tube.**



The midgut communicates with the yolk sac **by way of a broad stalk the VITELLINE DUCT**





The tube is divided into three regions:

FOREGUT

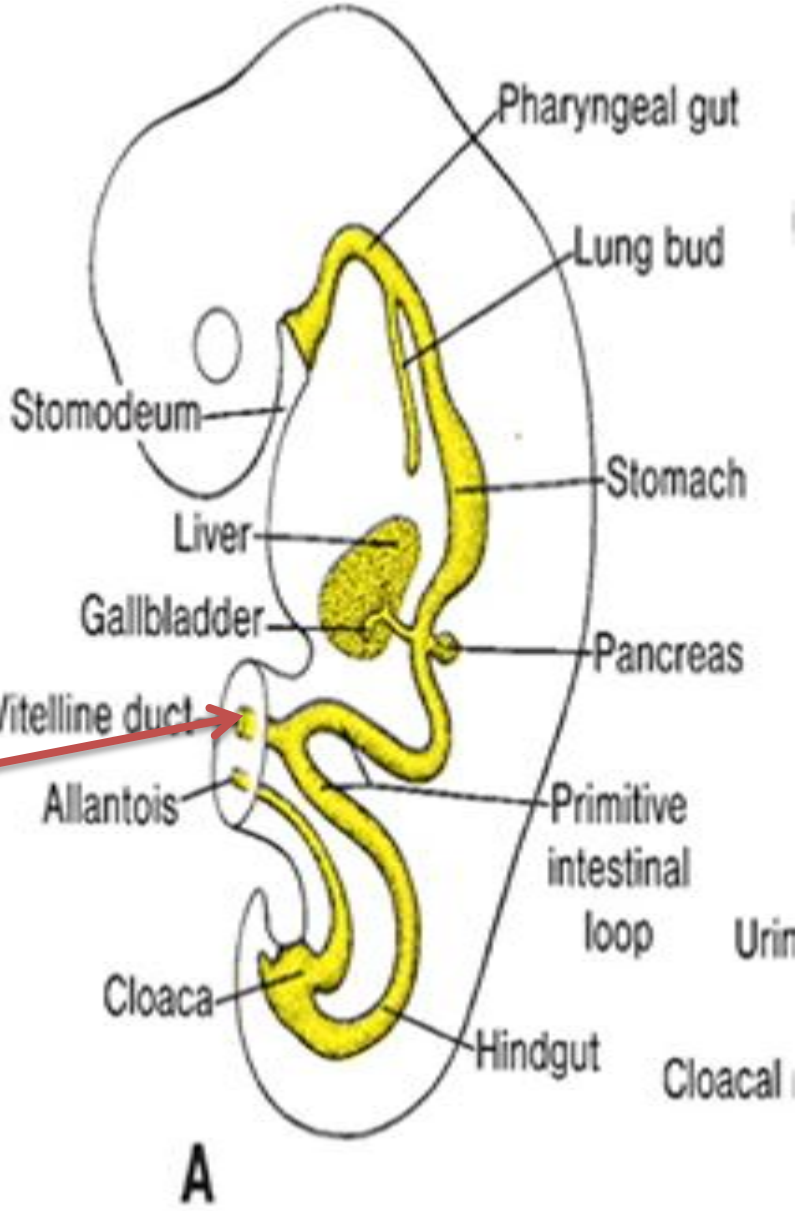
MIDGUT

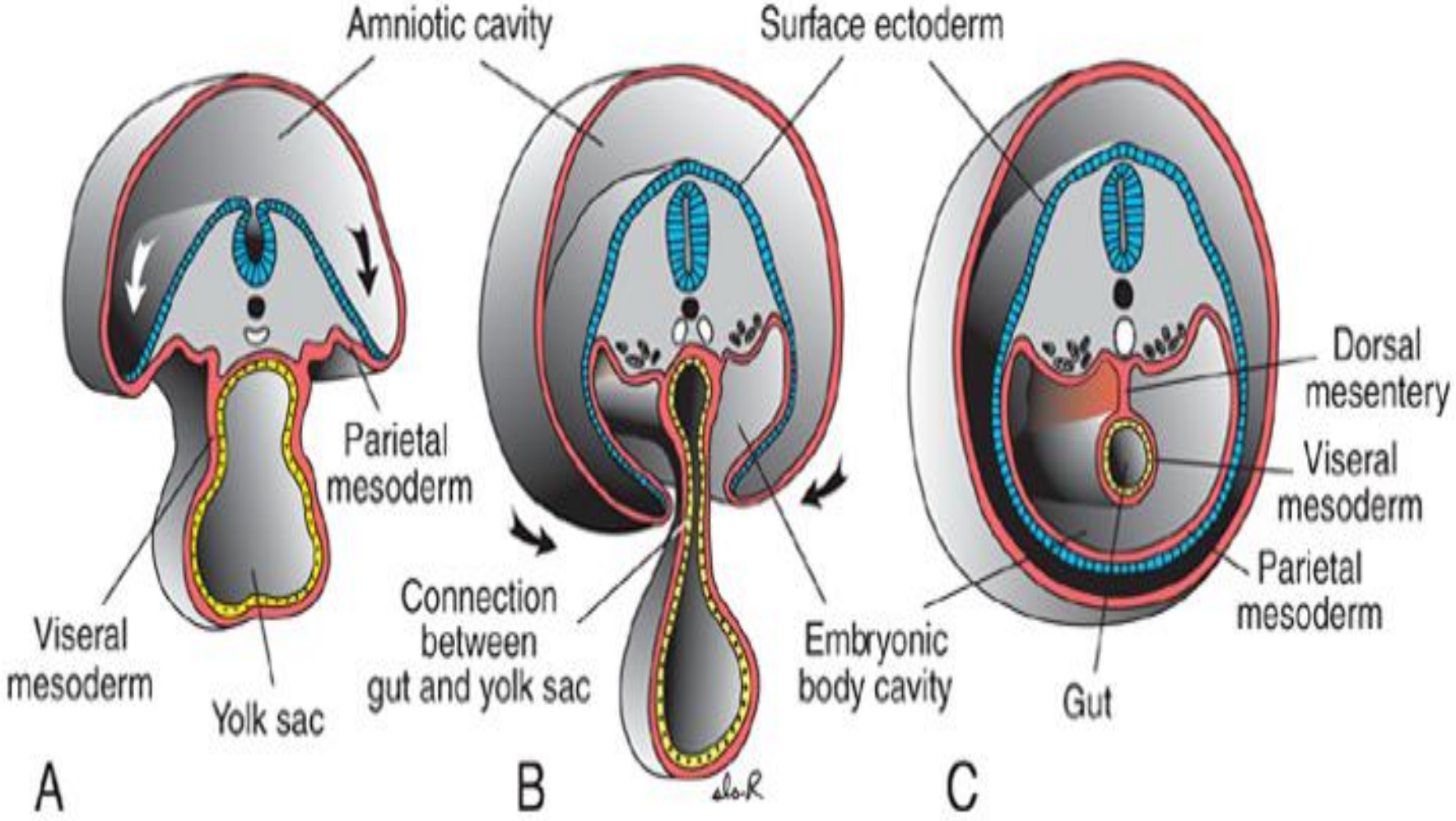
HINDGUT

<u>The midgut remains in communication with the yolk sac</u>.
Initially, this connection is wide but as a result of body folding, it gradually becomes long and narrow to form

<u>the vitelline duct</u>

Only much later, when the vitelline duct is obliterated, does the midgut lose its connection with the original endoderm-lined cavity and obtain its free position in the abdominal cavity





At its cephalic end, **the foregut** is temporarily bounded by

an ectodermal-endodermal (no mesoderm)

membrane called the

OROPHARYNGEAL membrane

This membrane separates the stomadeum,(the primitive oral cavity derived from ectoderm), from the pharynx, (a part of the foregut derived from endoderm).

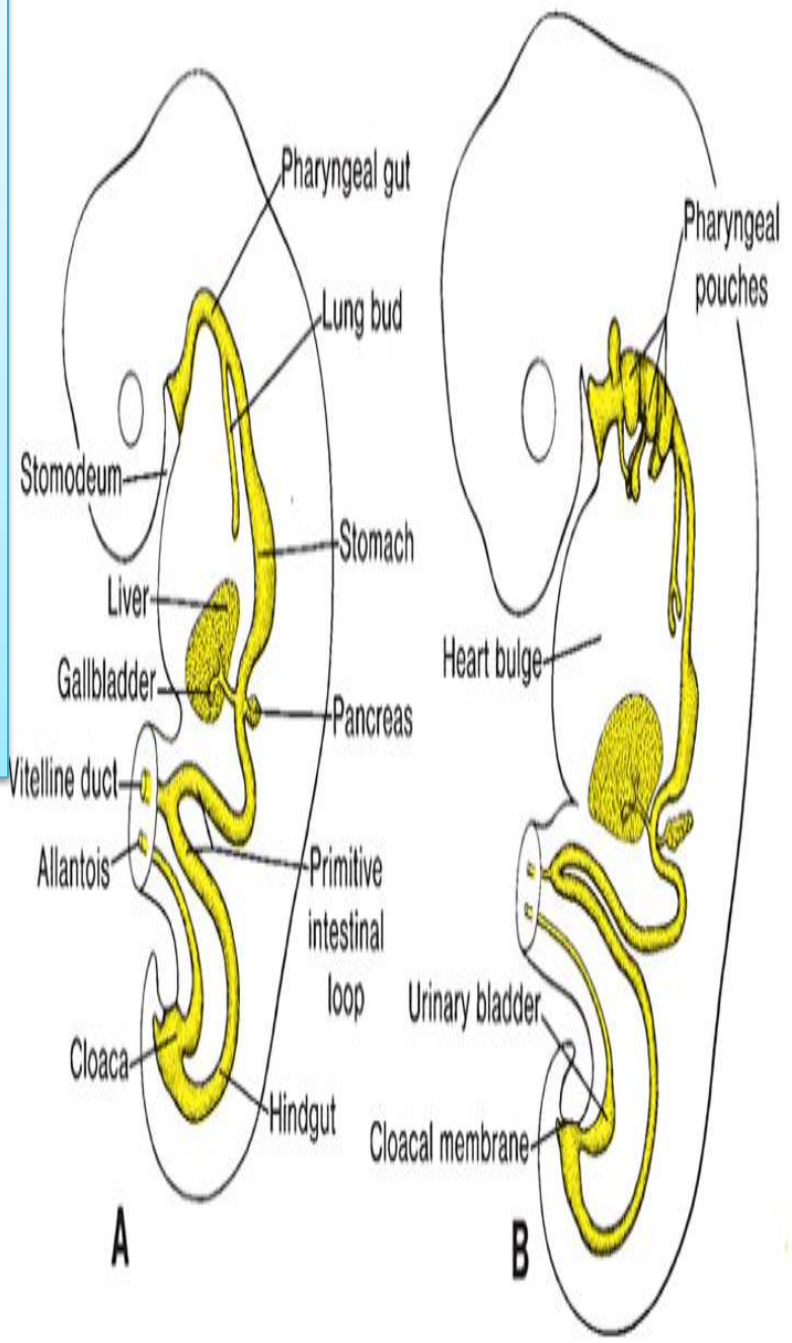
In the fourth week, the oropharngeal membrane ruptures, establishing an open connection between **the oral cavity** and the primitive gut

The hindgut also terminates temporarily at an ectodermal-endodermal membrane,

THE CLOACAL membrane

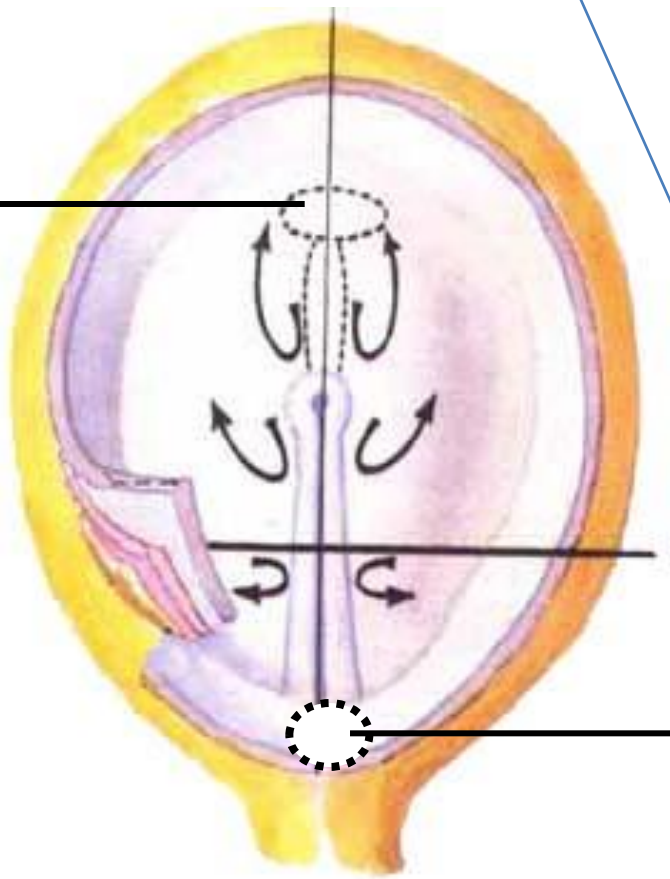
This membrane separates the upper part of the anal canal (derived from endoderm), from the lower part called (the proctoderm) that is formed by an invaginating pit lined by ectoderm.

The membrane breaks down in the seventh week to create the opening for the **anus**



No mesoderm

Buccopharyngeal membrane



Cloacal membrane

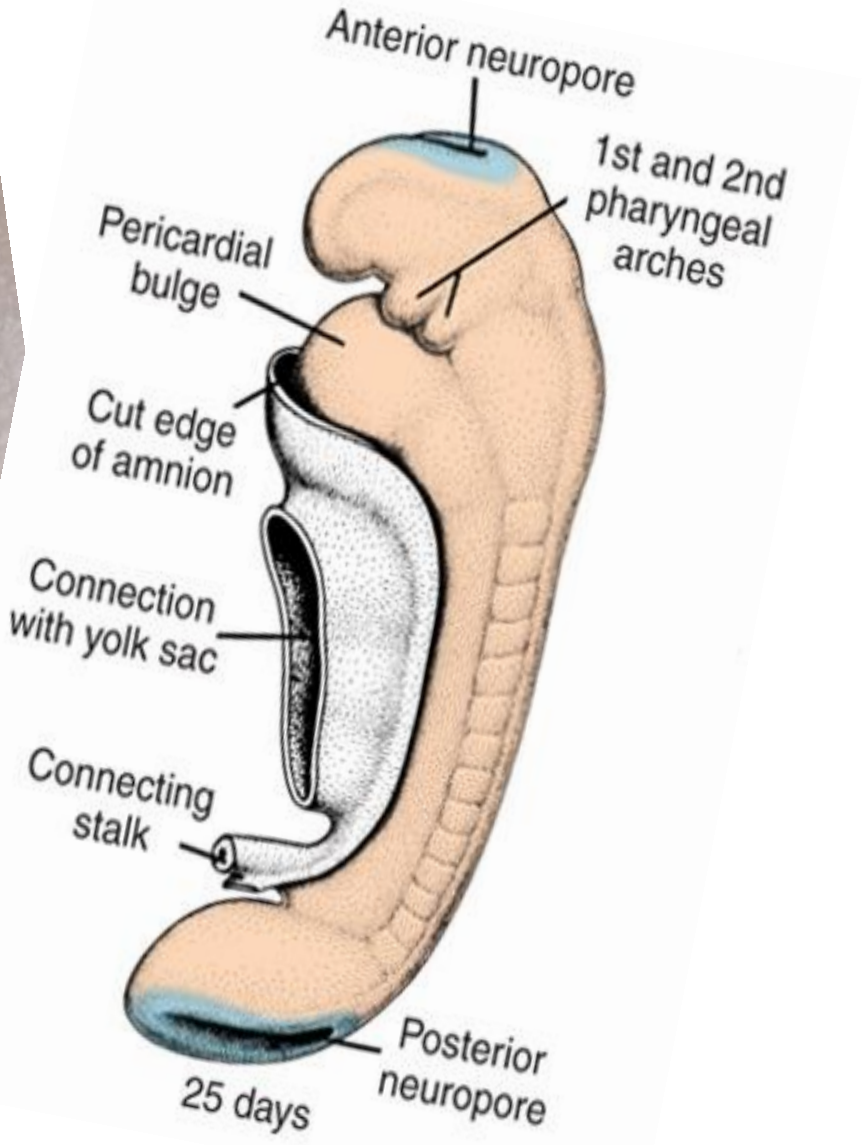
WHY?

As a result of folding from the head, tail, and two lateral body wall folds

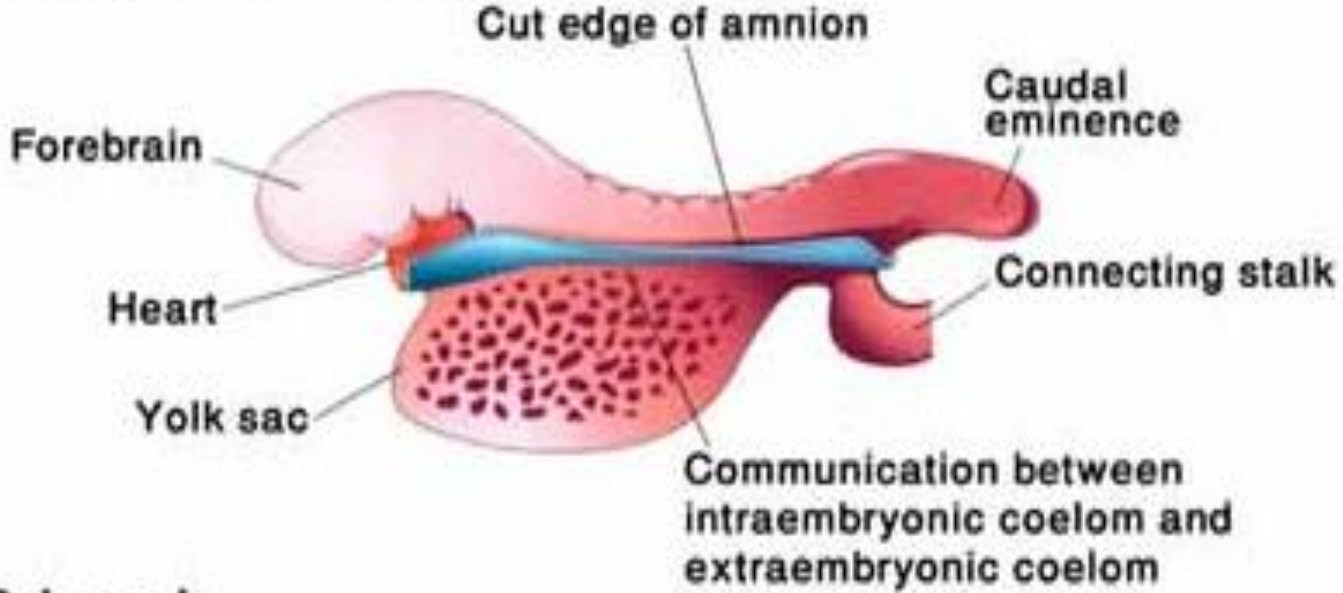
The ventral body wall of the embryo is closed except for a small part in the umbilical region where the yolk sac duct and connecting stalk are attached.

ENDODERM GIVES RISE TO:

- The epithelial lining of the respiratory tract
- The parenchyma of the thyroid, parathyroids, liver, and pancreas
- The reticular stroma of the tonsils and thymus
- The epithelial lining of the urinary bladder and urethra
- The epithelial lining of the tympanic cavity and auditory tube


Anterior neuropore
1st and 2nd pharyngeal arches
Pericardial bulge
Cut edge of amnion
Connection with yolk sac
Connecting stalk
Posterior neuropore
25 days

A.Human Embyro



B.leech


Stage 13 Human Embryo
(approx. 28 days)
0.5 mm


The bones of the Baby is completing its developement by
clothed with flesh during this stage

Eleventh Week to Full Term