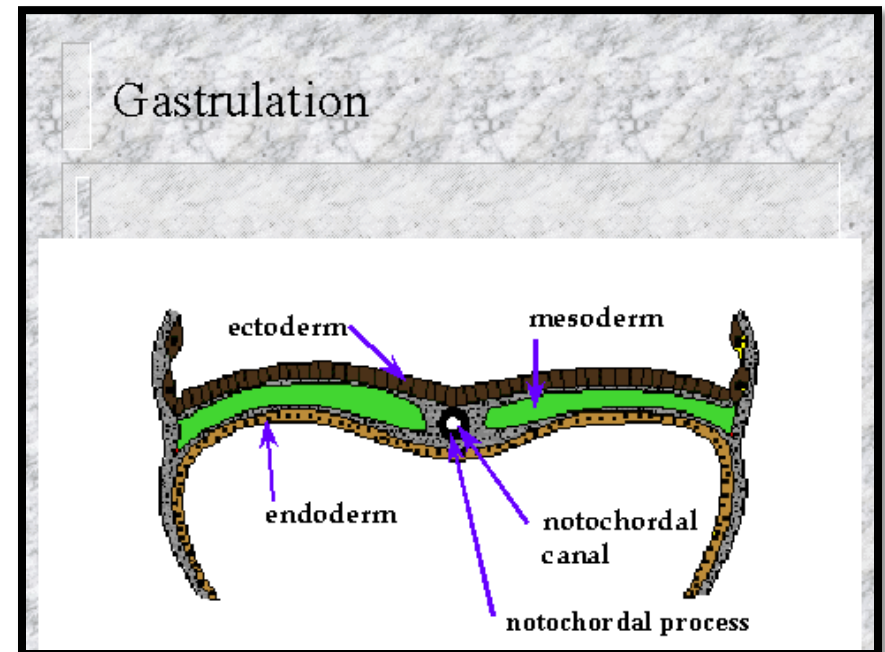


3RD WEEK OF DEVELOPMENT

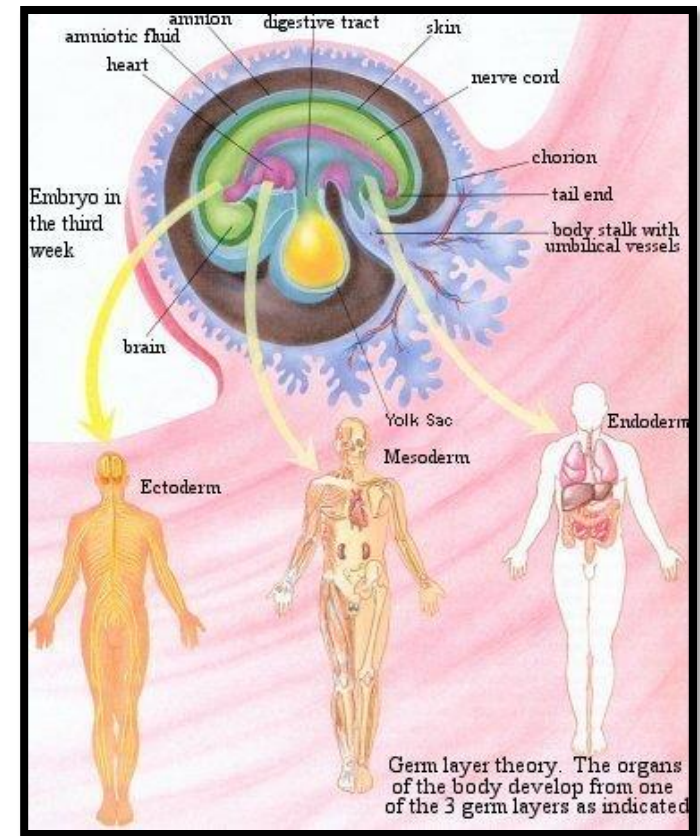
THIRD WEEK OF DEVELOPMENT

- **Gastrulation**
- Gastrulation is the formative process by which the **3 germ layers & axial orientation** are established in the embryo
- During gastrulation the bilaminar germ disc is converted into a **trilaminar germ disc**



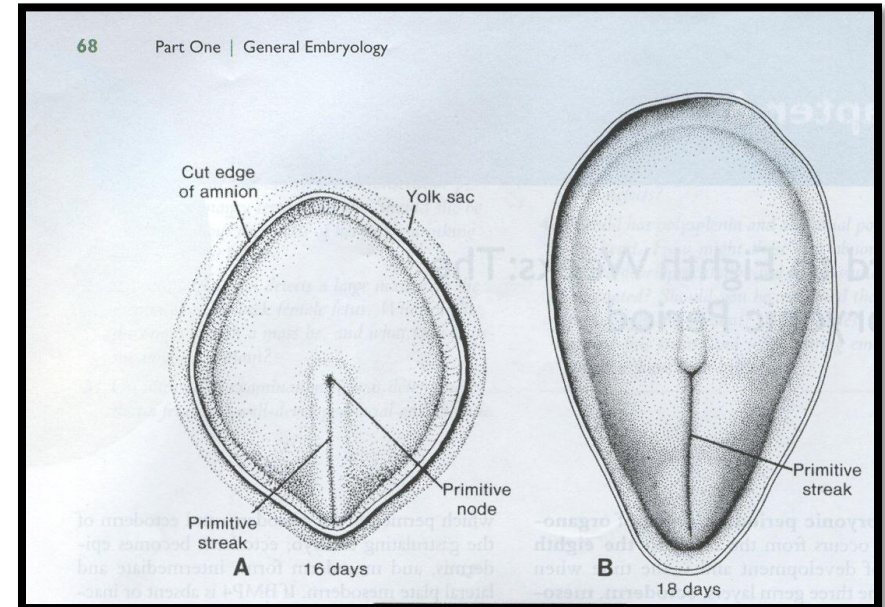
GASTRULATION

- Gastrulation establishes the 3 germ layers of the embryo – **ectoderm**, **mesoderm** & **endoderm**
- Each of these germ layers gives rise to specific tissues & organs
- Gastrulation is the beginning of **morphogenesis** (development of body form)



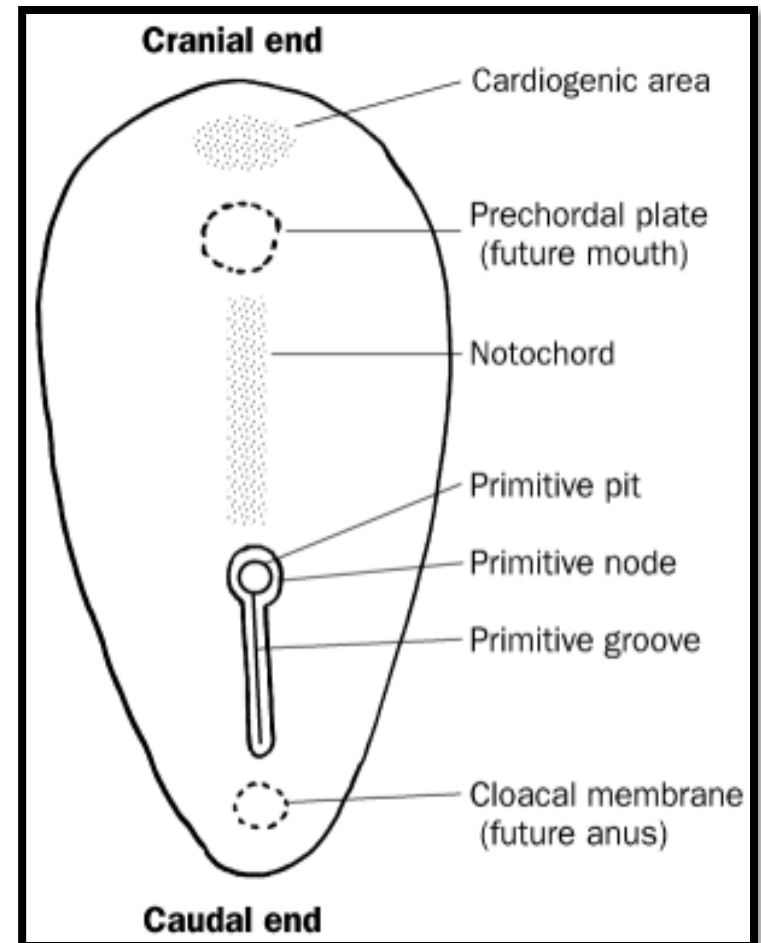
PRIMITIVE STREAK

- Gastrulation begins with formation of **primitive streak** on the surface of epiblast
- Opacity formed by a thickened linear band of **epiblast**
- Lies **caudally in the median plane** of the **dorsal** aspect of embryonic disc



PRIMITIVE STREAK

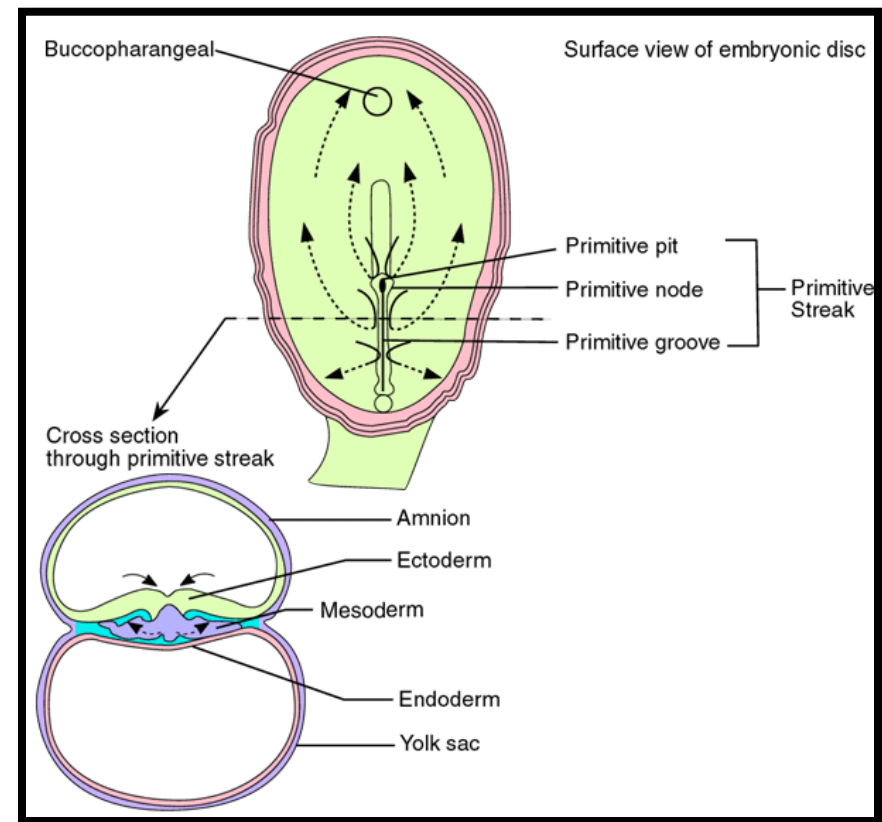
- As the streak elongates by addition of cells to its caudal end, its cranial end proliferates to form an elevation – **primitive node/Henson's node**
- A narrow groove develops in the primitive streak – **primitive groove**
- Primitive groove becomes continuous with a small depression in the primitive node – **primitive pit**

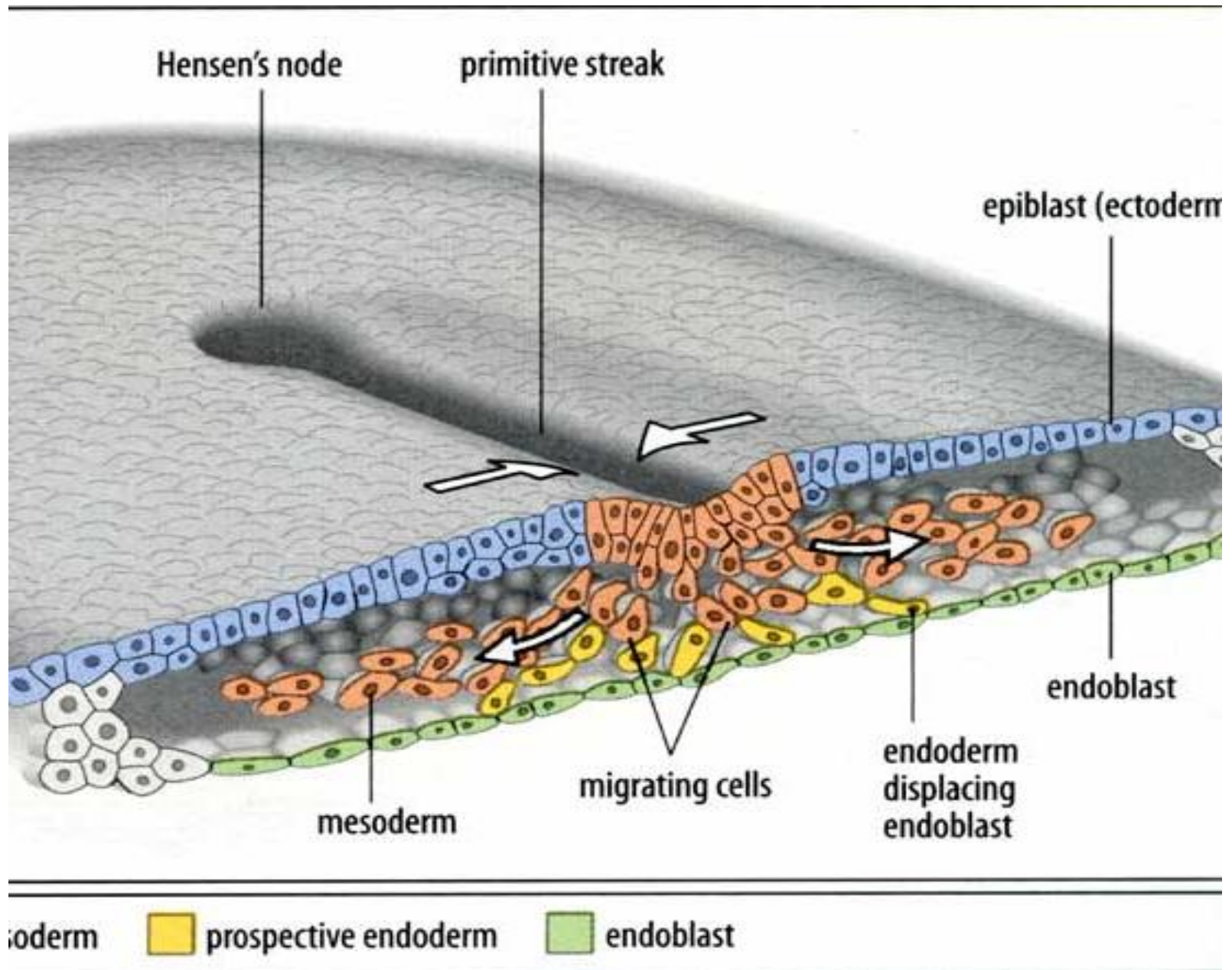


PRIMITIVE STREAK

After formation of primitive streak it is possible to identify the embryo's

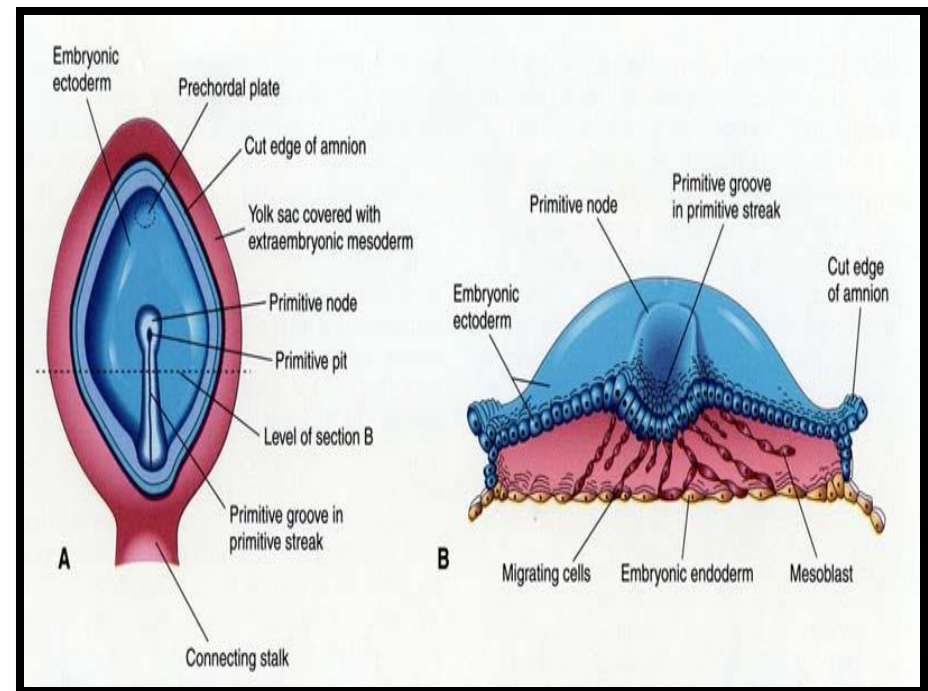
- Craniocaudal axis
- Its cranial & caudal ends
- Its dorsal & ventral surfaces
- Its right & left sides





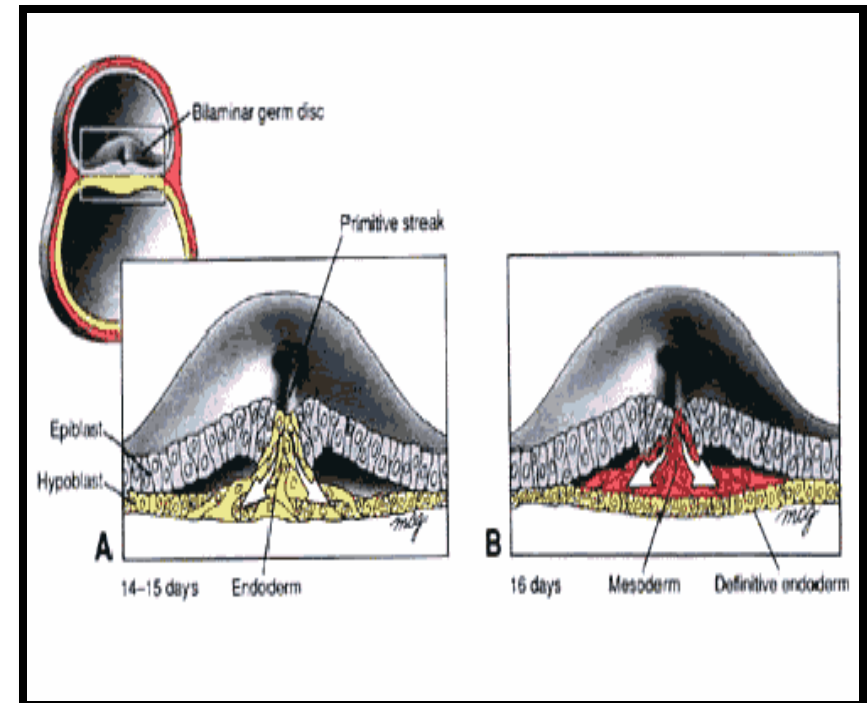
FORMATION OF INTRAEMBRYONIC MESODERM

- Cells of the **epiblast** migrate towards the primitive streak
- Upon arrival in the region of the streak, they become flask-shaped, detach from the epiblast & slip beneath it - **Invagination**



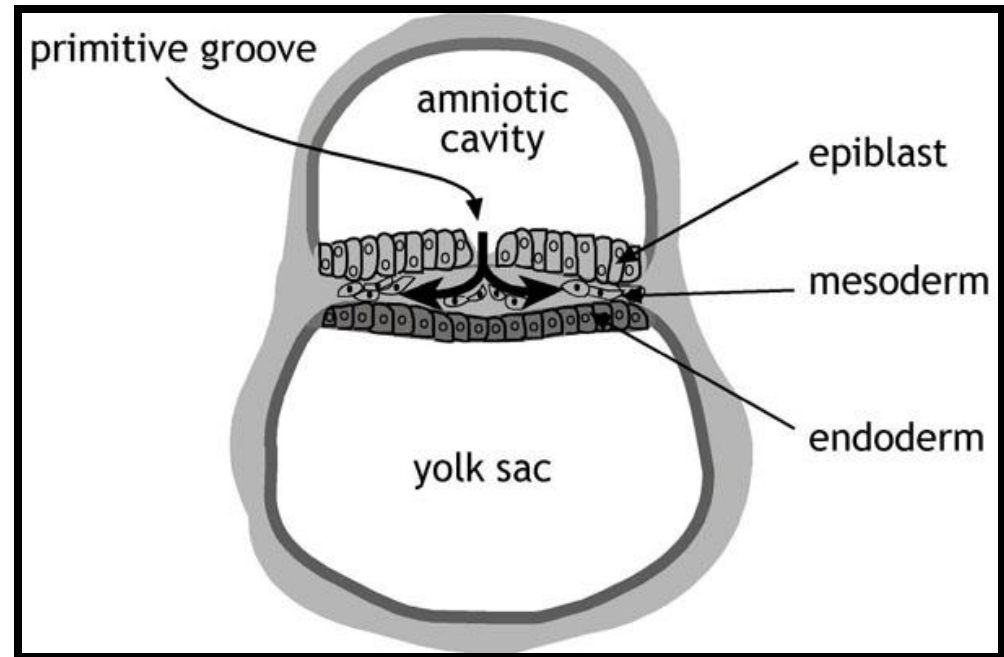
FORMATION OF GERM LAYERS

- Some of the invaginating cells displace the hypoblast, creating a new layer – embryonic **endoderm**
- Some cells come to lie b/w epiblast & newly formed endoderm – embryonic **mesoderm**

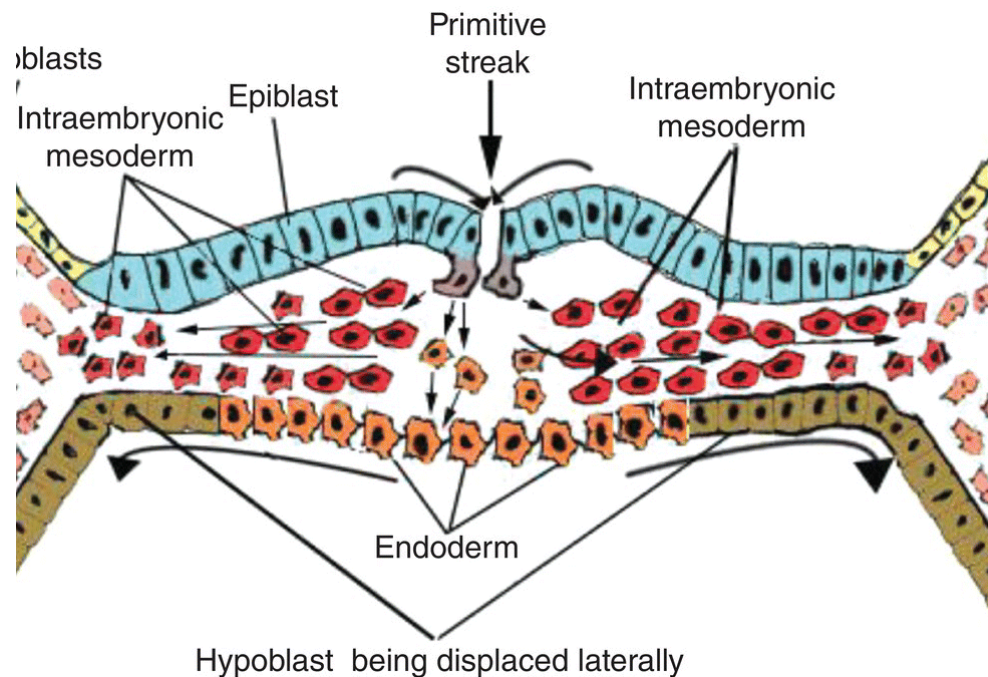


FORMATION OF GERM LAYERS

- Cells remaining in the epiblast then form the embryonic **ectoderm**
- **Epiblast** gives rise to all the 3 germ layers through the process of **gastrulation**



Formation of definitive germ layers



- Endoderm
- Mesoderm
- Ectoderm

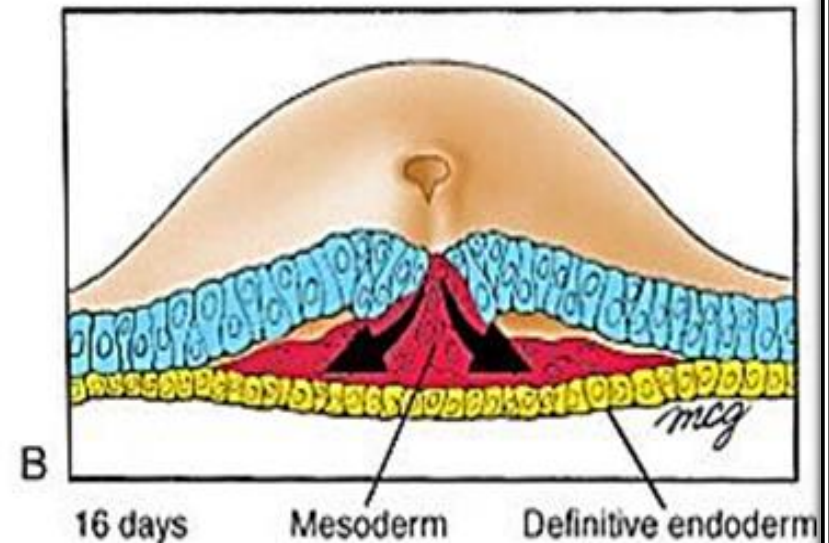
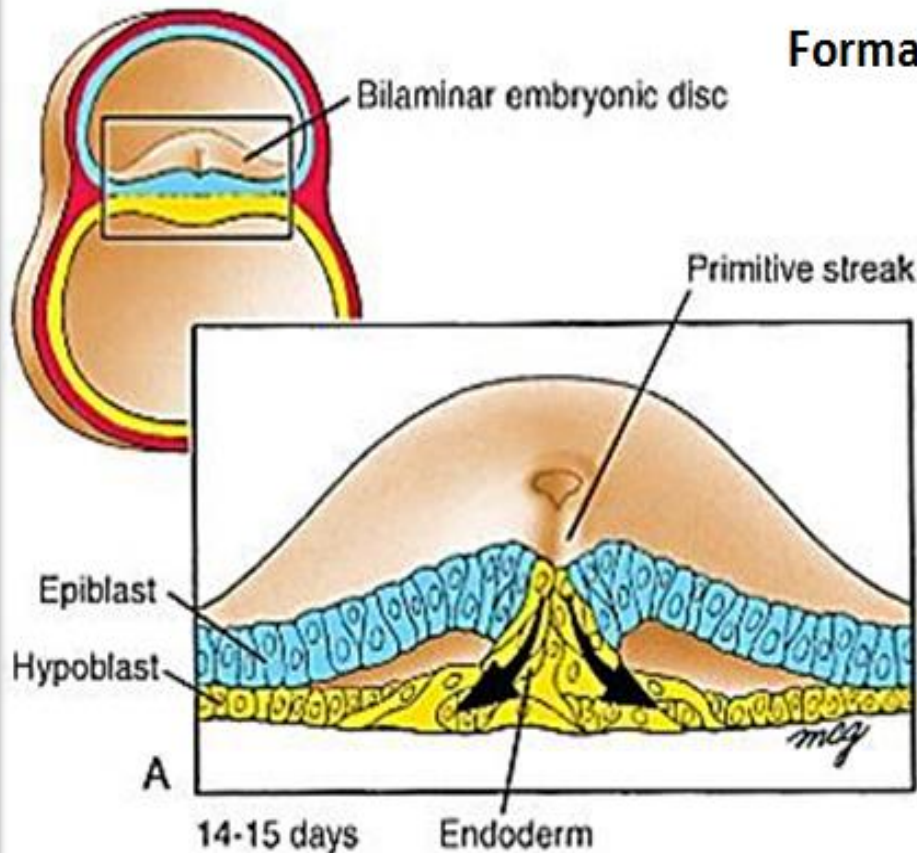
Gastrulation

Formation of trilaminar from bilaminar disc

Week 3 of development

Ectoderm; Mesoderm; Endoderm;

Primitive node and streak



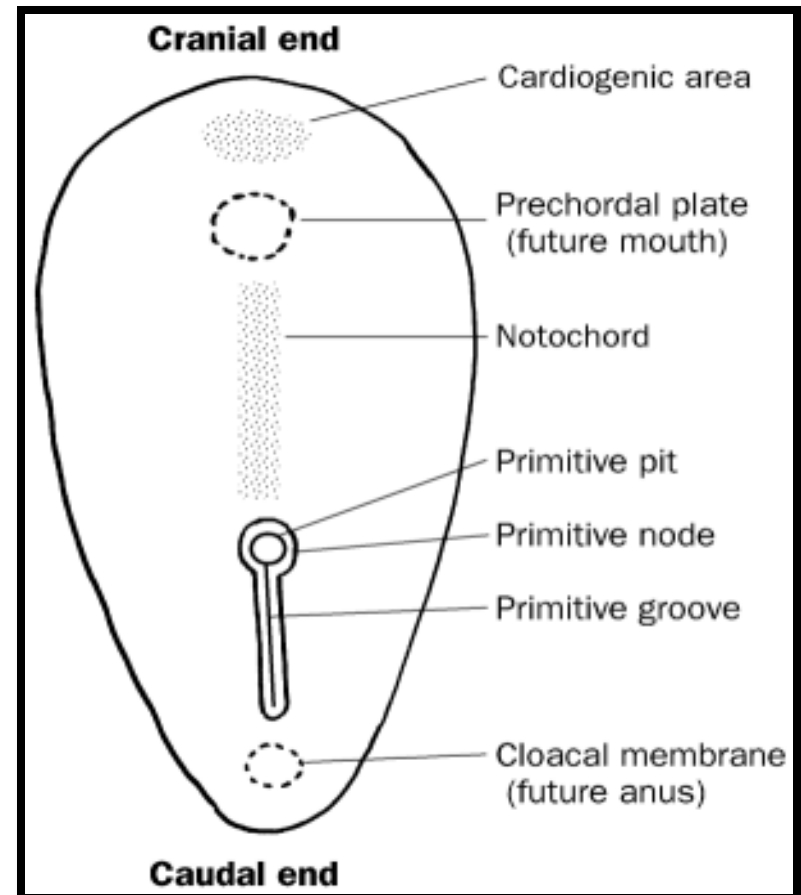
Ectoderm: Epidermis and CNS

Mesoderm: Musculoskeletal; Cardiovascular and Urogenital systems

Endoderm: Lining of GIT and respiratory tract

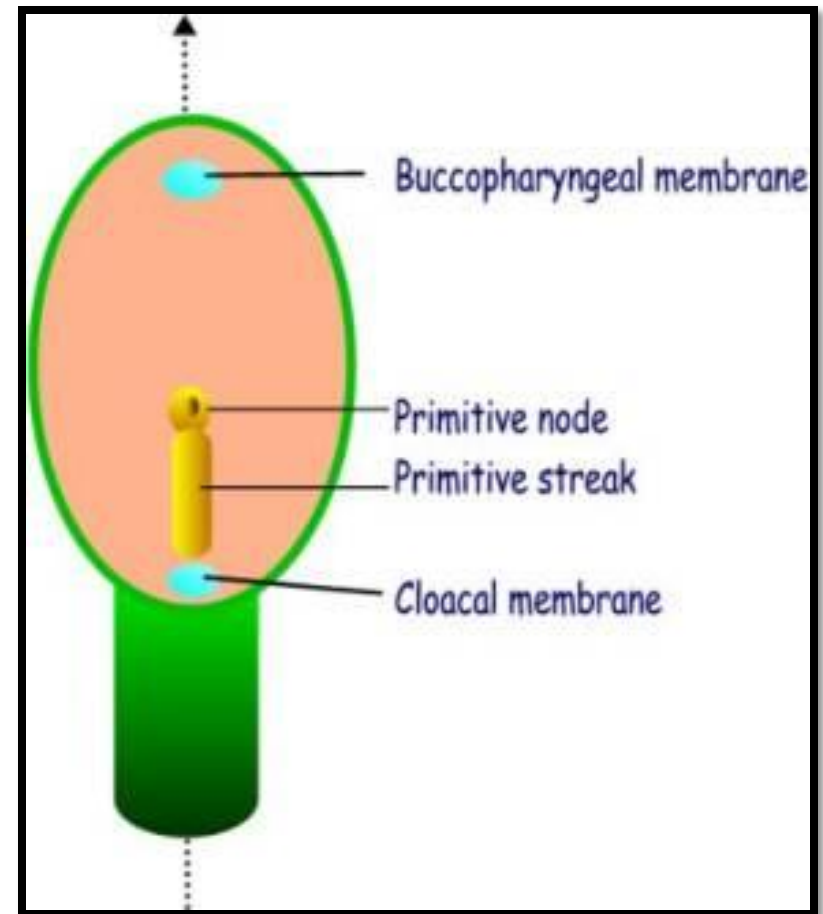
PRECHORDAL PLATE

- A small circular area of columnar **endodermal** cells near the **cranial** end
- Forms the primordium of buccopharyngeal membrane (future site of oral cavity)
- Ectoderm & endoderm are tightly adherent together at this region



INTRAEMBRYONIC MESODERM

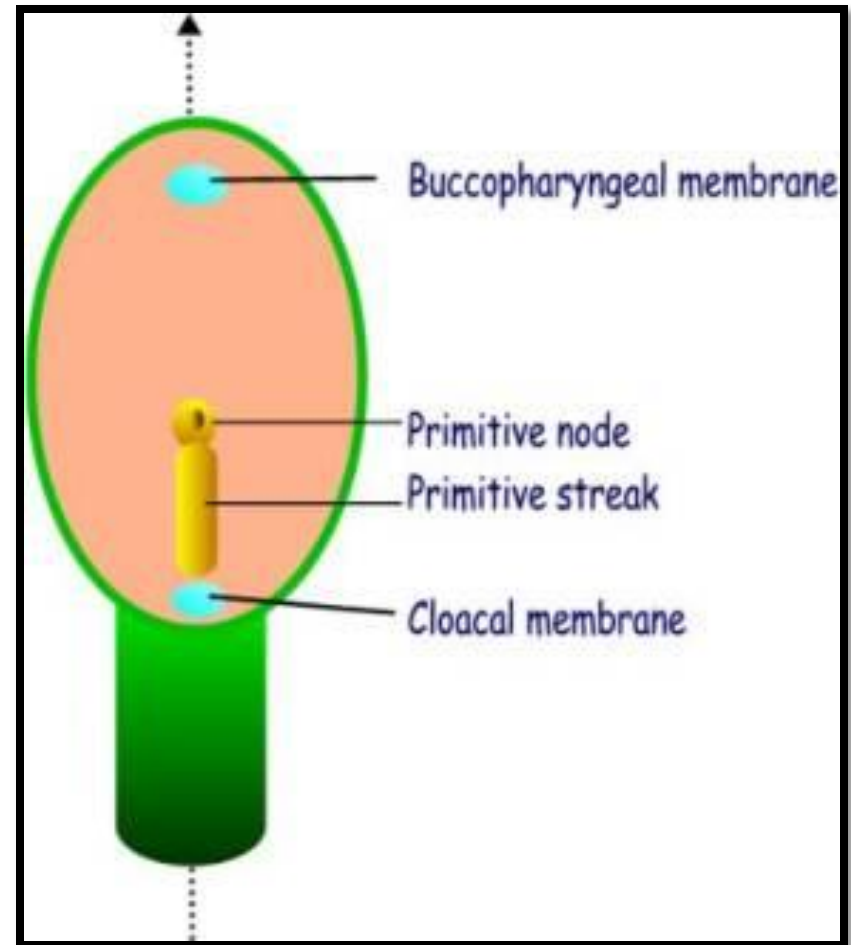
- Cells that proliferate in the region of primitive streak pass sideways pushing themselves b/w ectoderm & endoderm
- The IEM spreads throughout the disc **except in 3 regions**
 - 1. prechordal plate** – ectoderm & endoderm remain in contact- later forms **buccopharyngeal membrane**



INTRAEMBRYONIC MESODERM

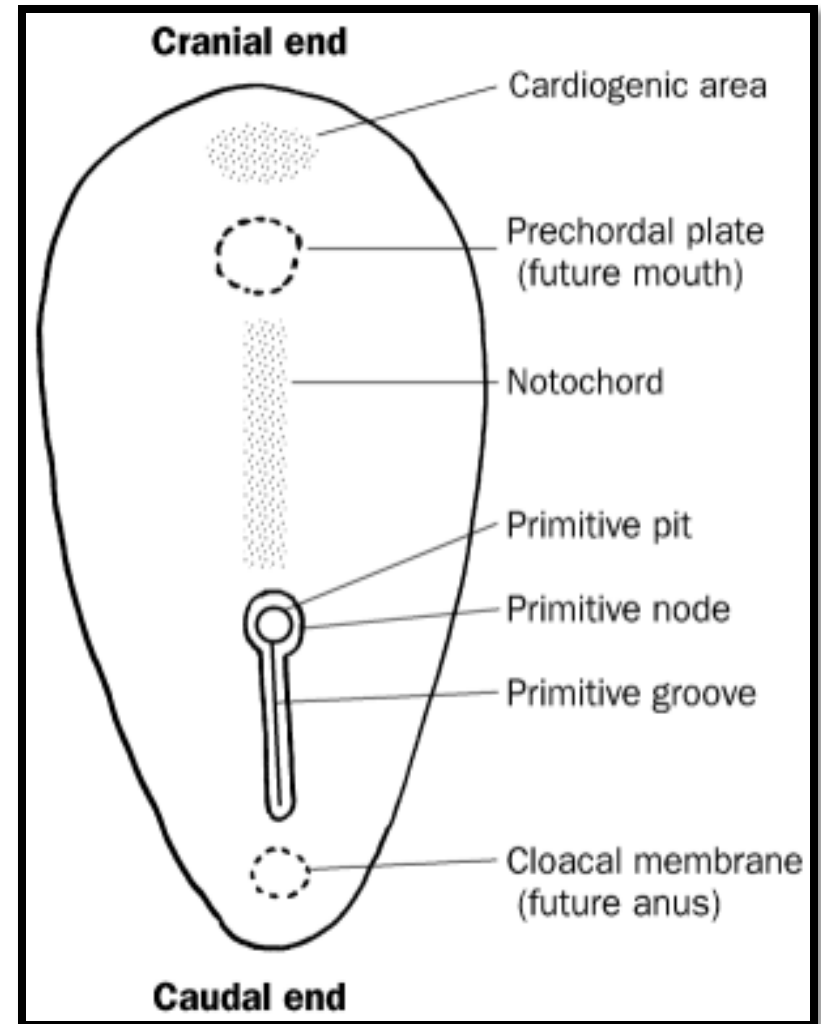
2. area caudal to primitive streak where ectoderm & endoderm remain in contact – **cloacal membrane**

3. area in the midline caudal to prechordal plate & cranial to primitive streak – which is occupied by the **notochord**



NOTOCHORD

- **Notochord** is a midline structure which develops in the region extending from the **cranial end of primitive streak** to the **caudal end of prechordal plate**
- Defines the **primordial axis** of the embryo & serves as the basis for the development of axial skeleton



STEPS IN THE FORMATION OF NOTOCHORD

- Cells in the region of primitive node proliferate & extend towards the caudal end of prechordal plate passing b/w ectoderm & endoderm. These cells form a solid cord – **notochordal process**
- Cavity of primitive pit extends into the notochordal process, converting it into a tube – **notochordal canal**

NOTOCHORD

- Floor of the notochordal canal fuses with the underlying endoderm to form a single layer which separates notochordal canal from yolk sac
- Later, this floor begins to break down & finally notochordal canal communicates with the yolk sac

NOTOCHORD

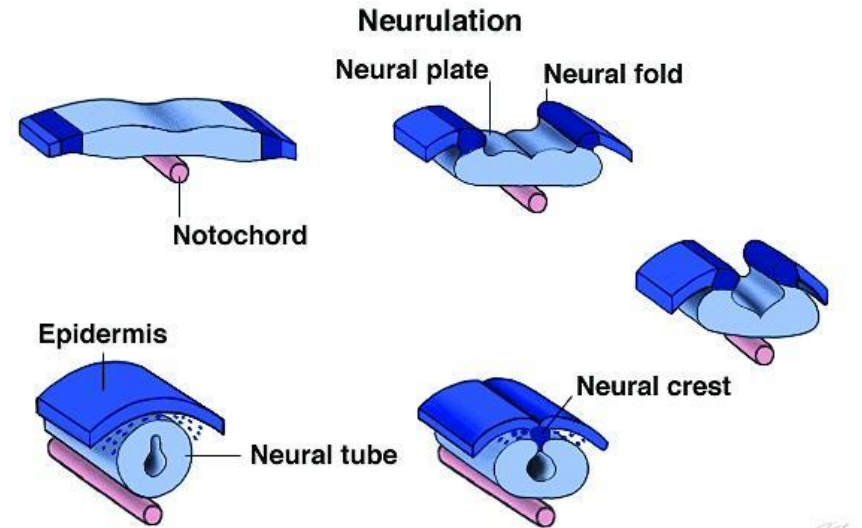
- Gradually the walls of the canal become reformed & flattened to form a flat plate of cells – **notochordal plate**
- Notochordal plate again becomes curved into a tube & proliferation of cells into it converts it into a solid rod of cells - **definitive notochord**.
- Proximal part of NC persists temporarily, forming a transitory communication b/w AC & YS – **neurenteric canal**

FATE OF NOTOCHORD

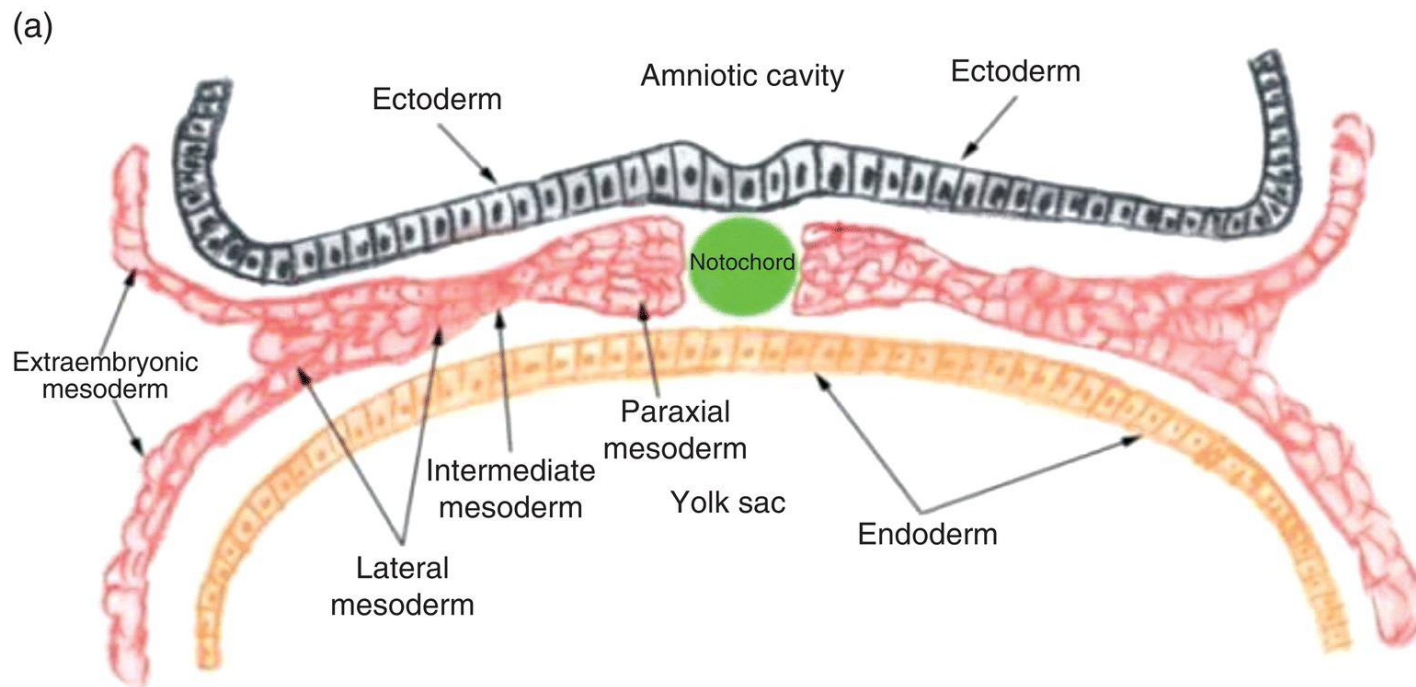
- Notochord extends from the oropharyngeal membrane to the primitive node
- The **vertebral column** develops around the notochord
- Notochord degenerates & disappears as the bodies of the vertebra form
- Persists as the **nucleus pulposus** of each **intervertebral disc** & **apical ligament of dens**

IMPORTANCE OF NOTOCHORD

- Functions as the **primary inductor/organizer** in the early embryo
- The developing notochord **induces** the **overlying ectoderm** to thicken & form the **neural plate**
- Neural plate serves as the **primordium of the central nervous system**



Intraembryonic mesoderm - subdivisions

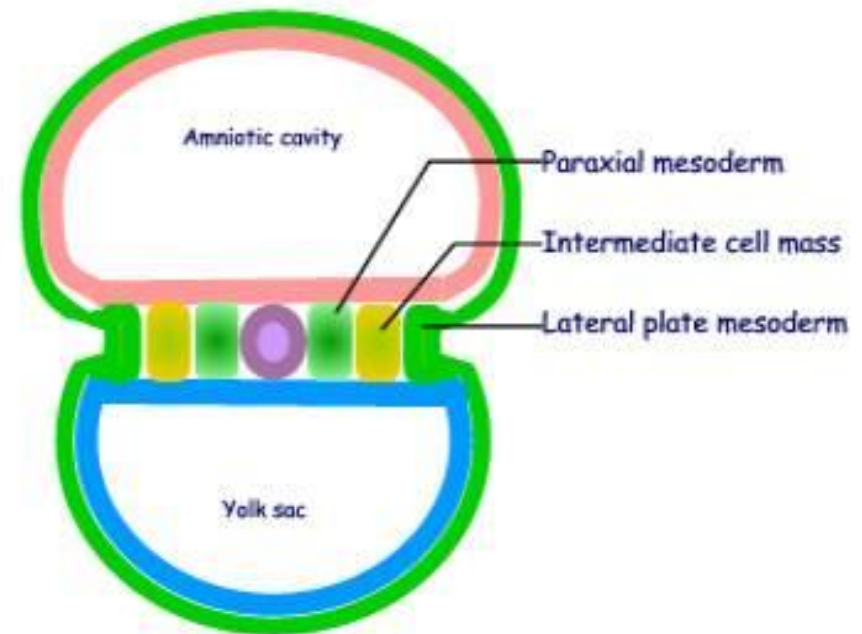


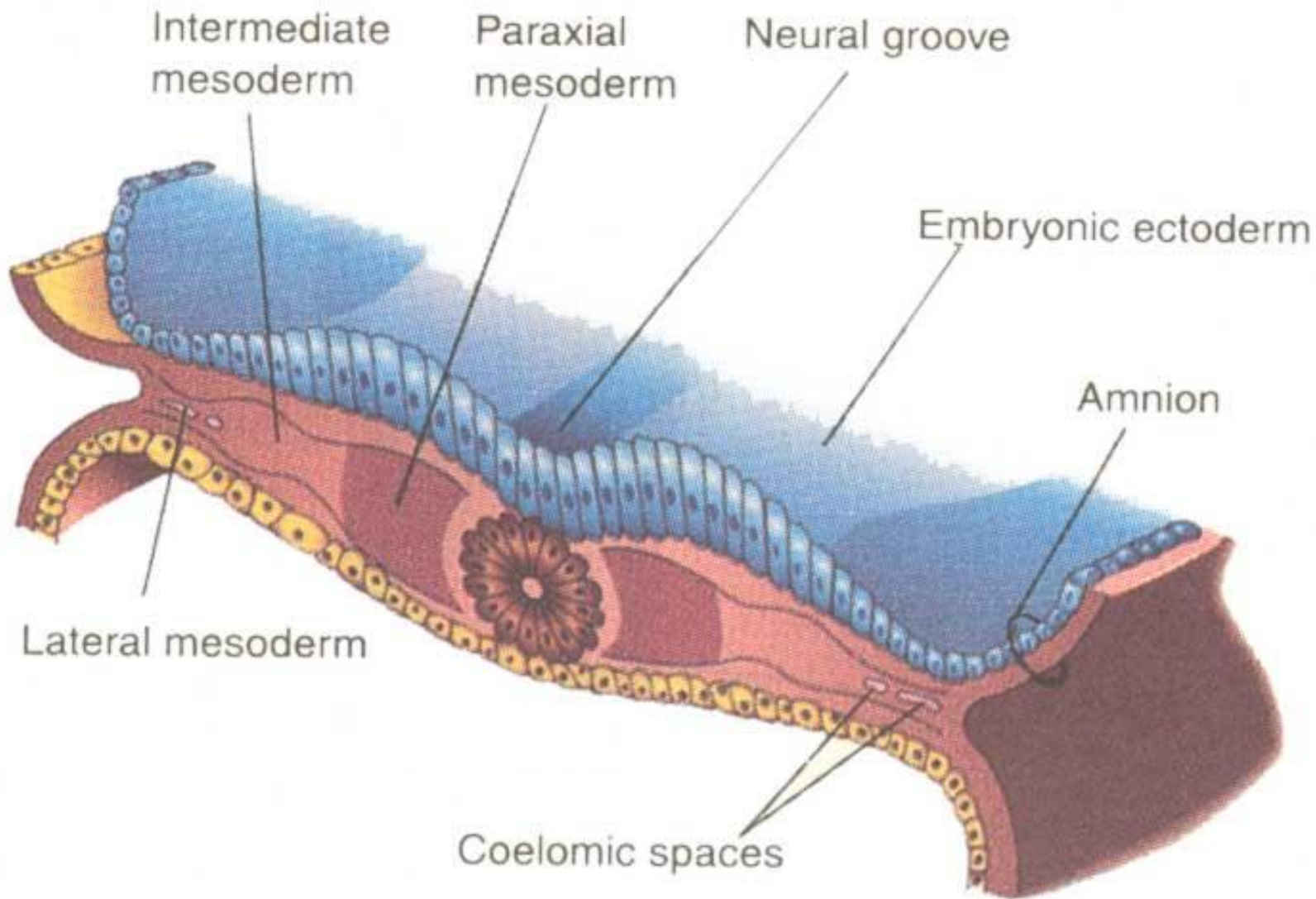
INTRAEMBRYONIC MESODERM

- By the 17th day, the mesoderm gets divided into **3 parts**
- On either side of notochord, it becomes thick – **paraxial mesoderm**
- More laterally, mesoderm remains thin – **lateral plate mesoderm**
- A thin longitudinal strip of mesoderm connecting these two – **intermediate mesoderm**

Intraembryonic mesoderm - subdivisions

- Paraxial mesoderm
- Intermediate mesoderm
- Lateral plate mesoderm

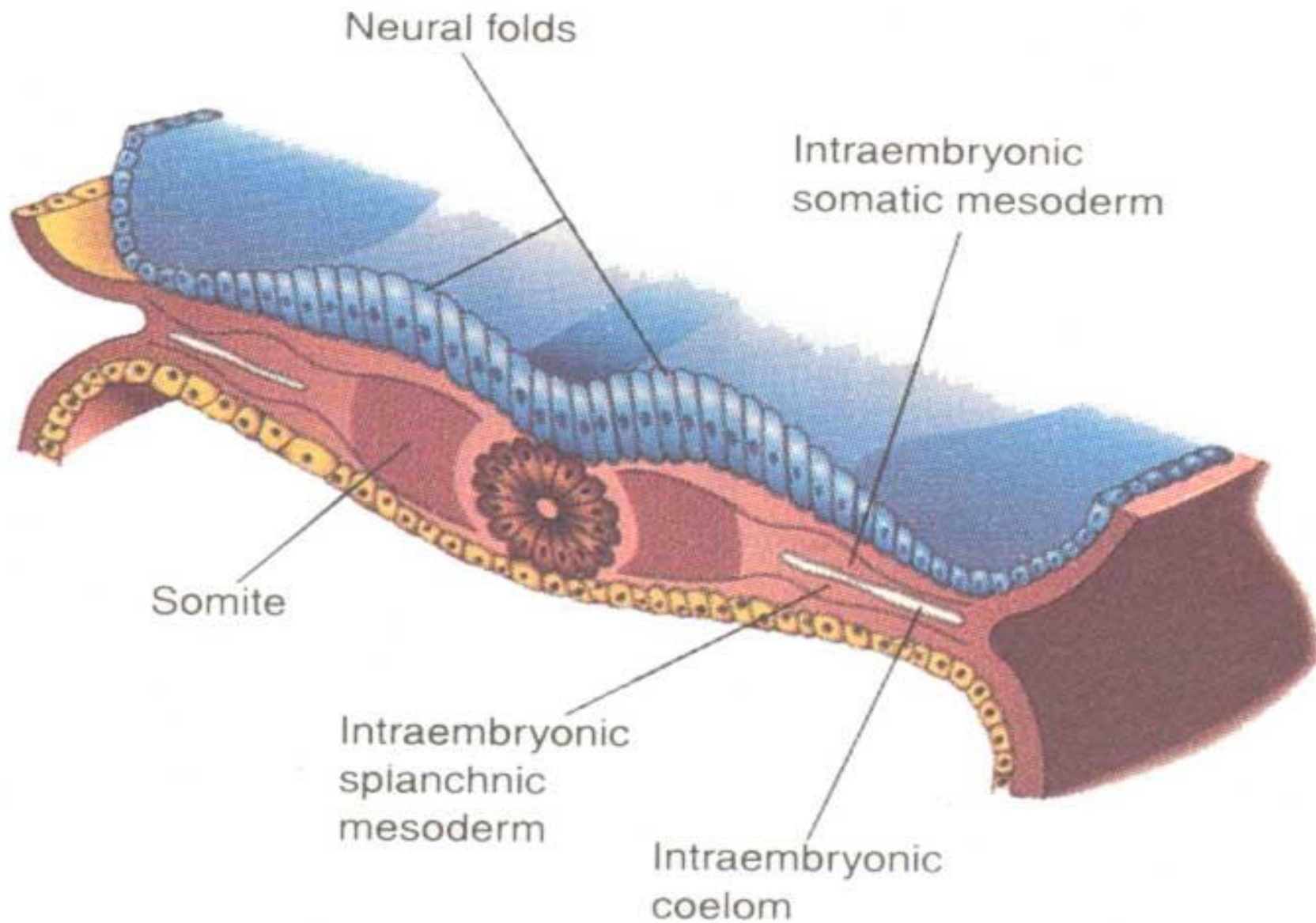




B

INTRAEMBRYONIC MESODERM

- Small cavities appear in the lateral plate mesoderm. These join to form a large cavity – **intraembryonic coelom**
- Initially this horse-shoe shaped cavity is closed, later it becomes continuous with the EEC on each side of embryo



D

DIVISIONS OF LATERAL PLATE MESODERM

- With the formation of IEC, the lateral plate mesoderm divides into 2 layers:
- A layer continuous with the mesoderm covering the amnion – **somatic / parietal** intraembryonic mesoderm
- A layer continuous with the mesoderm covering the yolk sac – **splanchnic /visceral** intraembryonic mesoderm
-

Cut edge of amnion

Neural fold

Neural groove

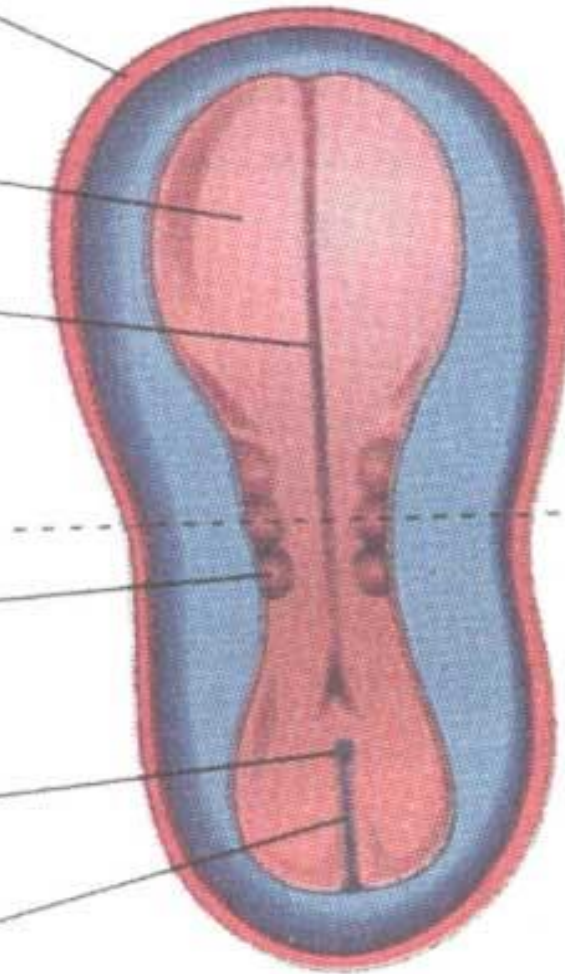
Somite

Primitive node

Primitive streak

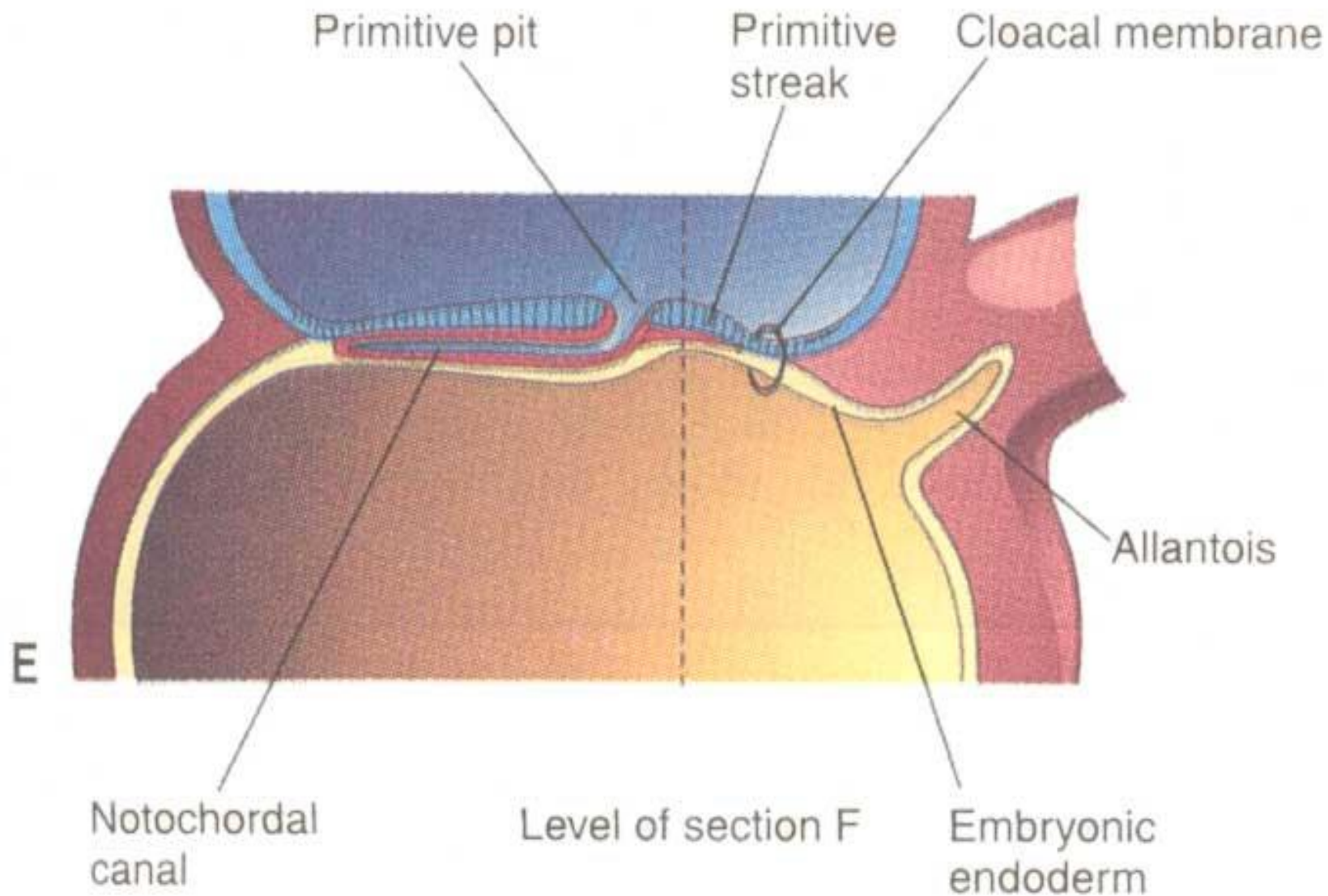
Level of
section B

A



SOMITES

- Paraxial mesoderm becomes segmented to paired cuboidal bodies – **somites**
- These blocks of mesoderm are located on each side of the developing neural tube
- Somites first appear in the future occipital region (end of 3rd week). Subsequent pairs form in a craniocaudal sequence
- Somites form **most of axial skeleton** and **associated musculature**



ALLANTOIS

- A small sausage-shaped diverticulum (outpouching) from caudal wall of yolk sac that extends into the connecting stalk
- Remains very small in human embryos
- Involved with early blood formation
- Associated with development of urinary bladder