
بسم الله الرحمن الرحيم


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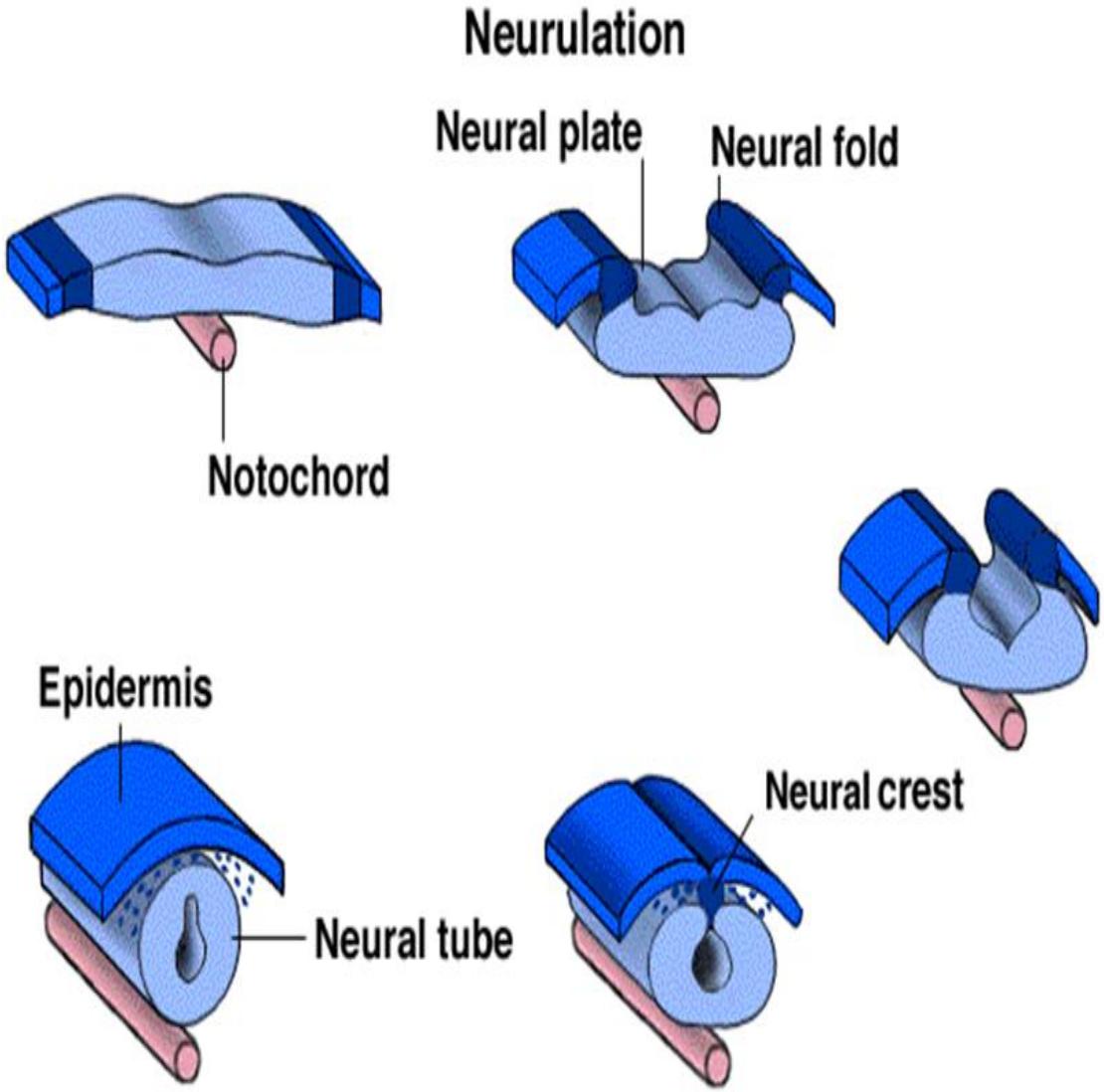
Neurulation

Neurulation

is the process whereby the neural plate forms the neural tube.

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

- **Neural groove** .



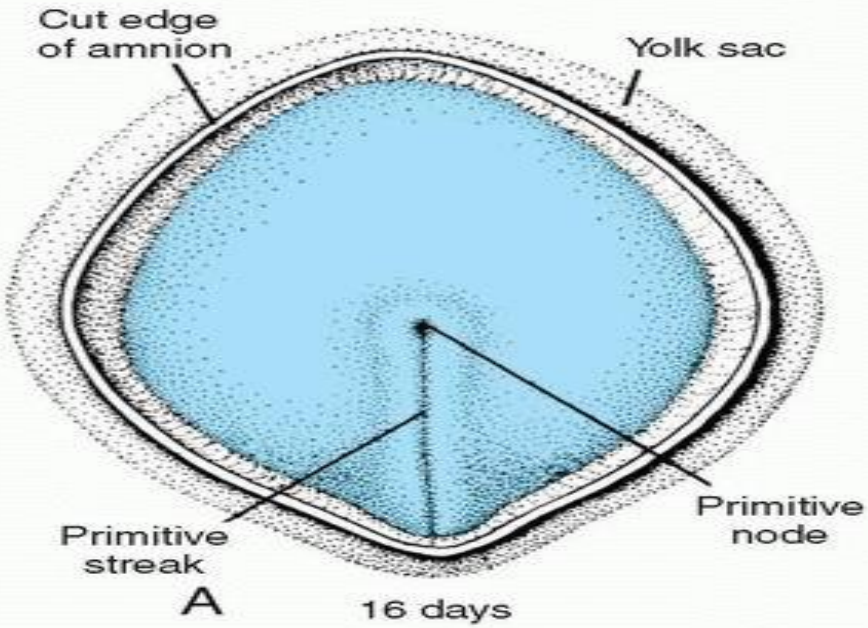
- Neural folds approach each other
- & fuse .
- Fusion begins in the **cervical** region proceeds cranially and caudally
- Neural tube

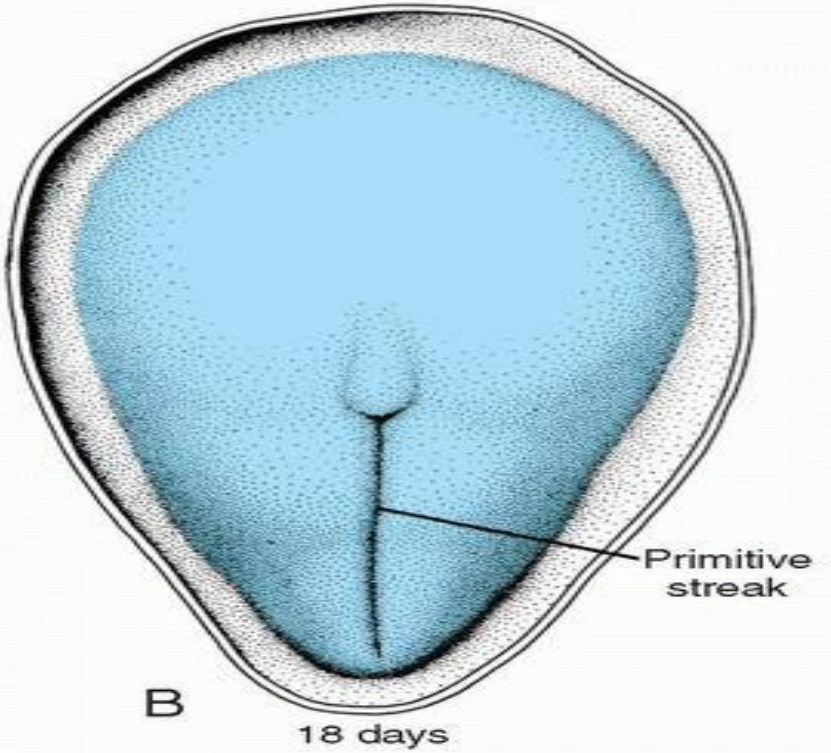
Open Cephalic and caudal ends of the neural tube
Anterior (cranial)) neuropores,

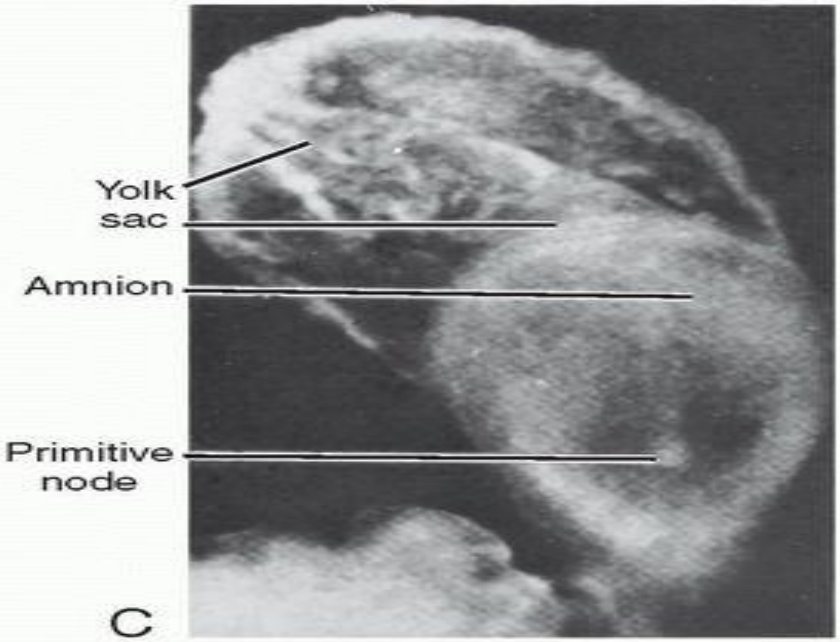
Posterior (caudal) neuropores,

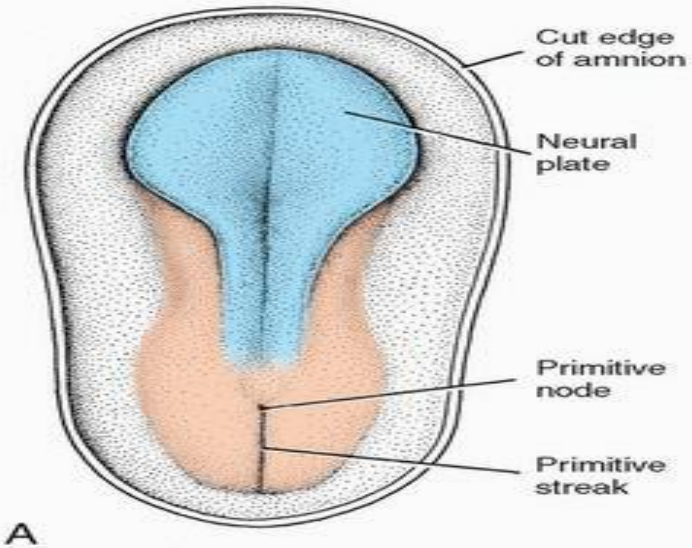
- Closure of cranial neuropore day 25 ,
- Posterior neuropore closes at day 28,

- **Neurulation is then complete**,
- A closed tubular structure with a narrow caudal portion, **the spinal cord,**
- Broader cephalic portion characterized by a number of dilations, the **brain vesicles**

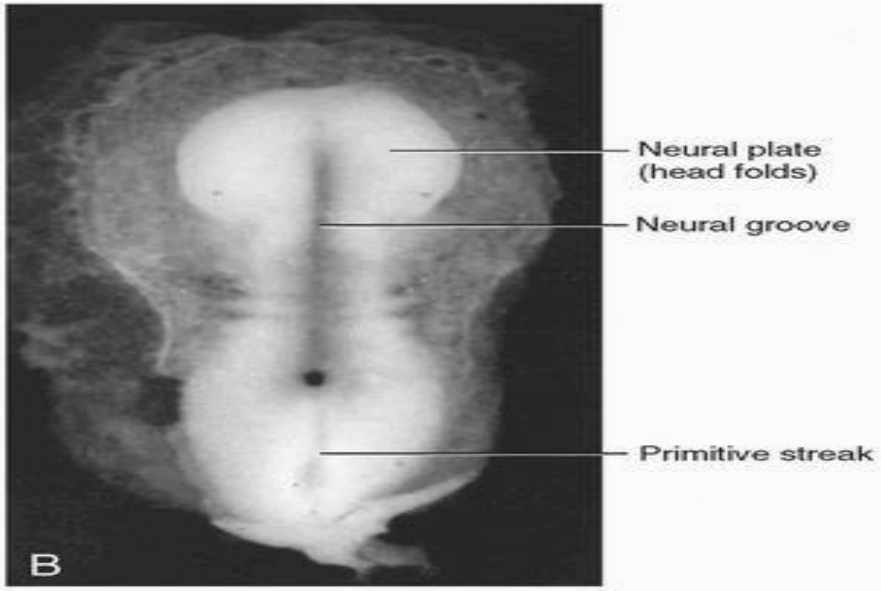

Cut edge
of amnion
Yolk sac
Primitive
node
Primitive
streak
A
16 days


Primitive
streak
B
18 days

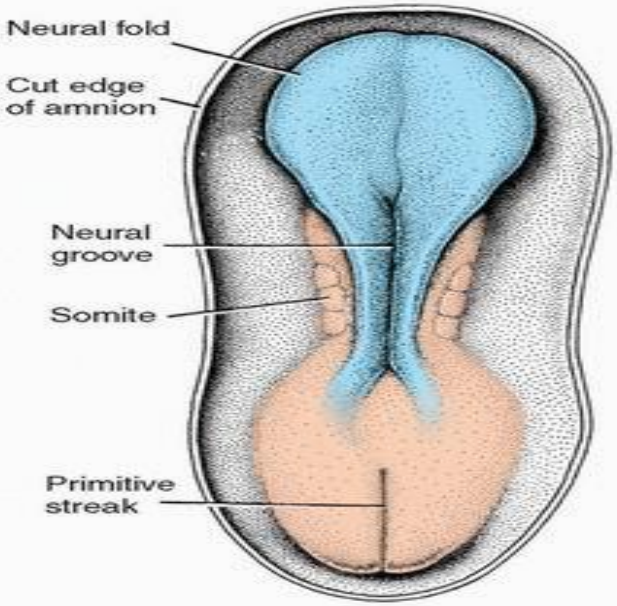

Yolk
sac
Amnion
Primitive
node
C



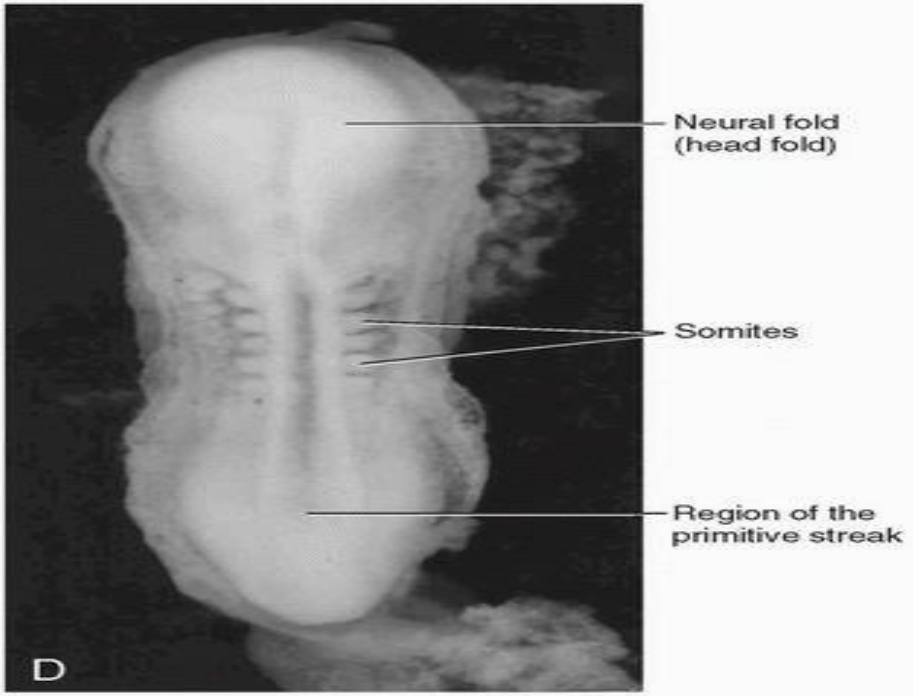
19 days



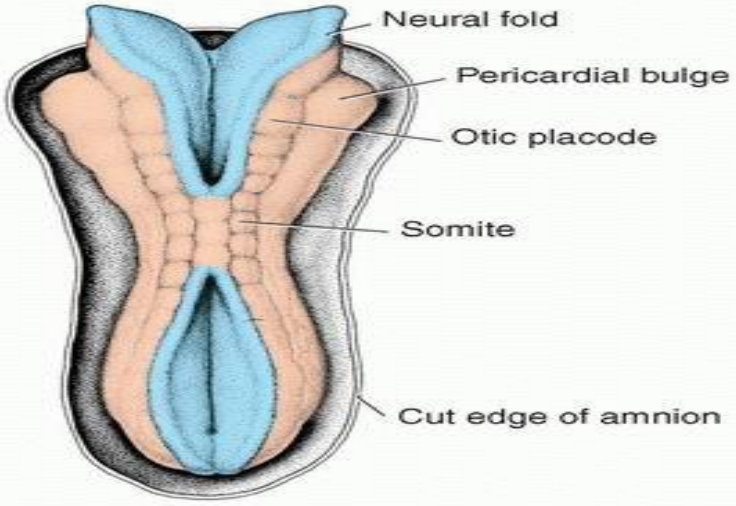
19 days



20 days

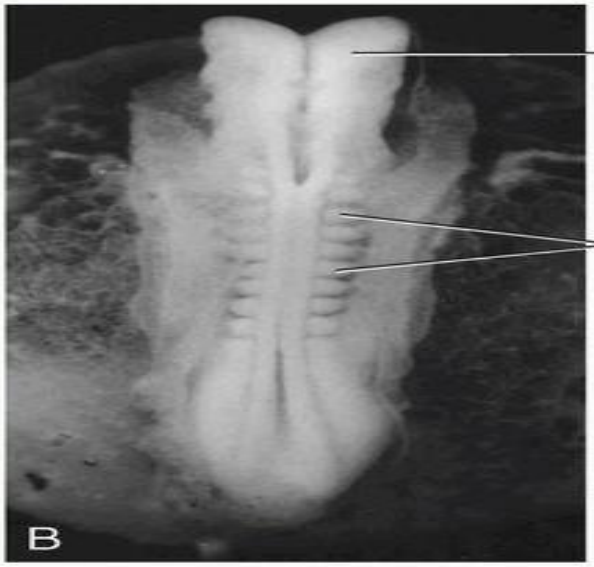


20 days

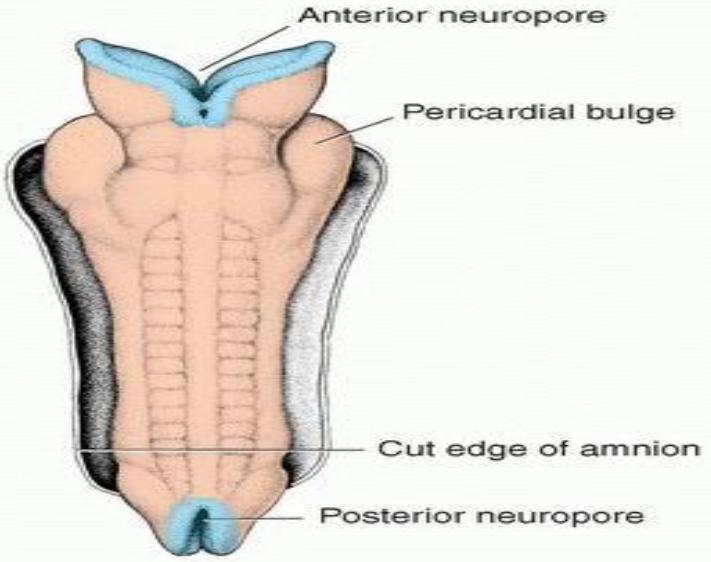


A

22 days

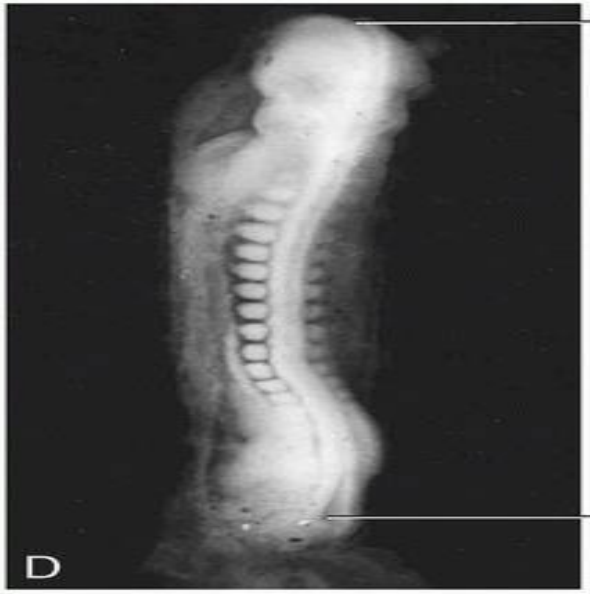


22 days



C

23 days



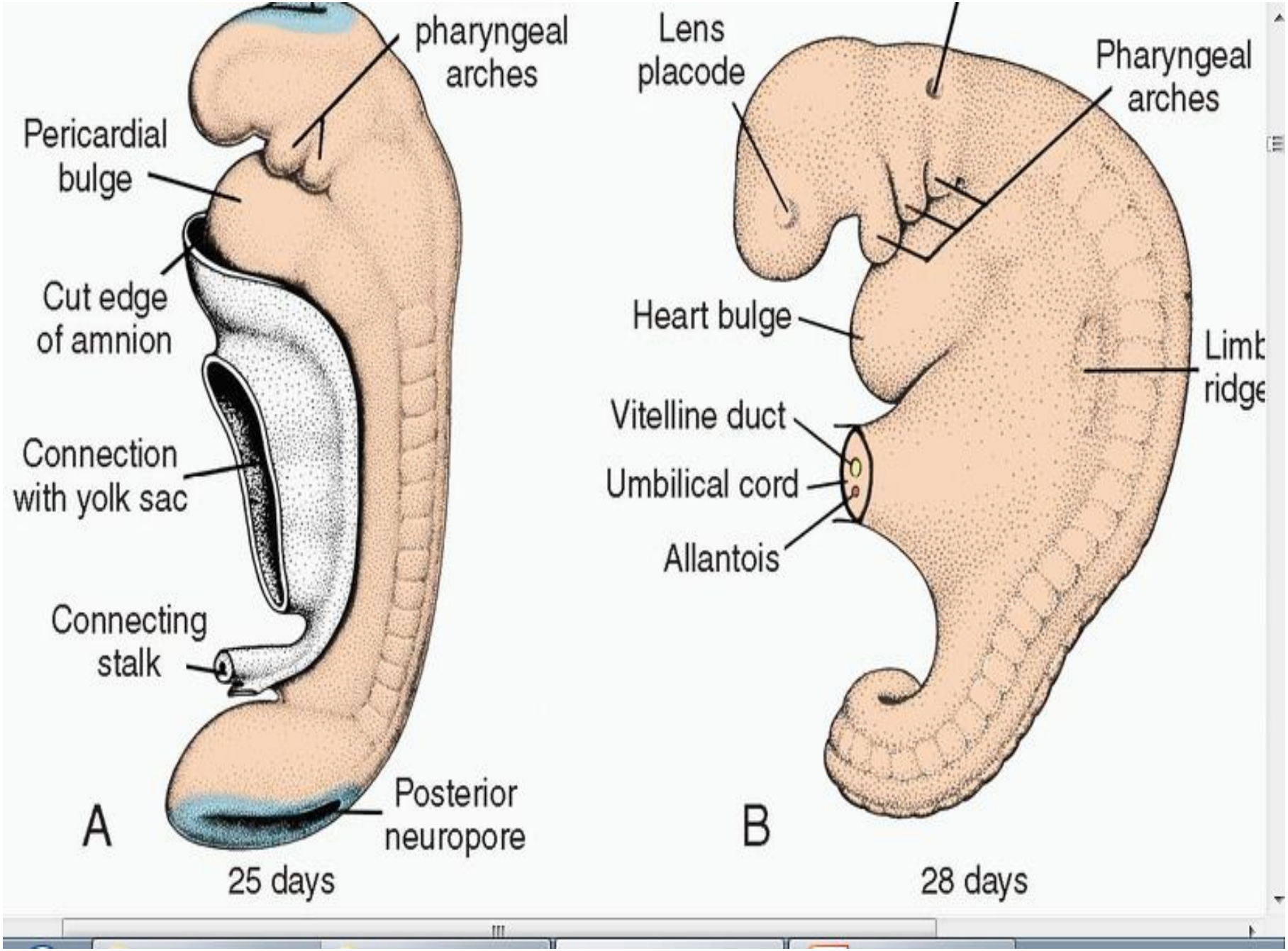
23 days

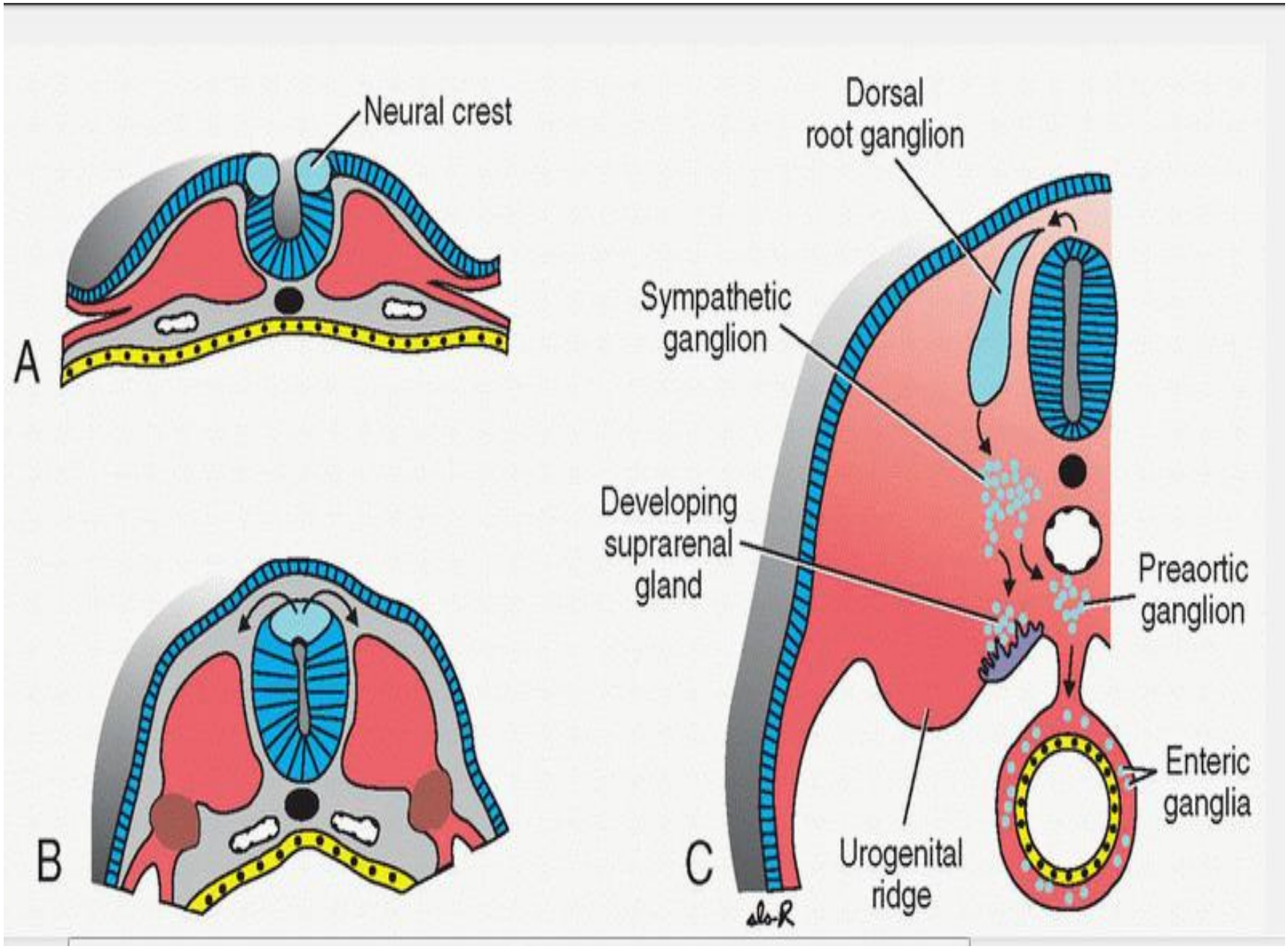
Neural Crest Cells

- Leaves the neuroectoderm by active migration and displacement to enter the underlying mesoderm.

- Crest cells migrate along
- (1) A dorsal pathway through the dermis, where they will enter the ectoderm to form **Melanocytes i**n 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 Adrenal medulla .**

- Neural crest cells migrate from cranial neural folds
- These cells contribute to the
- Craniofacial skeleton,
- Cranial ganglia,
- Glial cells,
- Melanocytes,


pharyngeal arches
Pericardial bulge
Cut edge of amnion
Connection with yolk sac
Connecting stalk
Posterior neuropore
A
25 days
Lens placode
Pharyngeal arches
Heart bulge
Limb ridge
Vitelline duct
Umbilical cord
Allantois
B
28 days


Neural crest
A
B
Dorsal
root ganglion
Sympathetic
ganglion
Developing
suprarenal
gland
Preaortic
ganglion
Enteric
ganglia
C
Urogenital
ridge

Ectodermal germ layer gives rise to organs and structures that maintain contact with the outside world:

Central nervous system;

Peripheral nervous system;

Sensory epithelium of the ear, nose, and eye; and

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.

Connective tissue and bones of the face and skull
Cranial nerve ganglia
Cells of the thyroid gland
Conotruncal septum in the heart
Odontoblasts
Dermis in face and neck
Spinal (dorsal root) ganglia
Sympathetic chain and preaortic ganglia

Parasympathetic ganglia of the gastrointestinal tract
Adrenal medulla
Schwann cells
Glial cells
Meninges (forebrain)
Melanocytes

Neural Tube Defects

Figure 6.7 Examples of neural tube defects (NTDs), which occur when closure of the neural tube fails. **A.** Anencephaly.

Clinical Correlates (continued)

Figure 6.7 *(Continued)* **B,C.** Spina bifida. Most cases of spina bifida occur in the lumbosacral region **(C).** Seventy

(Continued)
B,C. Spina bifida. Most cases of spina bifida occur in the lumbosacral region **(C).** Seventy percent of all of these NTDs can be prevented by the vitamin folic acid.

MAJOR DERIVATIVES OF THE ECTODERM GERM LAYER

Three subdivisions of the ectoderm:

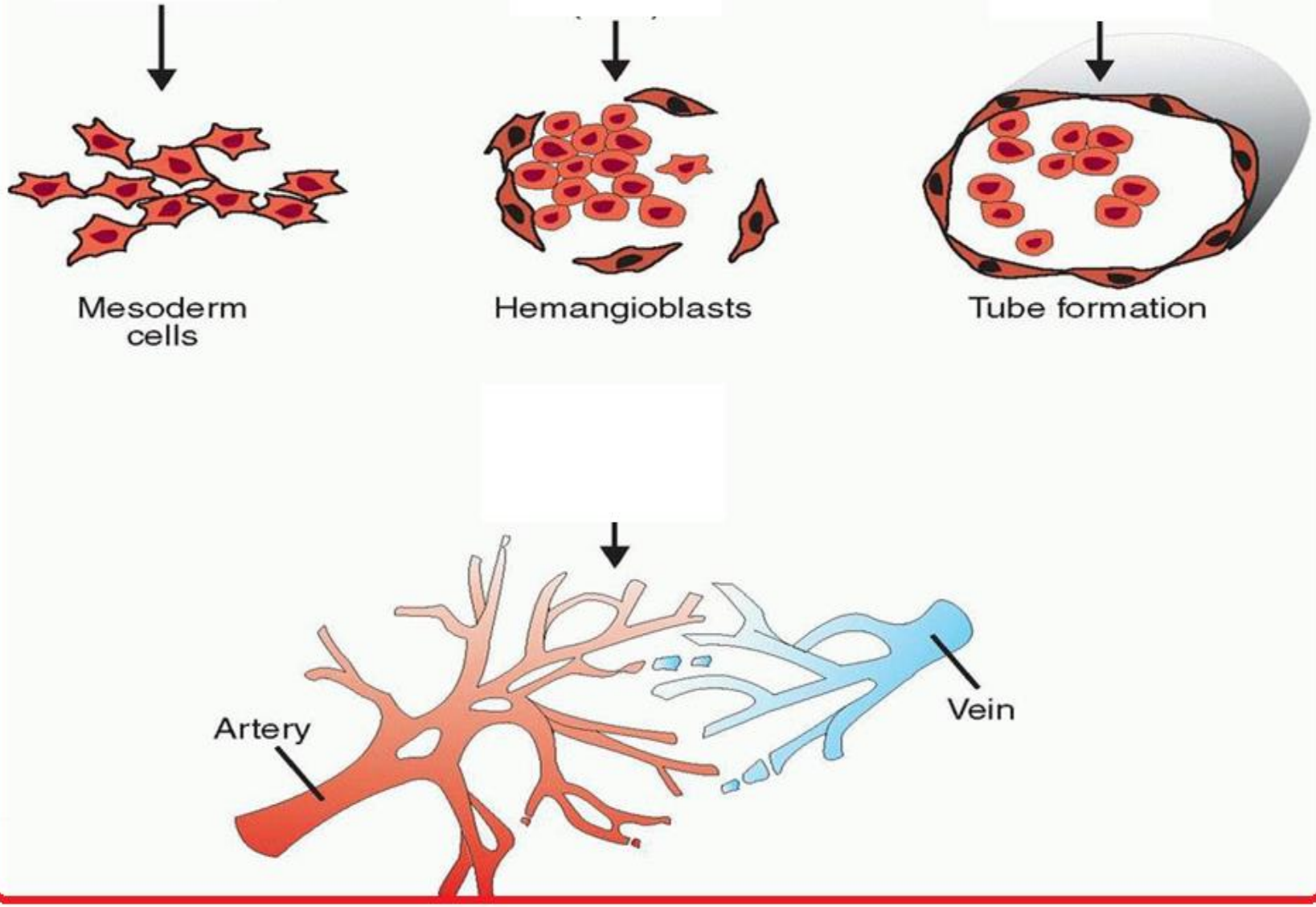
- Surface Ectoderm
- Neural Crest
- Neural Tube

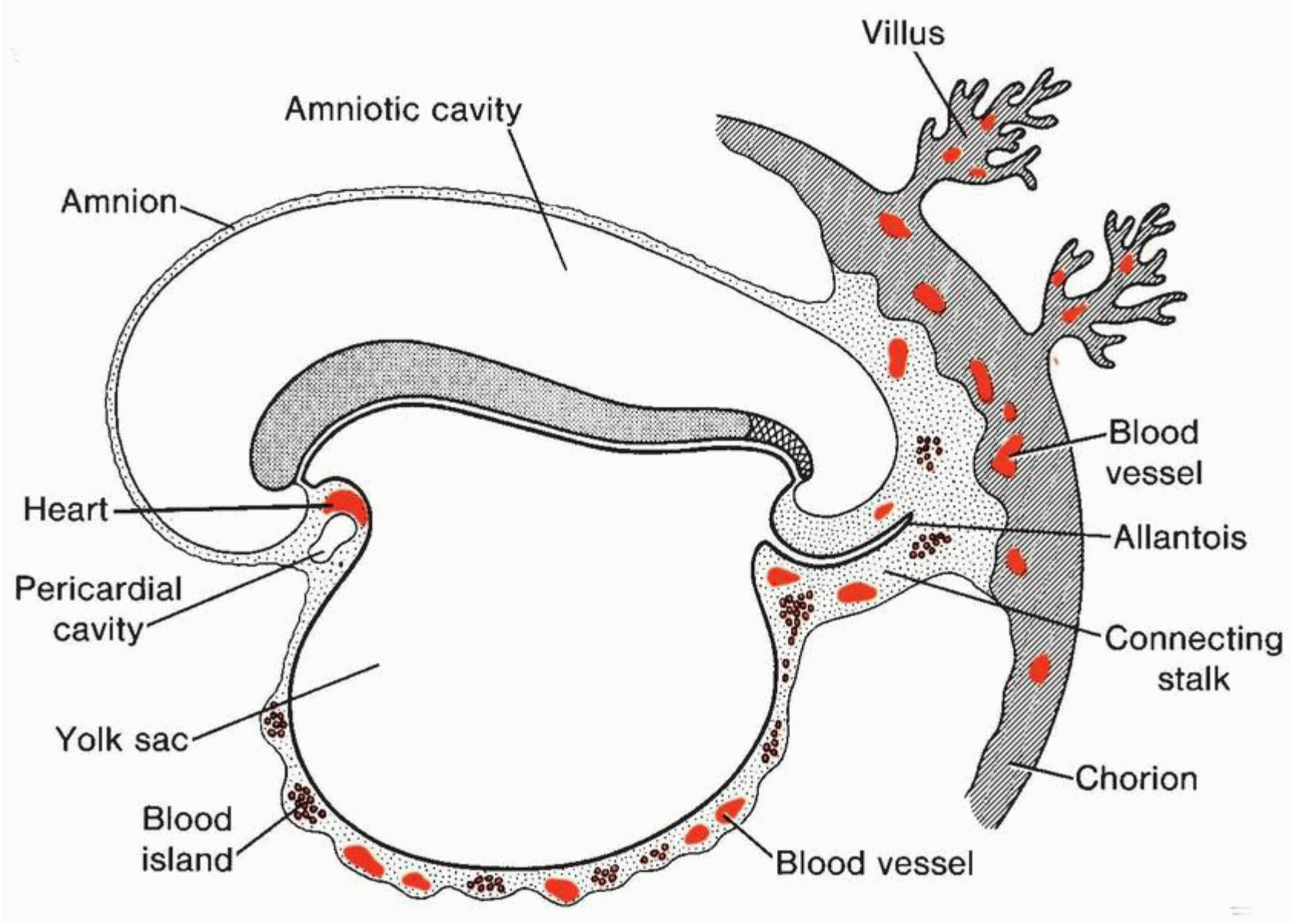
MESODERM

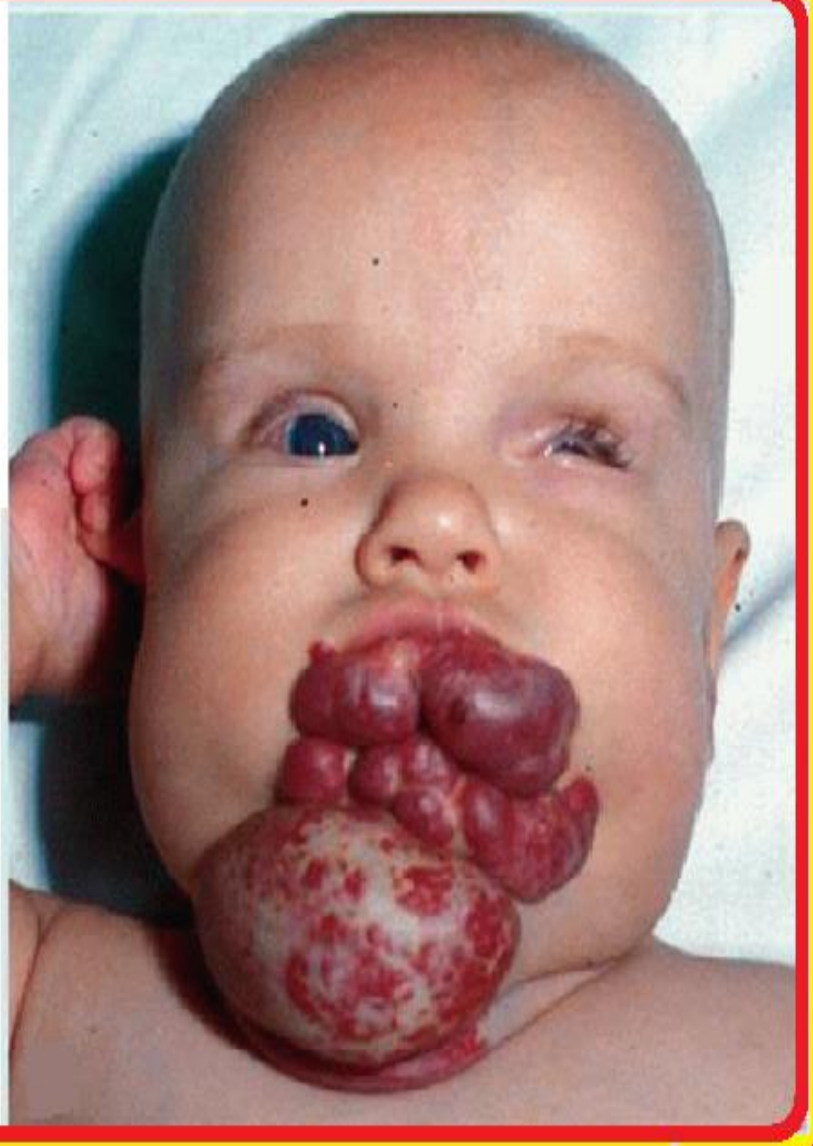
- Notochord
- Skeletal system
- Muscular system
- Muscular layer of stomach, intestine, etc.
- Excretory system
- Circulatory and lymphatic systems
- Reproductive system (except germ cells)
- Dermis of skin
- Lining of body cavity
- Adrenal cortex

ENDODERM

- Epithelial lining of digestive tract
- Epithelial lining of respiratory system
- Lining of urethra, urinary bladder, and reproductive system
- Liver
- Pancreas
- Thymus
- Thyroid and parathyroid glands


Mesoderm cells
Hemangioblasts
Tube formation
Artery
Vein


Villus
Amniotic cavity
Amnion
Blood vessel
Heart
Allantois
Pericardial cavity
Connecting stalk
Yolk sac
Chorion
Blood island
Blood vessel



- **DERIVATIVES OF THE MESODERMAL GERM LAYER**

Form a thin sheet of loosely woven tissue on each side of the midline .

Paraxial mesoderm .

Laterally, the mesoderm called the lateral plate.

Divided into two layers:

Somatic or parietal mesoderm layer,

Splanchnic or visceral mesoderm layer .

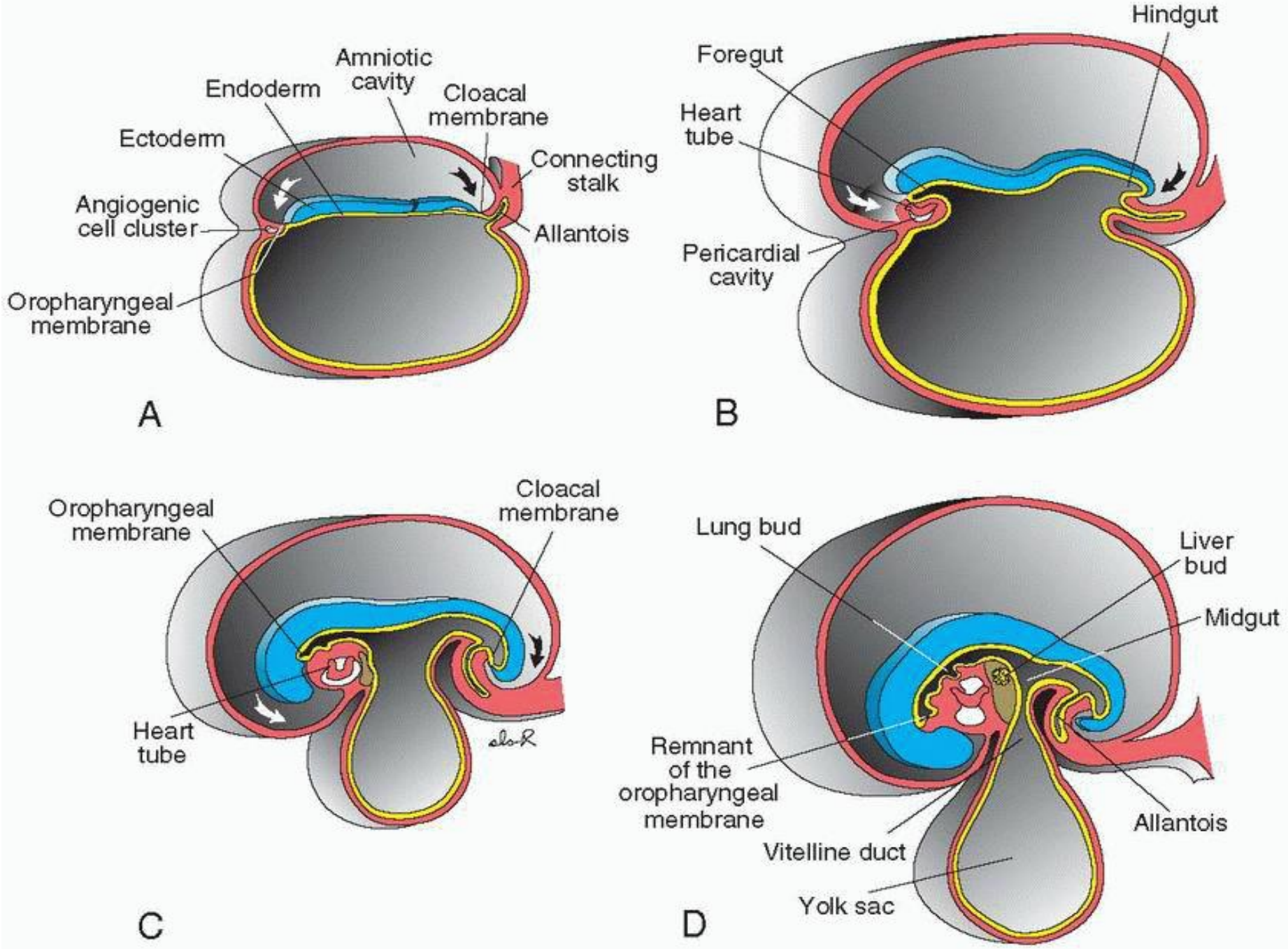
Intermediate mesoderm connects paraxial and lateral plate mesoderm

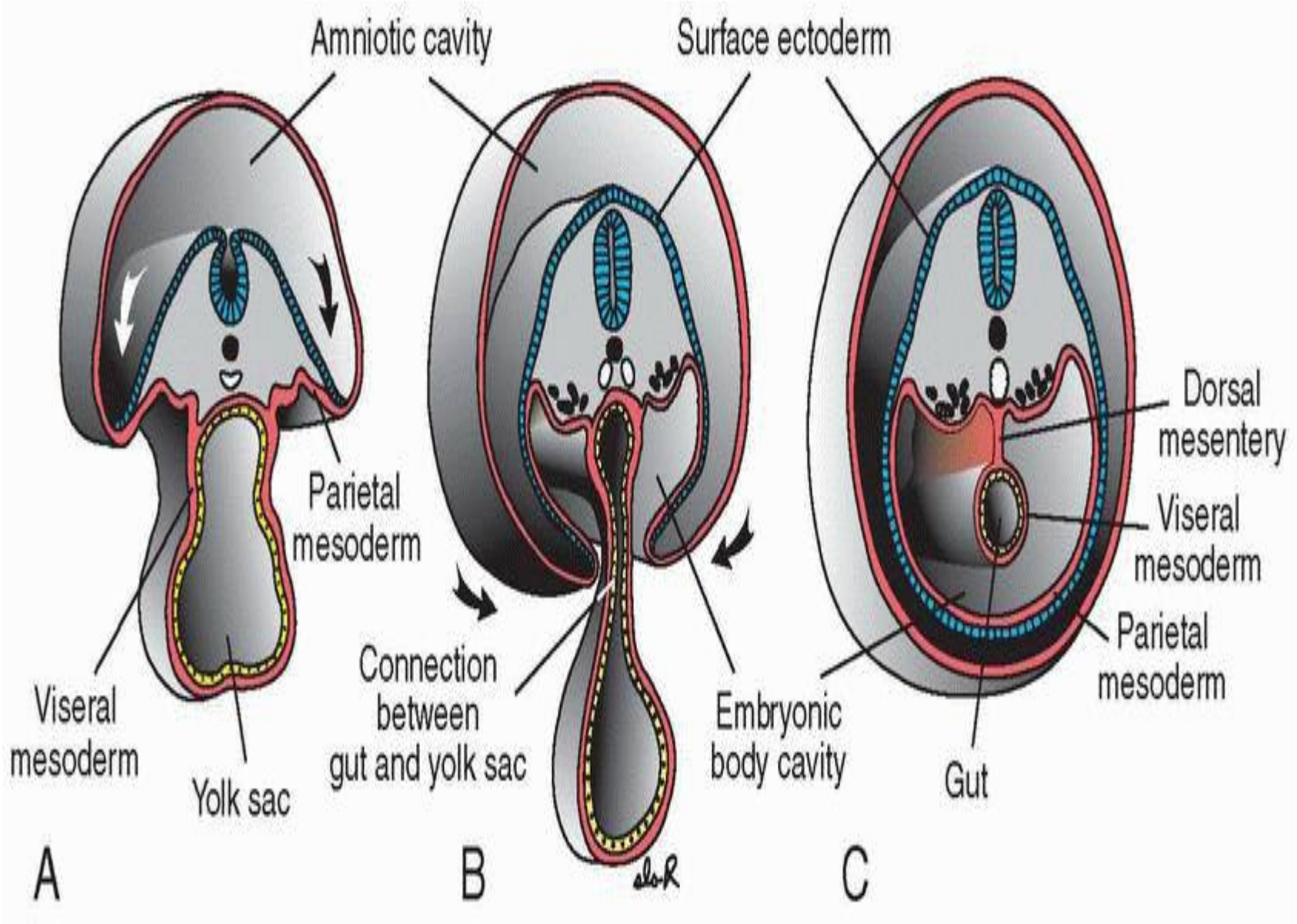
Paraxial Mesoderm

In third week form segments, called somitomeres,

Proceeds cephalocaudally.

- From the occipital region caudally, somitomeres further organize into somites.
- The first pair of somites arises in the occipital region of the embryo at approximately the 20th day .
- From here, new somites appear in craniocaudal


Amniotic cavity
Endoderm
Cloacal membrane
Ectoderm
Connecting stalk
Angiogenic cell cluster
Allantois
Oropharyngeal membrane
A
Hindgut
Foregut
Heart tube
Pericardial cavity
B
Oropharyngeal membrane
Cloacal membrane
Heart tube
C
Lung bud
Liver bud
Midgut
Remnant of the oropharyngeal membrane
Allantois
Vitelline duct
Yolk sac
D


Amniotic cavity
Surface ectoderm
Parietal mesoderm
Viseral mesoderm
Yolk sac
Connection between gut and yolk sac
Embryonic body cavity
Dorsal mesentery
Viseral mesoderm
Parietal mesoderm
Gut
A
B
C

THANKS