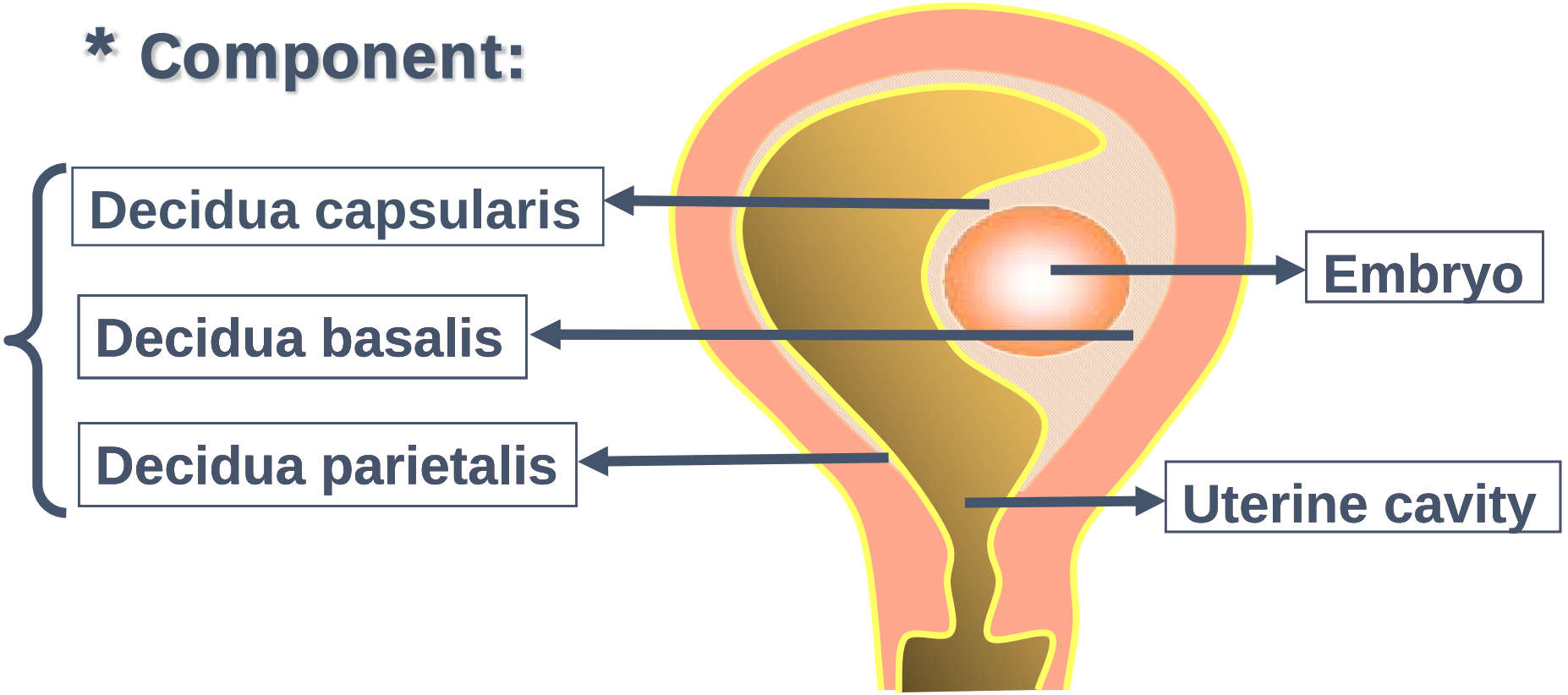
Quadruplets - Test-tube Baby

Decidua

Definition: Endometrium after implantation.

*** Component:**



Decidua Reaction

- **the tissue thickens and becomes more highly vascularized**
- **uterine glands and arteries become coiled**
- **stroma cells accumulate glycogen and lipids → decidual cells**

Cotents

- Maturation of germ cells and Fertilization
- Cleavage, Blastocystformation and Implantation
- The formation of embryonic disc
- The differentiation of trilaminar germ disc and Embryonic folding
- Fetal membrane and Placenta

1. Bilaminar Germ Disc

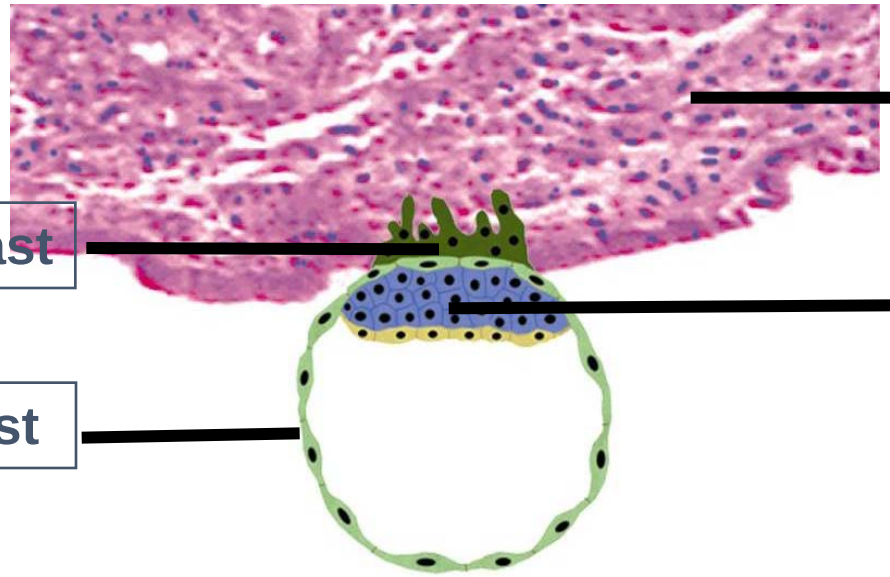
(1) Formation of epiblast layer and hypoblast layer

(2) Formation of amniotic cavity and yolk sac

(3) Bilaminar Germ Disc：

* By the end of the 2nd week, epiblast layer and hypoblast layer forms a flat disc.

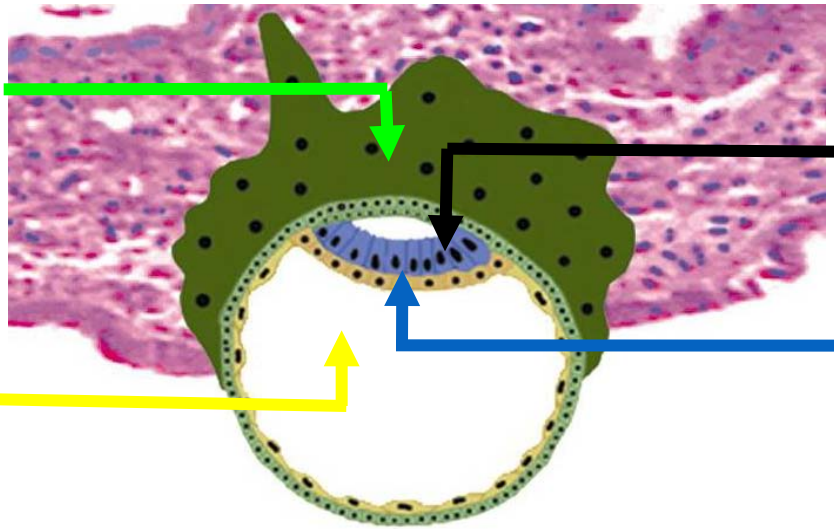
The 7th day-Implantation



- Second week, blastocyst implantation
- Inner cell mass proliferate and differentiate into a flat disc → germinal disc (consists of 2 germinal layers) →

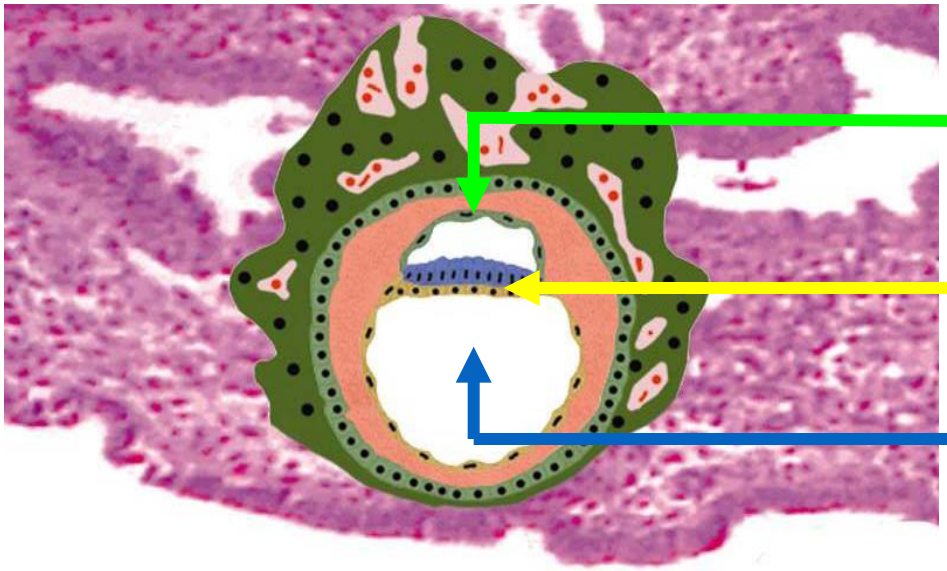
  Bilaminar Germ Disc

The 8th day-Differentiation of 2 germinal layers



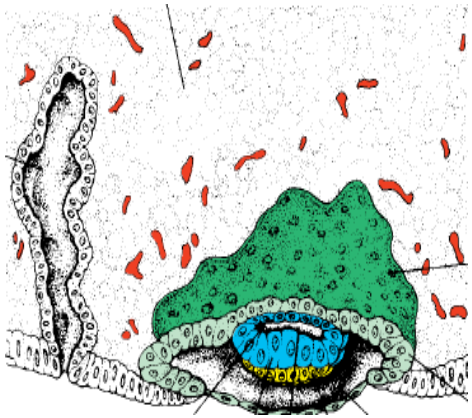
- Germ Disc
  - **epiblast layer:** a layer of tall columnar cells
  - **hypoblast layer:** a layer of cuboidal cells
- a small cavity between epiblast and trophoblasts → Amniotic cavity
  Amnioblast

The 10th day

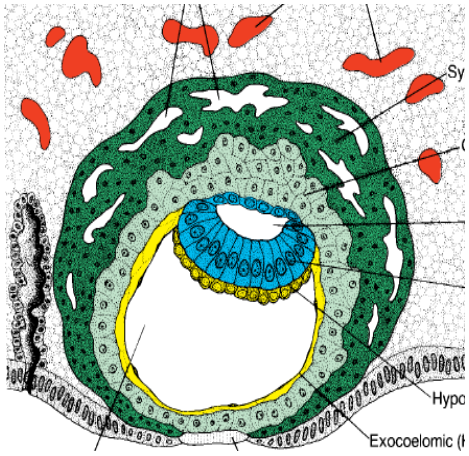


- Amnioblasts: Epiblast cells adjacent to the cytotrophoblast.
- Yolk Sac: Flattened hypoblast cells form a membrane → This membrane together with hypoblast forms the lining of yolk sac.
- Bilaminar Germ Disc → primordium of human body

Formation of Bilaminar Germ Disc



I



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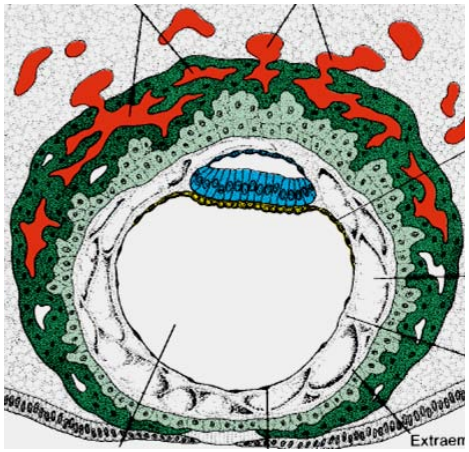
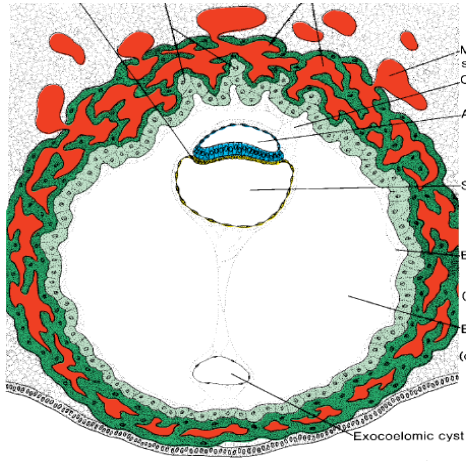


III

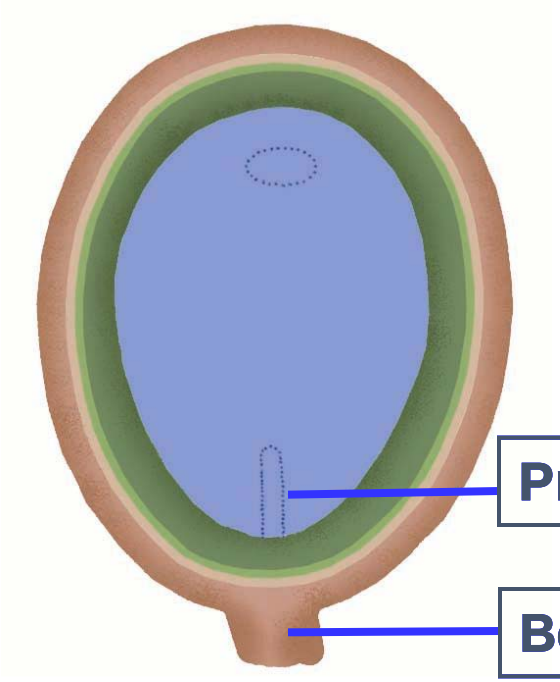


IV

2. Trilaminar Germ Disc

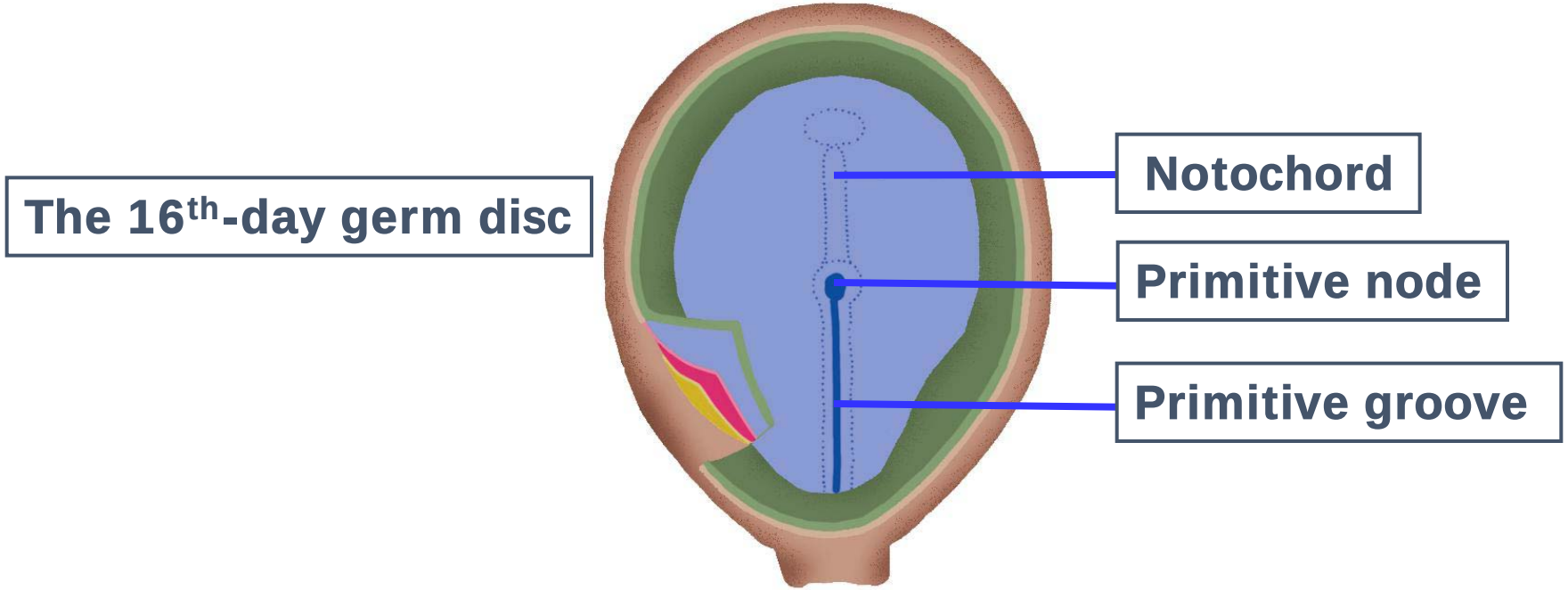
Formation of primitive streak

- in the early of the 3rd week
- cells of epiblast proliferate
- form a longitudinal arranged cell cord



The 15th-day germ disc

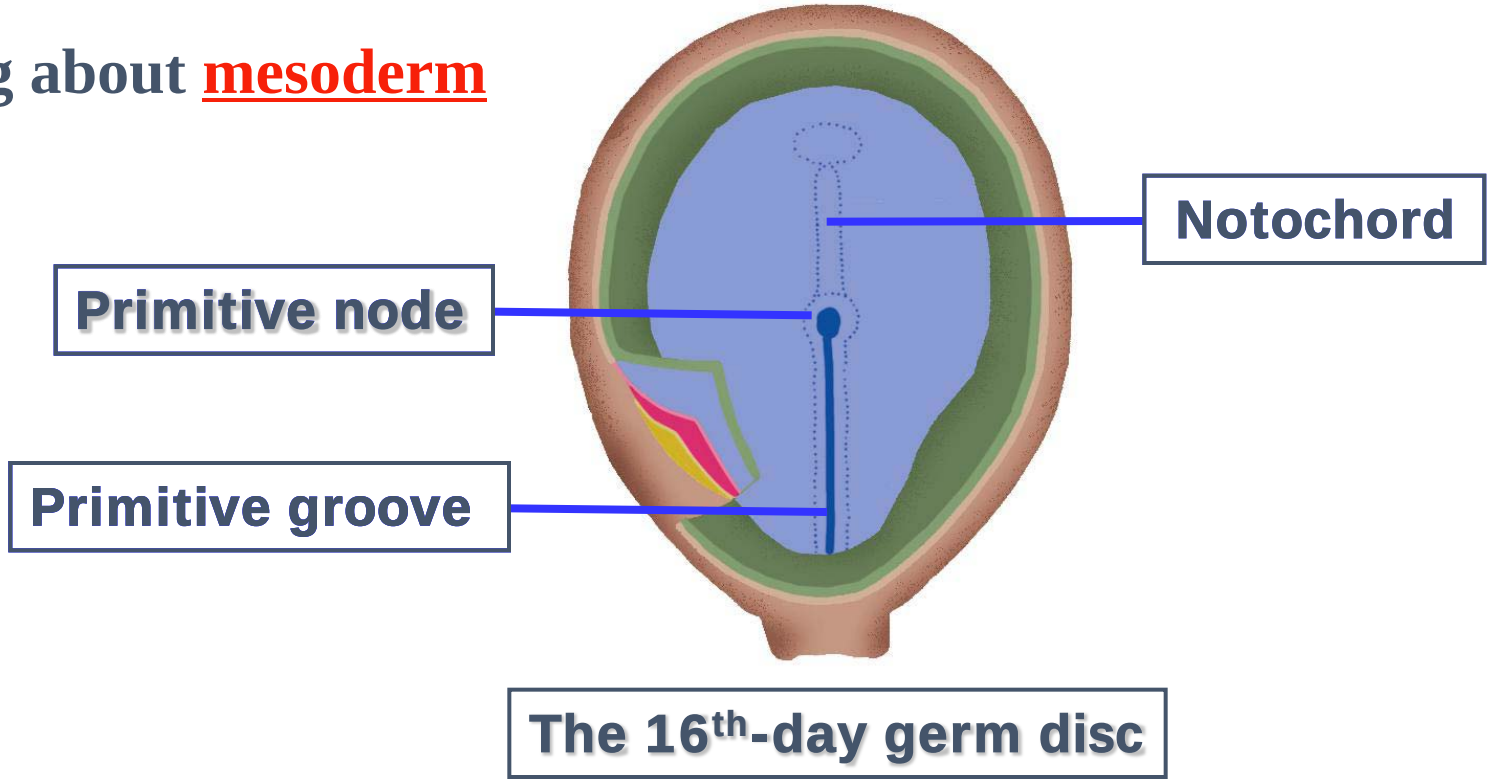
- Primitive node - The cephalic end of streak
- Primitive pit - The pit in the center of primitive node
- Primitive groove - A narrow groove in the midline of primitive streak



* Significance of primitive streak

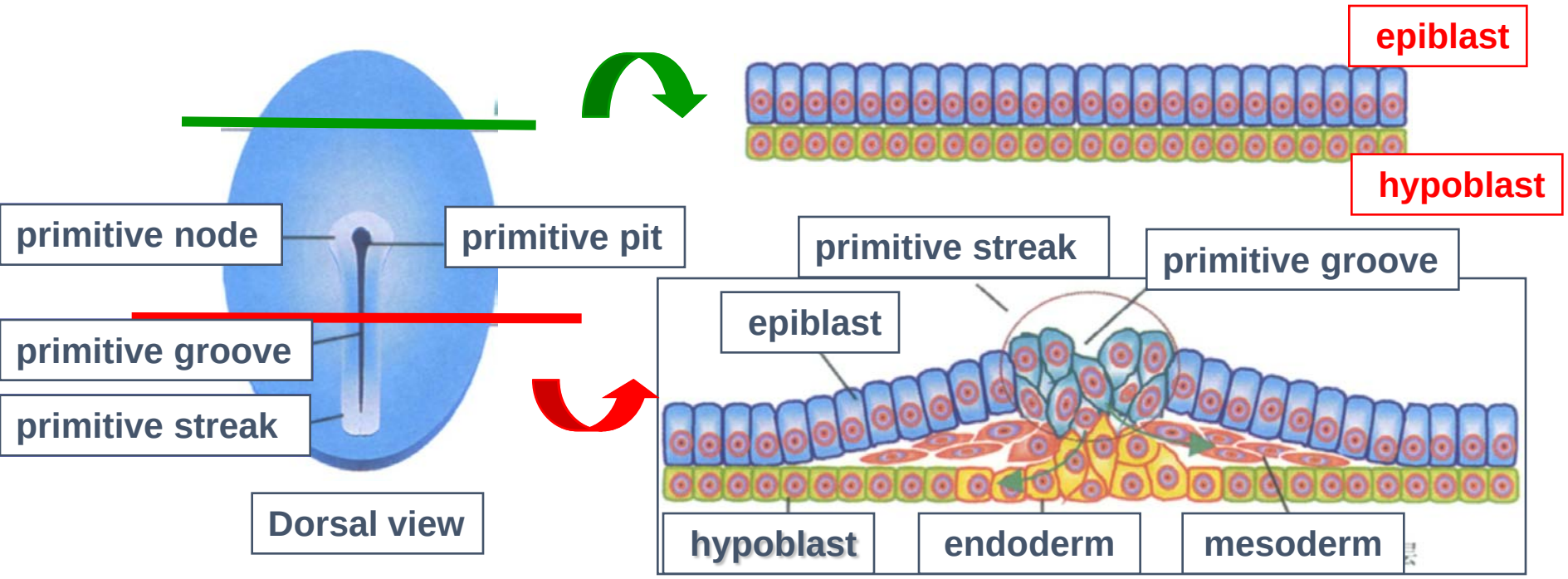
（1）Determination of head and tail of germ disc

（2）Bring about mesoderm



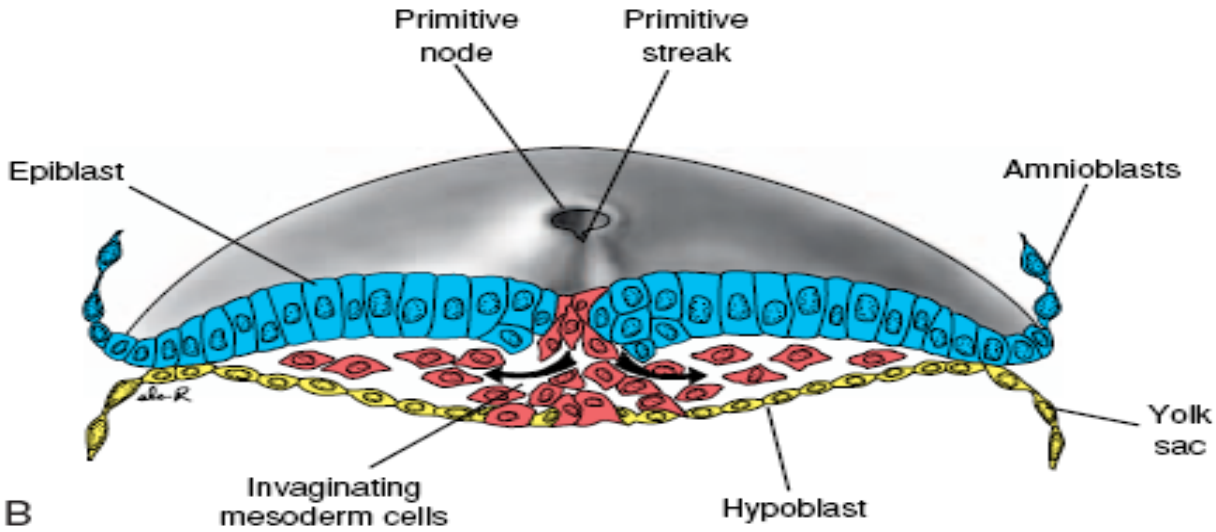
Formation of Mesoderm

- Originate from primitive streak
- Some cells at the bottom of primitive groove come to lie between epiblast and hypoblast to form mesoderm



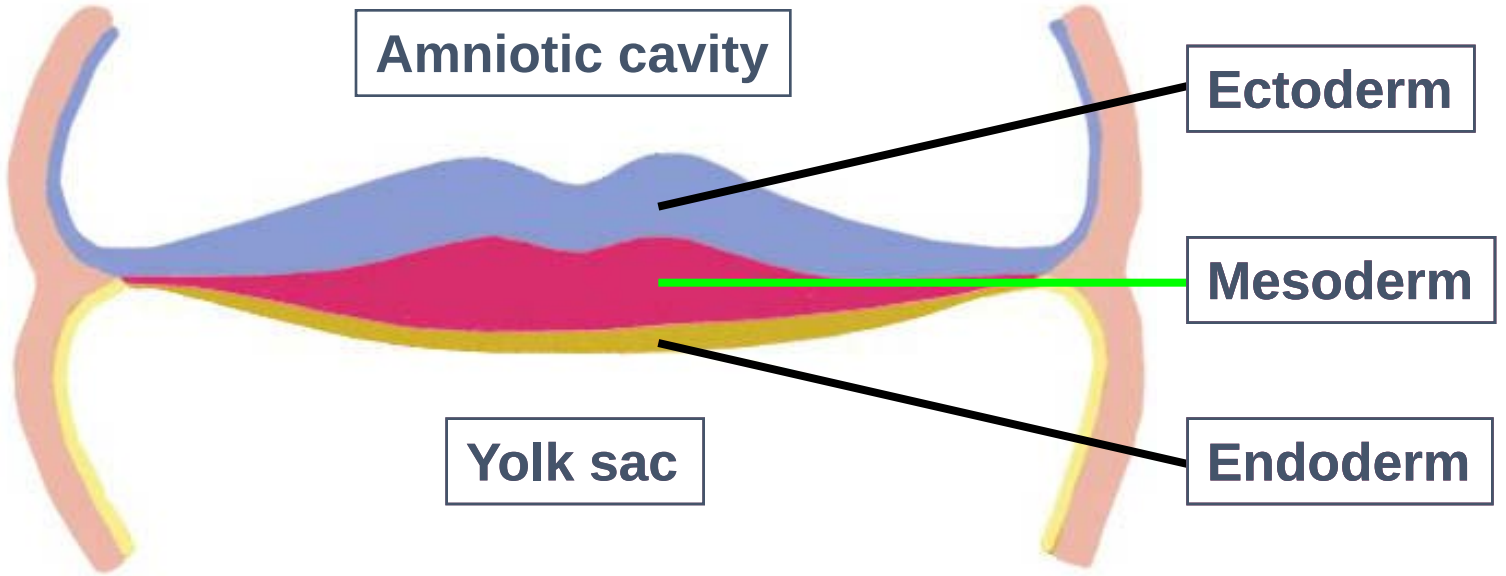
Formation of trilaminar germ disc

- Other cells from primitive groove displace hypoblast, creating the embryonic endoderm
- Cells remaining in epiblast then form ectoderm
- * By the end of the 3rd week, trilaminar germ disc forms



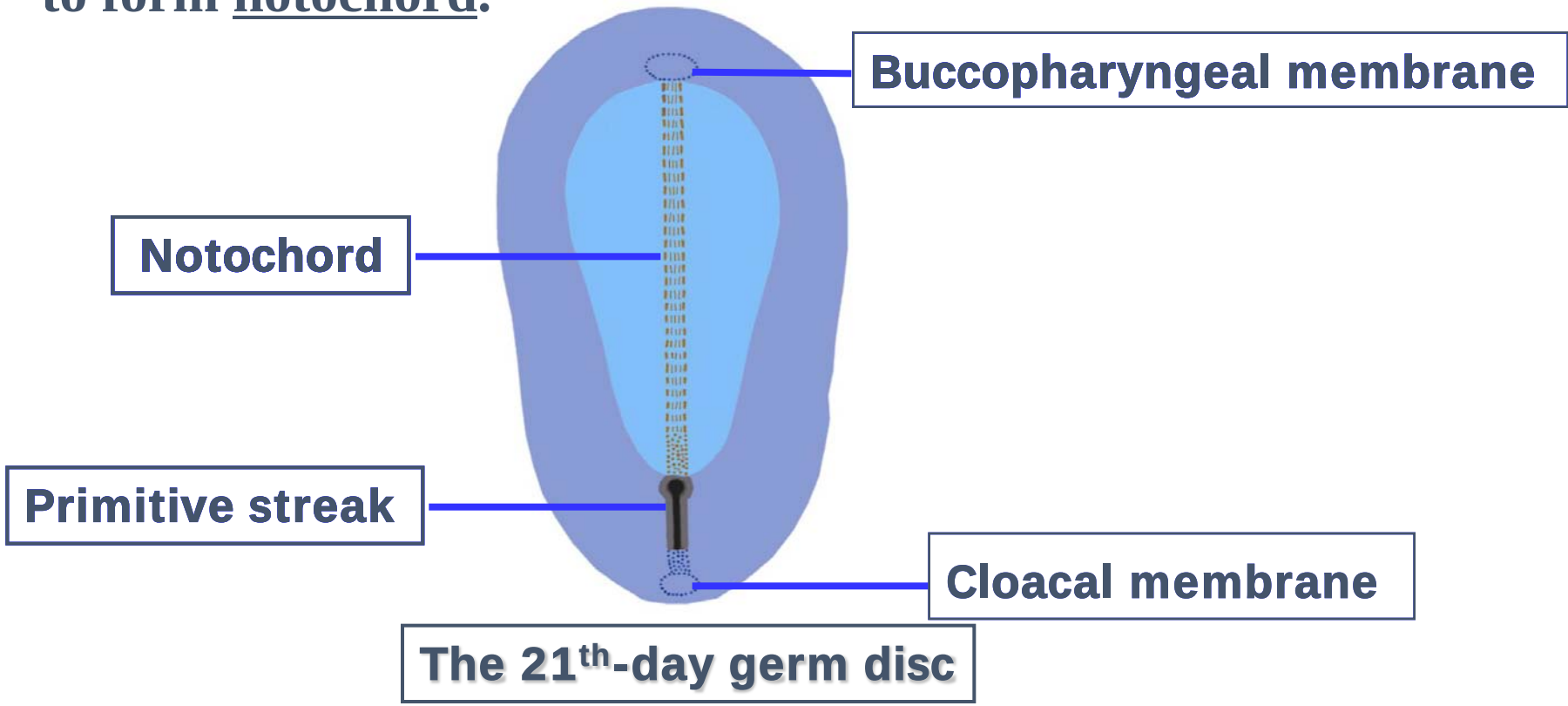
Trilaminar germ disc

* Component
  - Ectoderm
  - Mesoderm
  - Endoderm

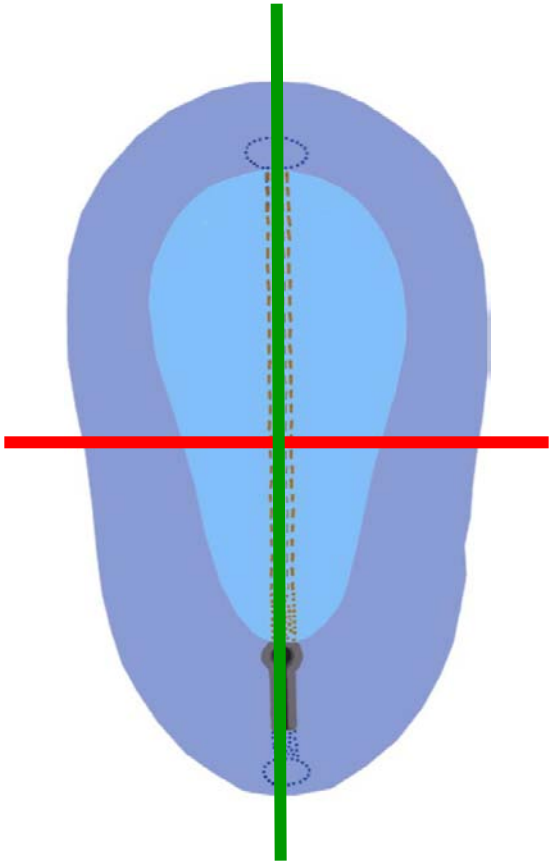


Formation of the Notochord

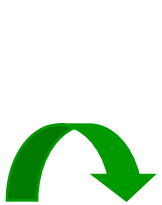
- Some cells of primitive pit proliferate and migrate cephalad to form notochord.

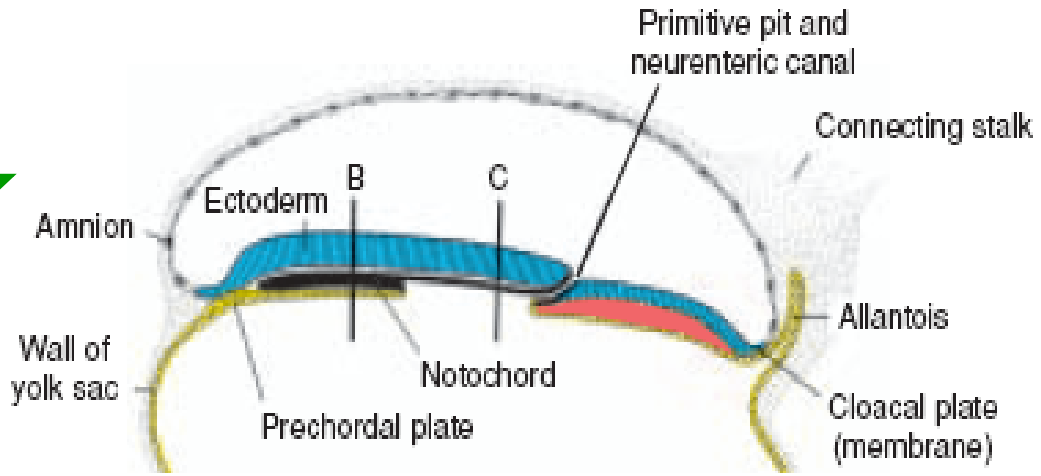


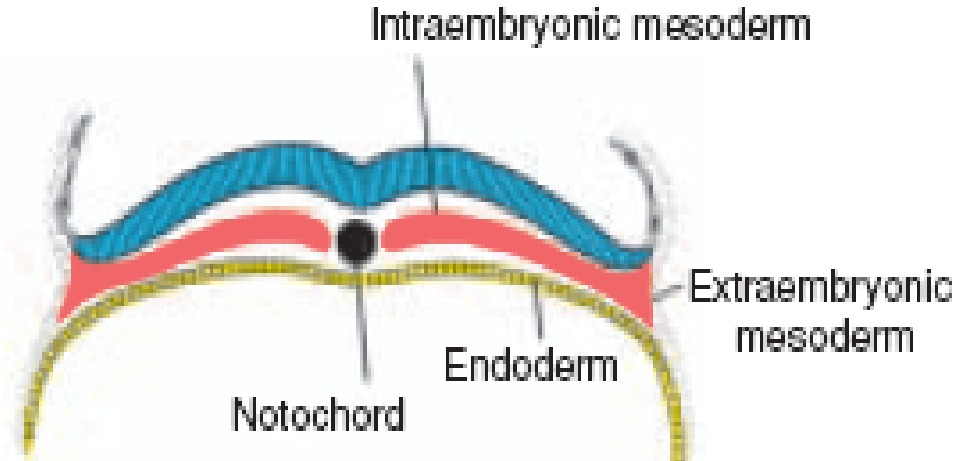
Formation of the Notochord



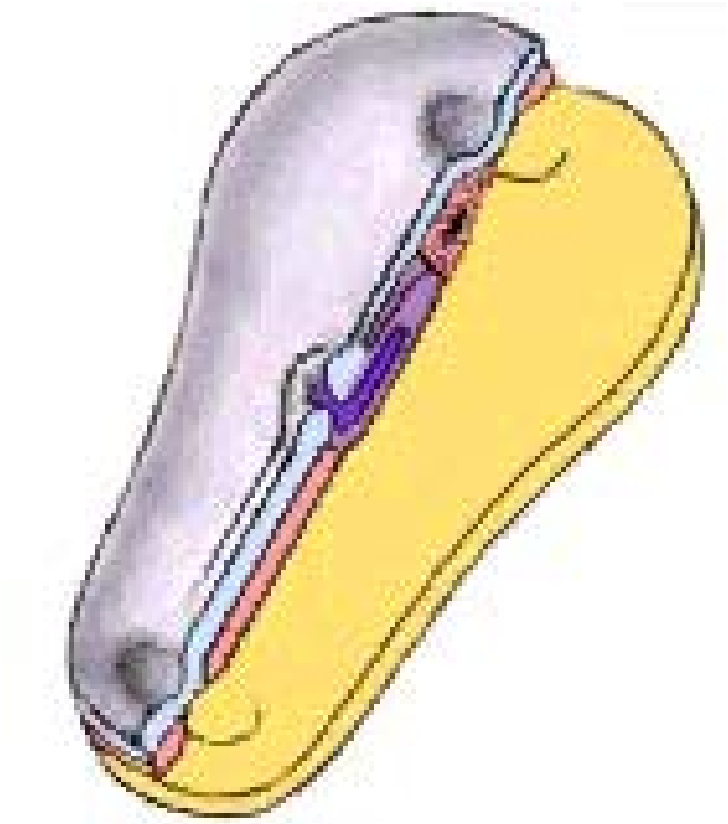
The 21th-day germ disc





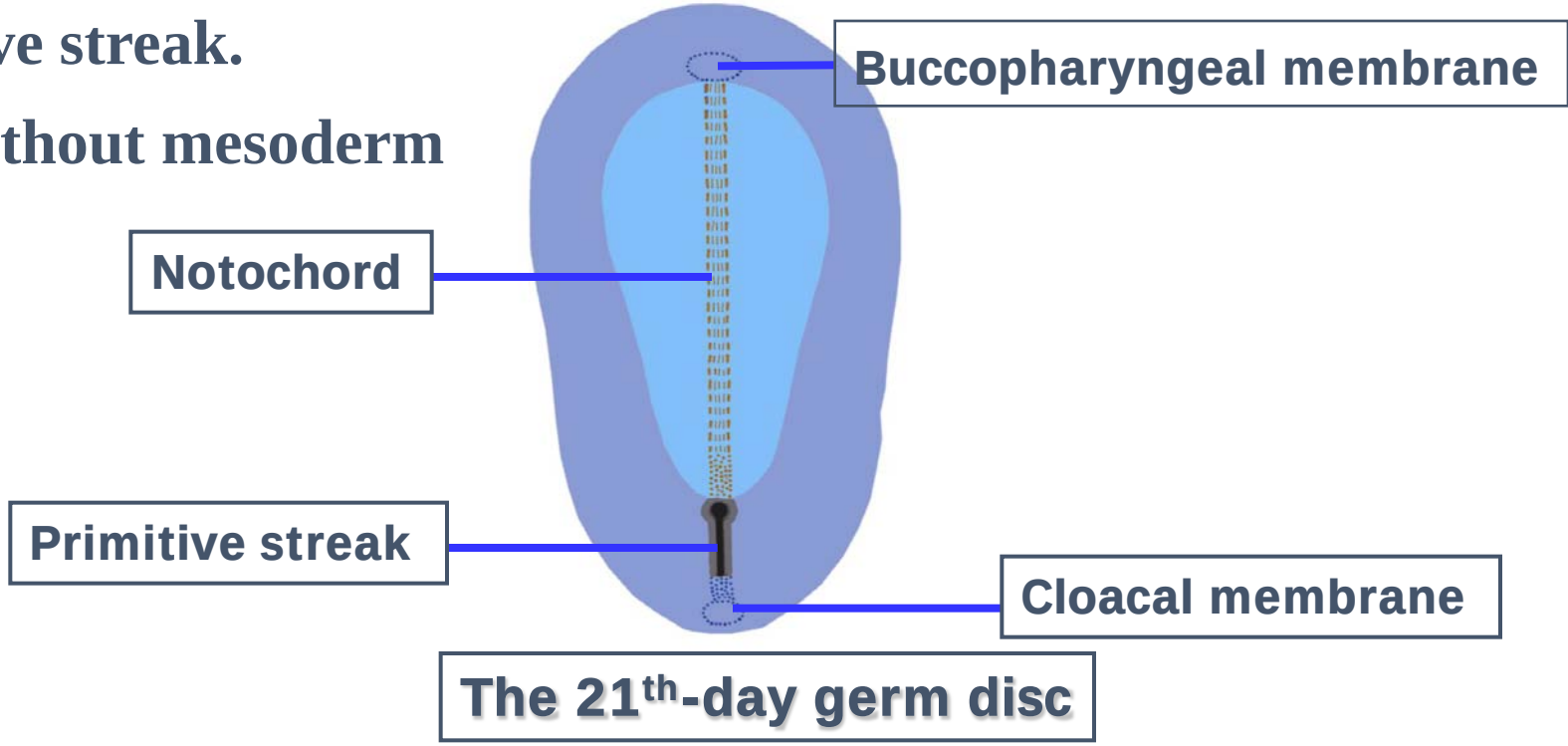


Formation of the Notochord



Buccopharyngeal membrane and Cloacal membrane

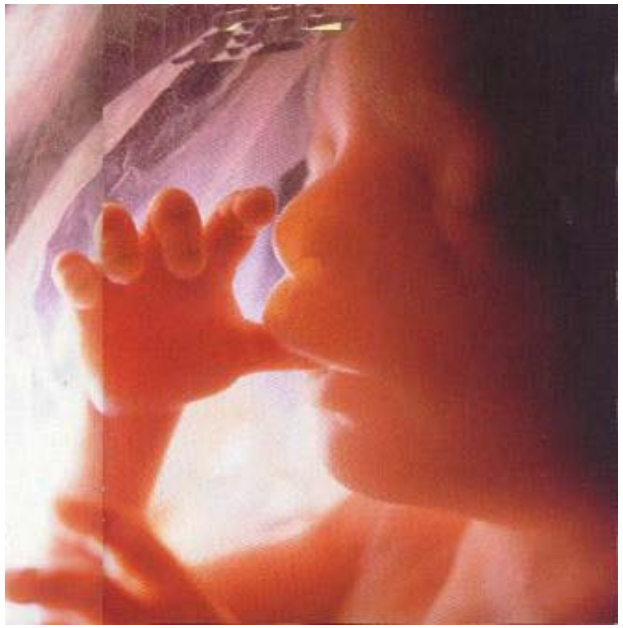
- Buccopharyngeal membrane is formed at the head end of notochord
- Cloacal membrane is formed at the caudal end of primitive streak.
- Both without mesoderm



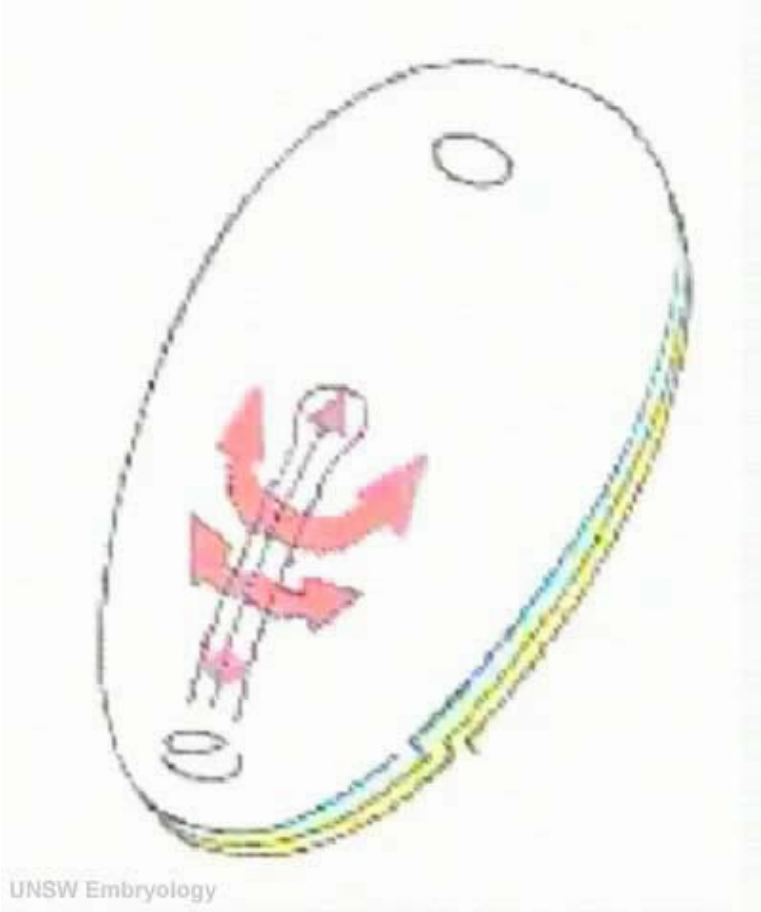
Fetus

6W

8W



4M


UNSW Embryology

Cotents

- Maturation of germ cells and Fertilization
- Cleavage, Blastocystformation and Implantation
- The formation of embryonic disc
- The differentiation of trilaminar germ disc and Embryonic folding
- Fetal membrane and Placenta

1. Differentiation of trilaminar germ disc

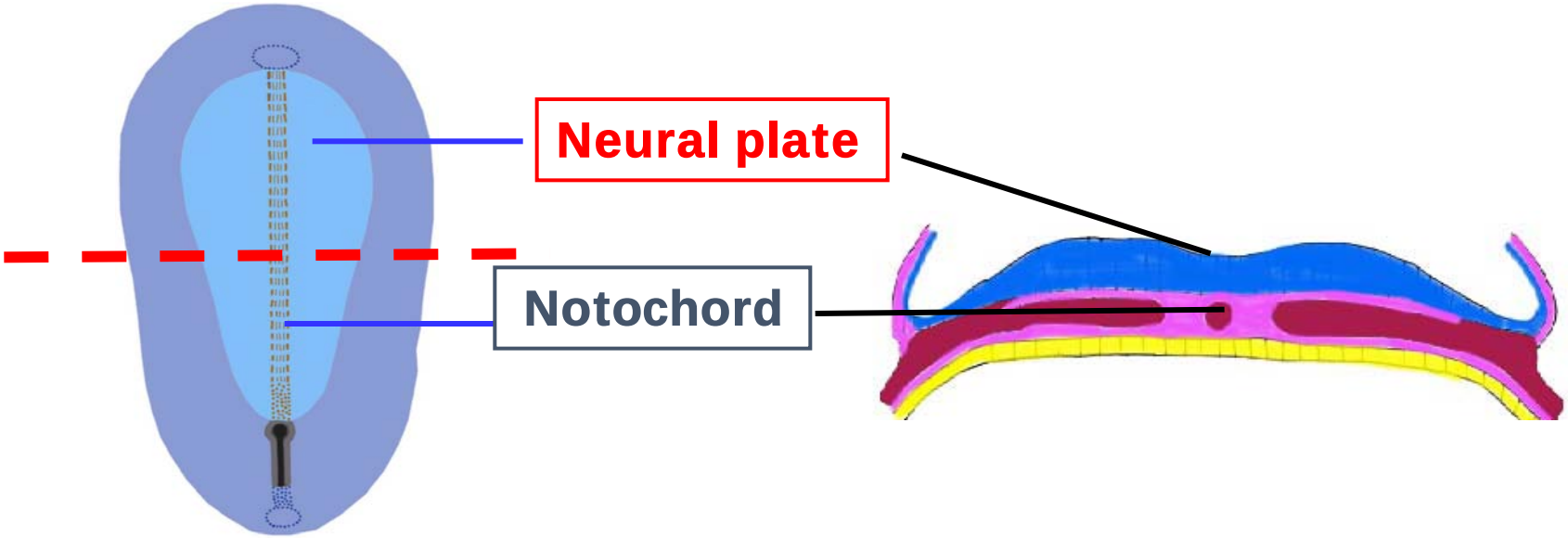
- 4^{th}-8^{th} weeks

- Ectoderm, mesoderm and endoderm, give rise to a number of specific tissues and organs.

(1) Differentiation of Ectoderm

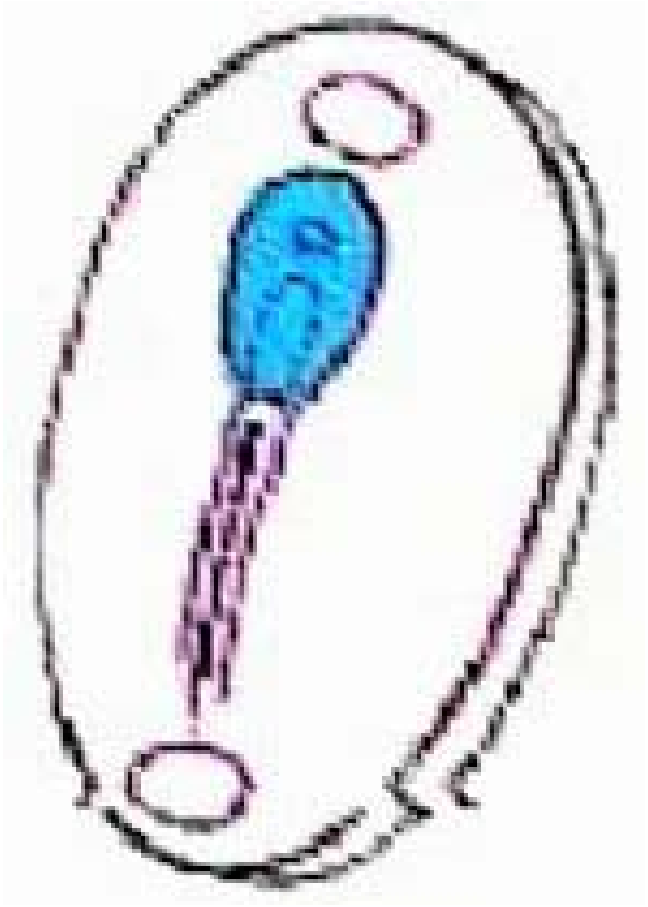
Neural Plate

- Appearance of notochord induces the overlying ectoderm to thicken and form neural plate.
- Cells of the plate make up neuroectoderm.



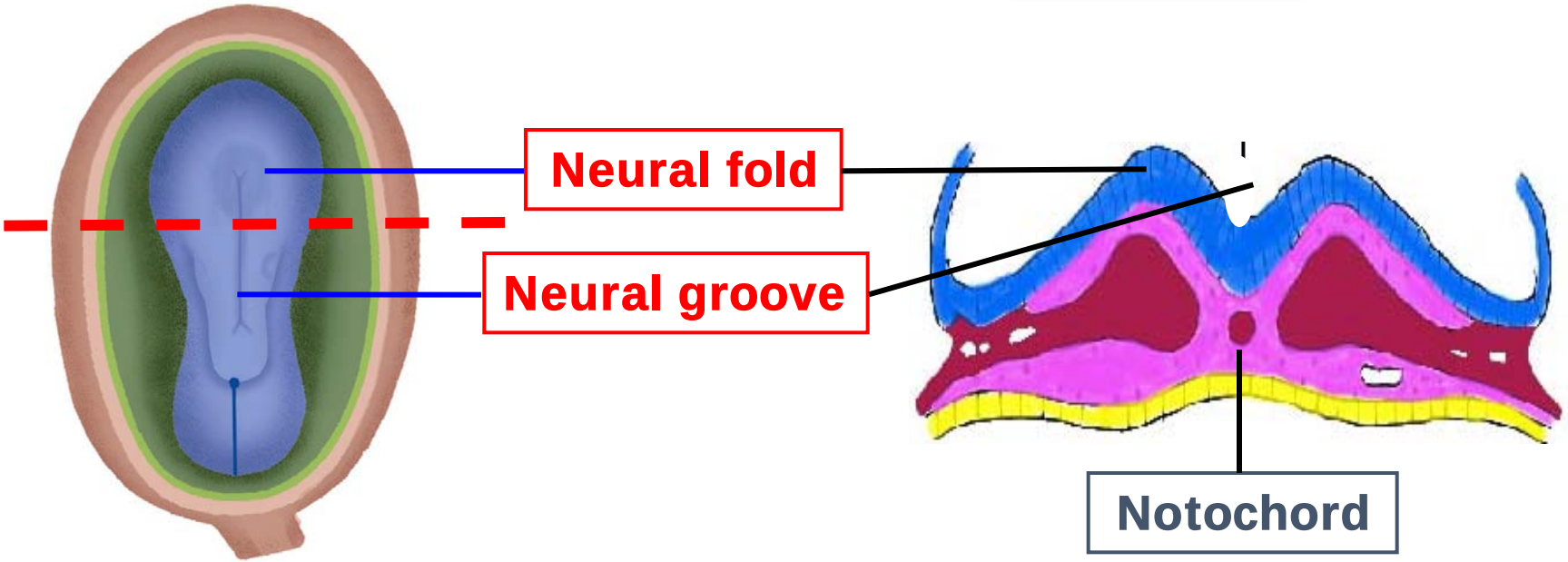
(1) Differentiation of Ectoderm

- blue region - neural plate
- white and black midline strip - primitive streak ending in primitive node
- white - ectoderm forming the epithelium of the skin
- upper circular region – buccopharyngeal membrane
- lower circular region – cloacal membrane



(1) Differentiation of Ectoderm

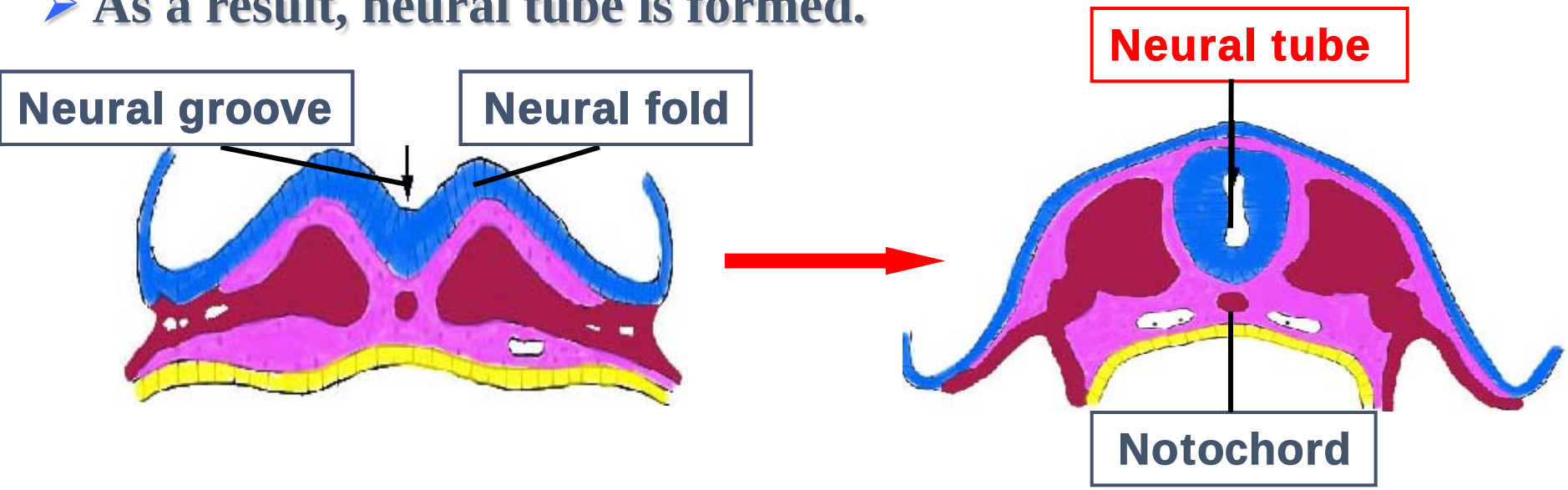
- **Neural Groove** - The depressed midregion of the neural plate forms neural groove.
- **Neural Fold** - The lateral edges of the neural plate become more elevated to form neural folds.



(1) Differentiation of Ectoderm

** Neural Tube

- Neural folds approach each other in the midline where they fuse.
- This fusion begins from middle and proceeds cephalad and caudadal.
- As a result, neural tube is formed.

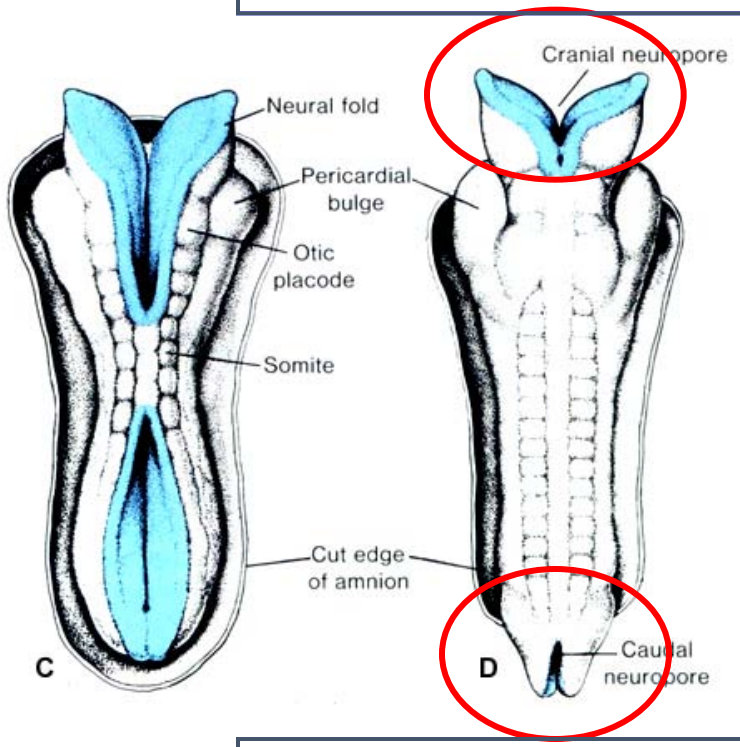


(1) Differentiation of Ectoderm

** Neural Tube

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

Cranial neuropore

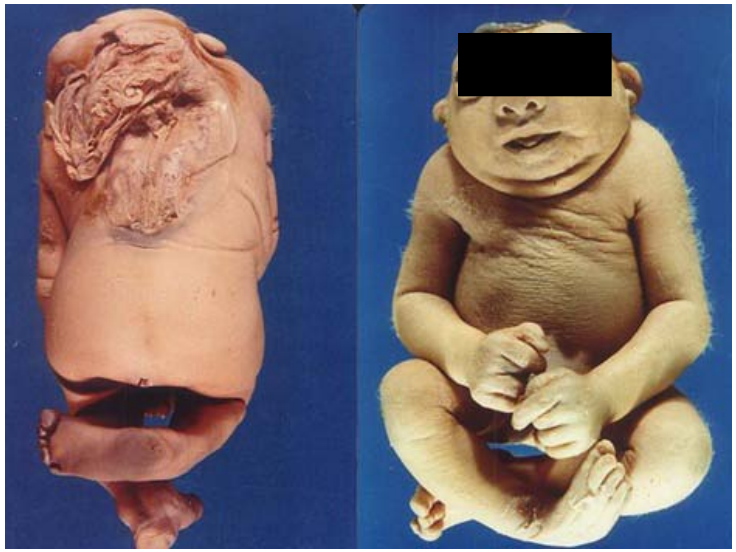


Caudal neuropore

* **Primordium of CNS**

Differentiate into brain and spinal cord, ect.

Common Malformations of Nervous System



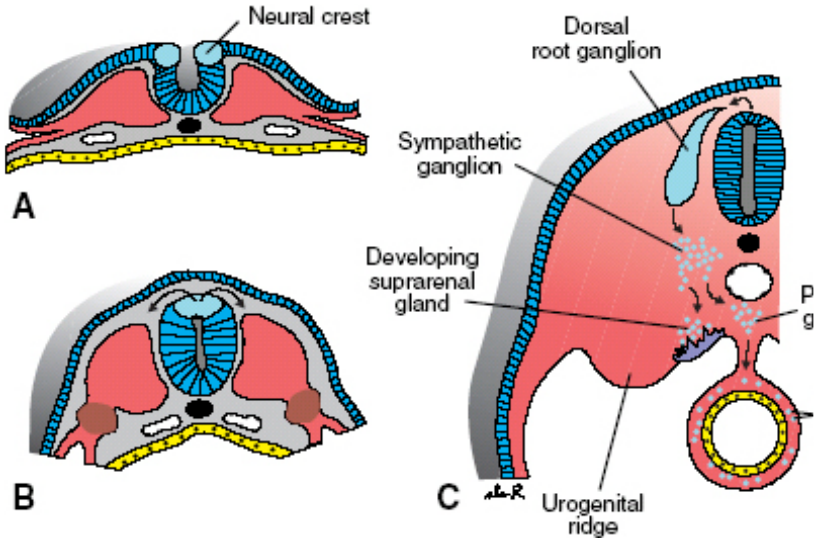
Anencephaly

Spina bifida

(1) Differentiation of Ectoderm

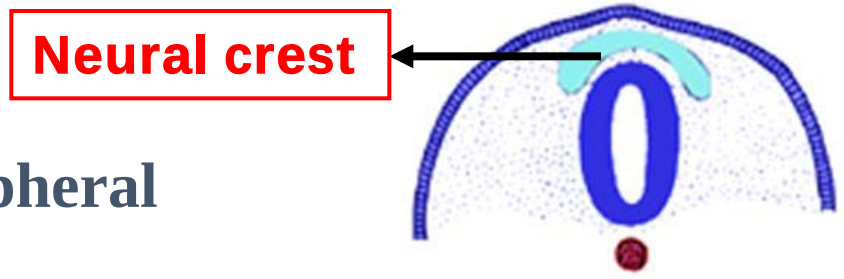
** Neural crest

- As neural folds elevate and fuse, cells at the lateral border of the neuroectoderm begin to dissociate from their neighbors.
- This cell population – neural crest
- Two lines of cell cords→ganglions



* <u>Primordium of PNS</u>

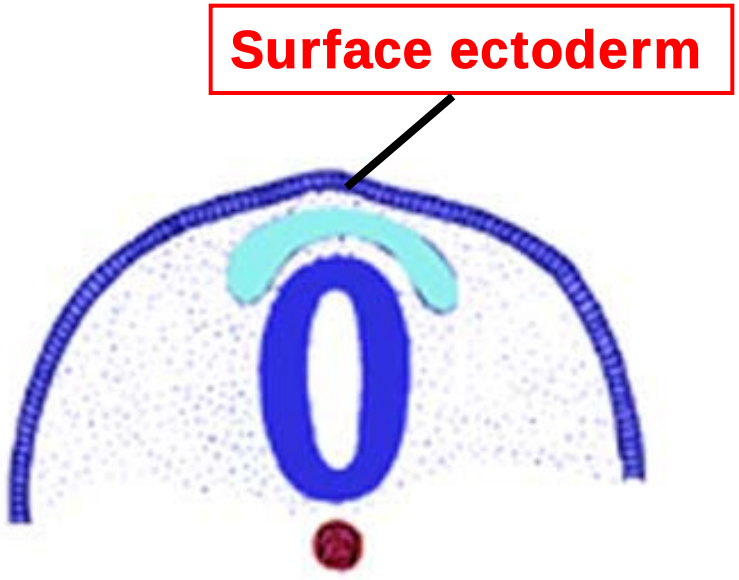
Differentiate into ganglion, peripheral nerve and adrenal medulla , ect.



(1) Differentiation of Ectoderm

Surface ectoderm

- The sensory epithelium of the ear, nose, and eye
- The epidermis, including the hair and nails
- Subcutaneous glands, the mammary glands, the pituitary gland, and enamel of the teeth.

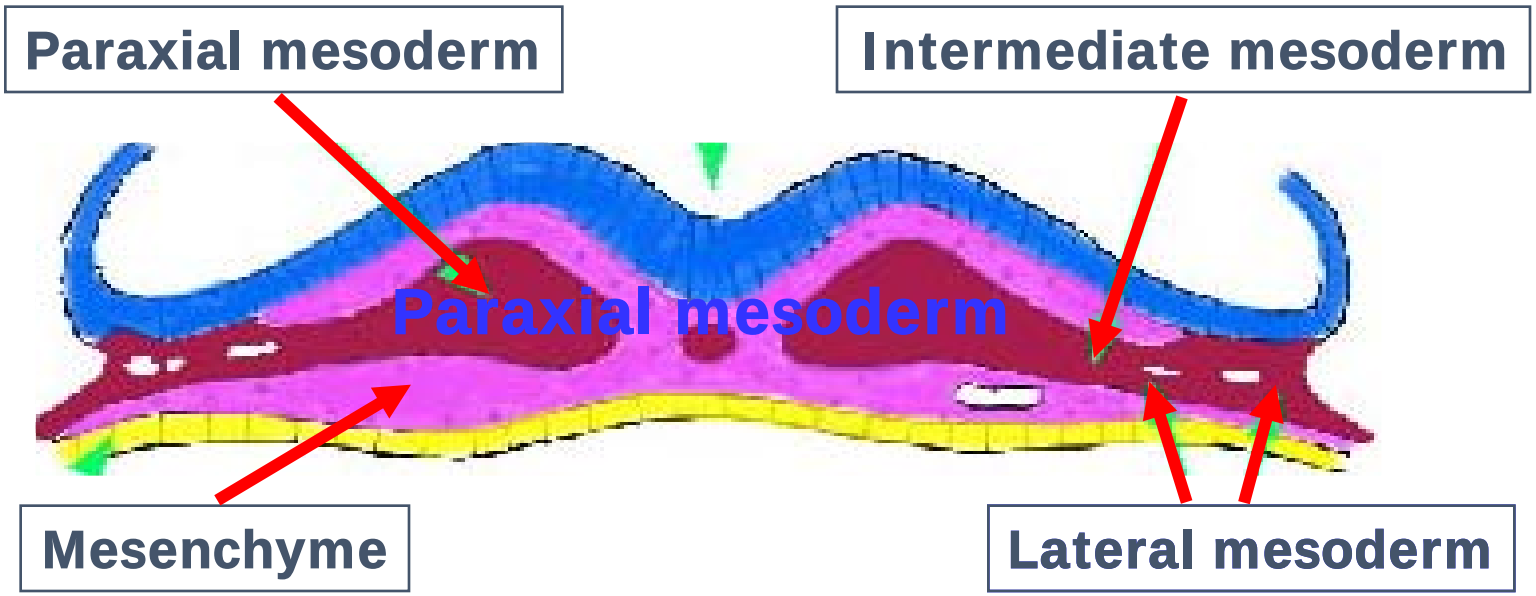


(1) Differentiation of Ectoderm

Organs and structures that maintain contact with the outside world:

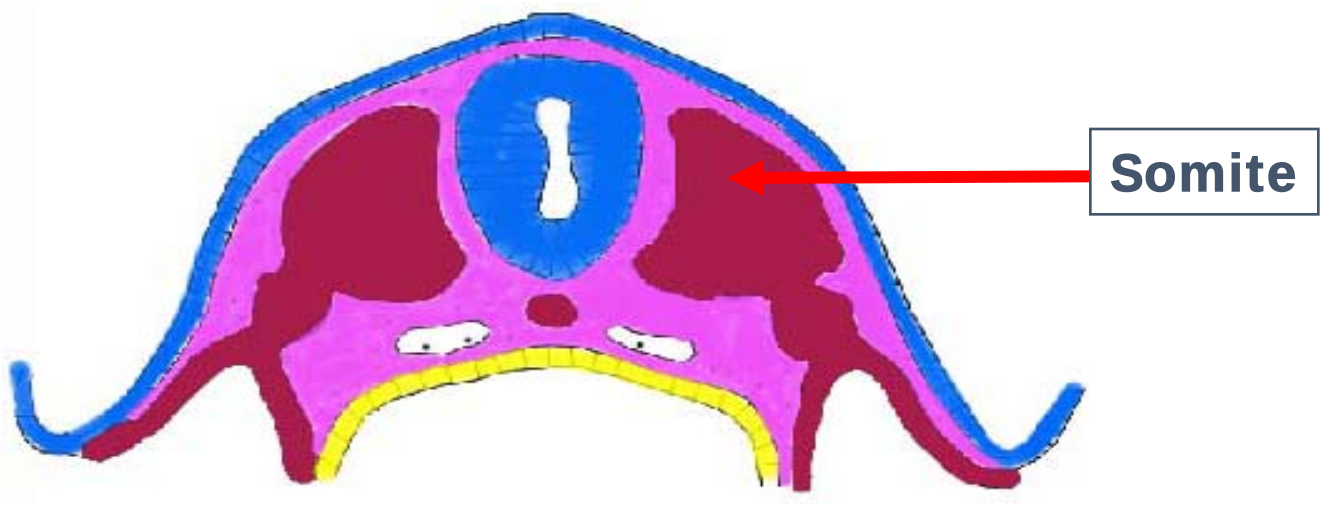
- **Neuroectoderm**
  - **Neural tube - The central nervous system**
  - **Neural crest - The peripheral nervous system**
- **Surface ectoderm**
  - **The sensory epithelium of the ear, nose, and eye**
  - **The epidermis, including the hair and nails**
  - **Subcutaneous glands, the mammary glands, the pituitary gland, and enamel of the teeth.**

(2)Differentiation of Mesoderm



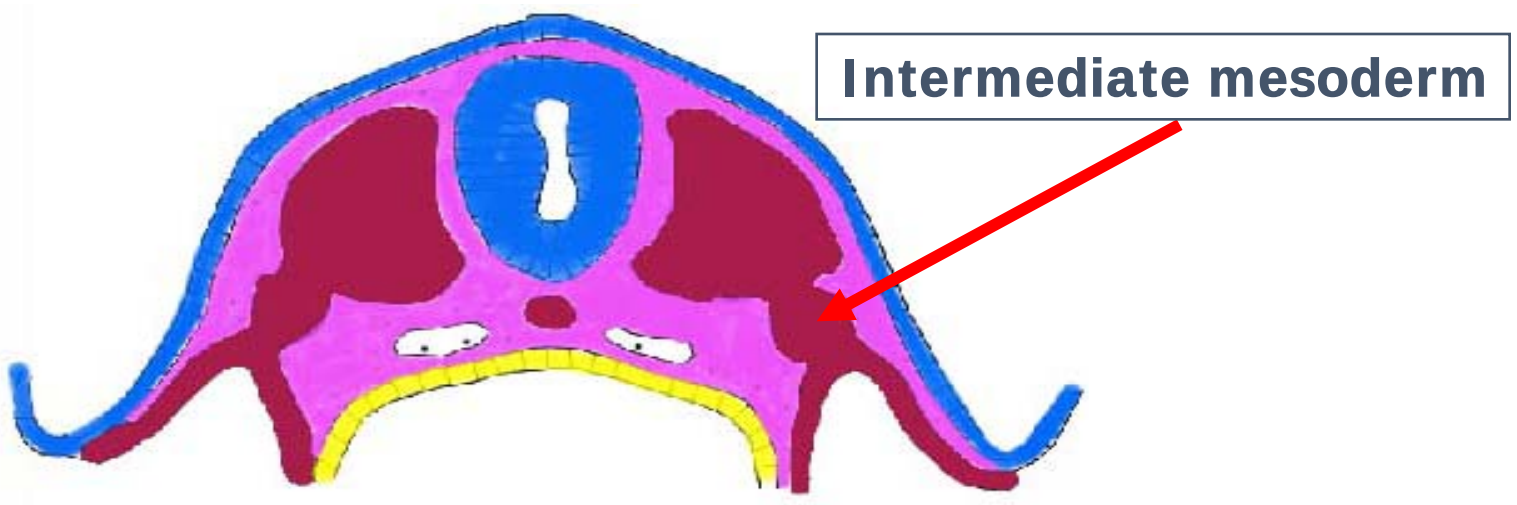
- Mesoderm divides to
  - Paraxial mesoderm
  - Intermediate mesoderm
  - Lateral mesoderm
  - Mesenchyme

Mesoderm - Paraxial mesoderm



- **Somite**
  - **Sclerotome → bone, cartilage**
  - **dermatome → dermis and hypodermis**
  - **myotome → skeletal muscle**

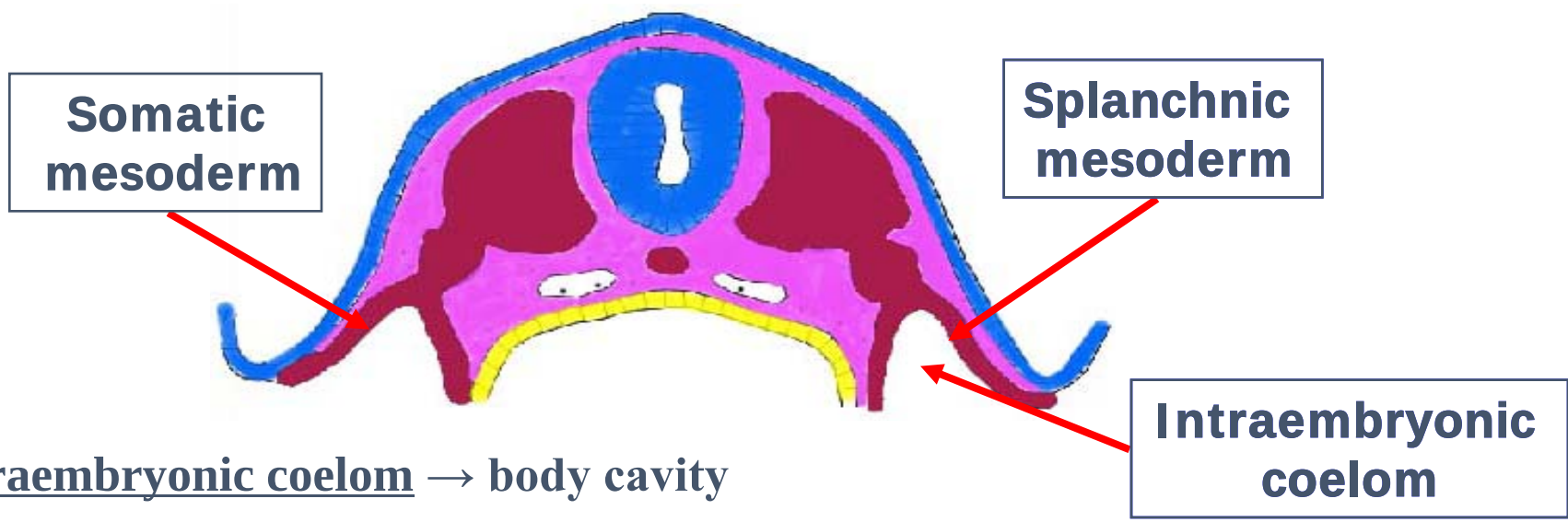
Mesoderm - Intermediate mesoderm



* **Primordium of urogenital system**

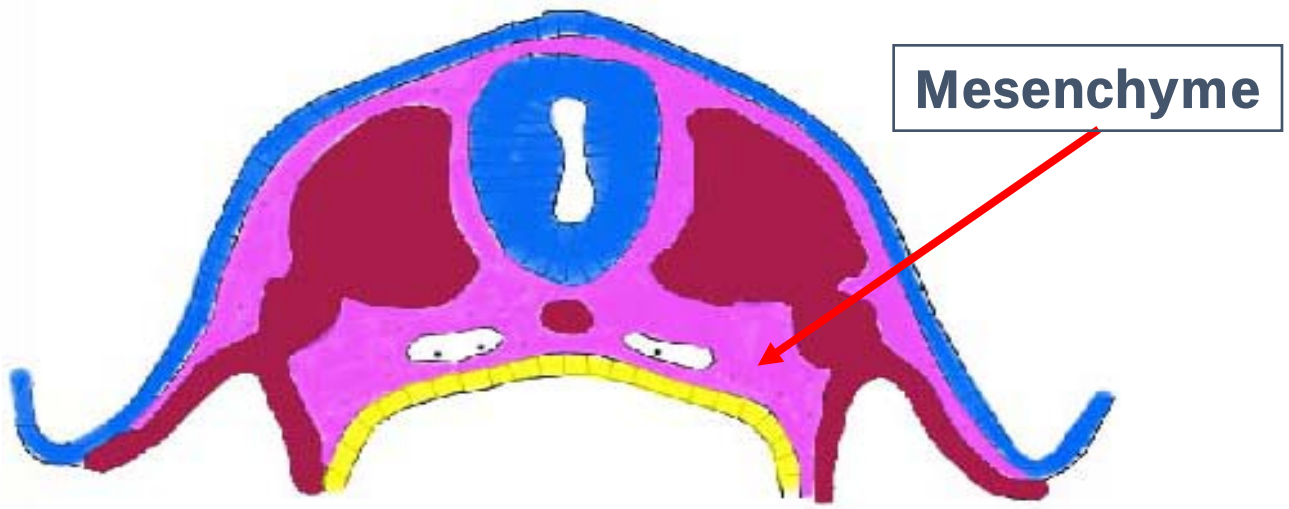
➢ **kidneys, associated ducts, as well as the main organs in male and female reproductive system.**

Mesoderm - Lateral mesoderm



- Intraembryonic coelom → body cavity
- Somatic / parietal mesoderm → skeleton body wall, CT, parietal pleura, peritoneum and pericardium
- Splanchnic / visceral mesoderm → heart, blood vessel, connective tissue and smooth muscle of viscera, the visceral pleura, pericardium and peritoneum, the mesenteries and so on.

Mesoderm - Mesenchyme



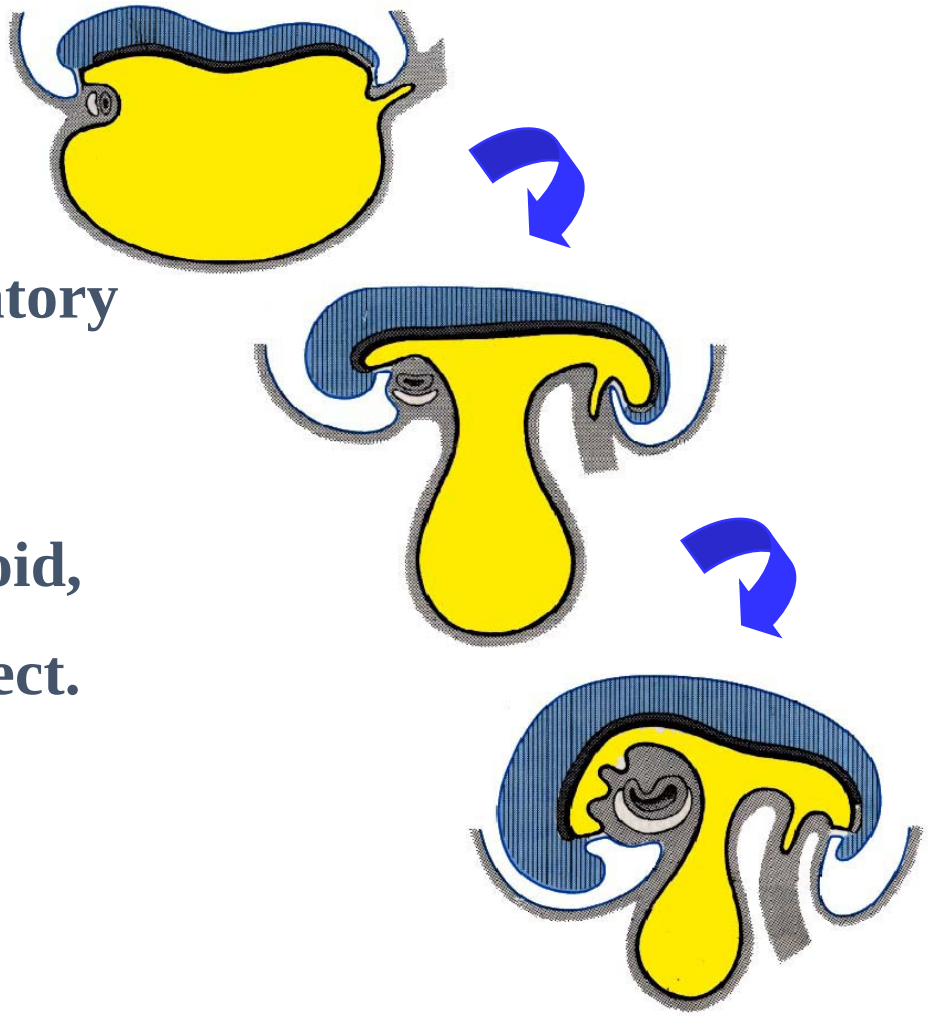
- CT
- Blood vessels
- Muscle tissue

(3)Differentiation of Endoderm

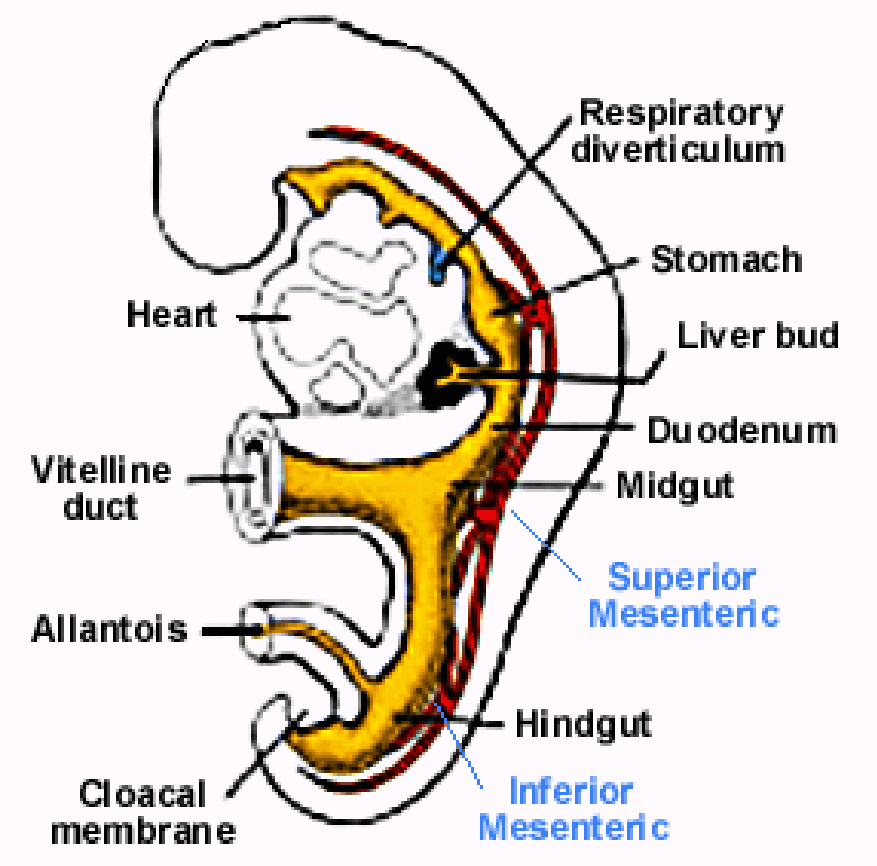
* Form primitive gut:

→ Epithelium of digestive, respiratory and urinary system

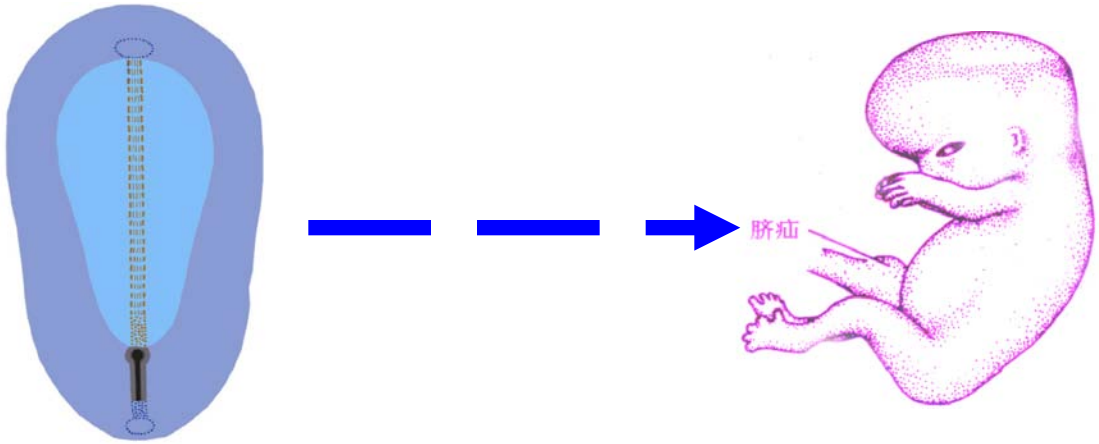
→ Epithelium of middle ear, thyroid, parathyroid, thymus, bladder, ect.



(3)Differentiation of Endoderm



2. Embryonic folding

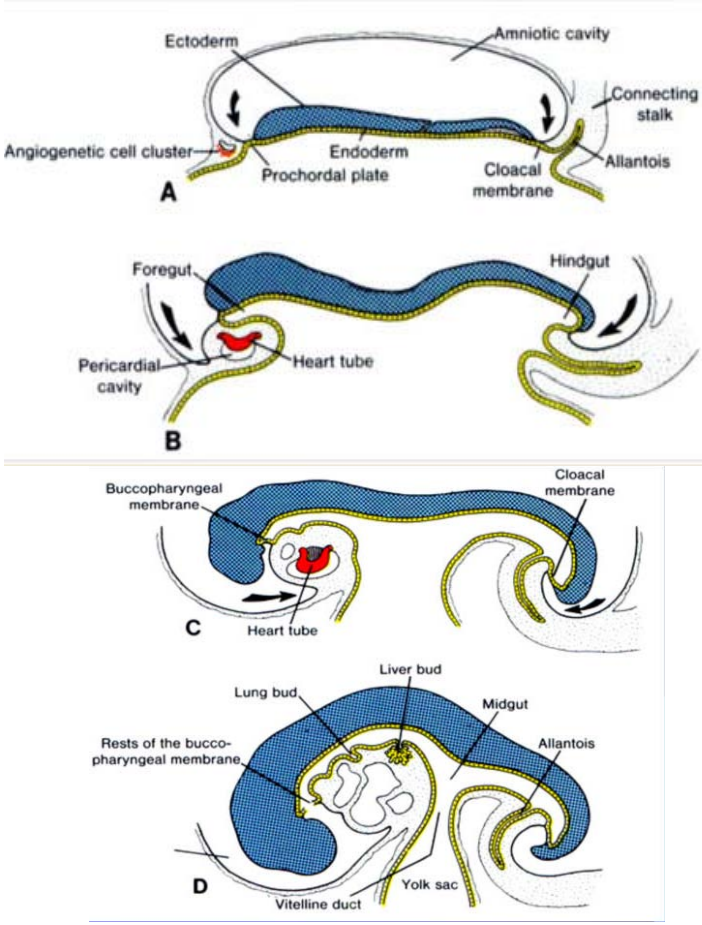


Flat germ disc —folding→ **Cylindrical embryoid Body**

- **Reason:** Differential growth of different portions of the embryo.

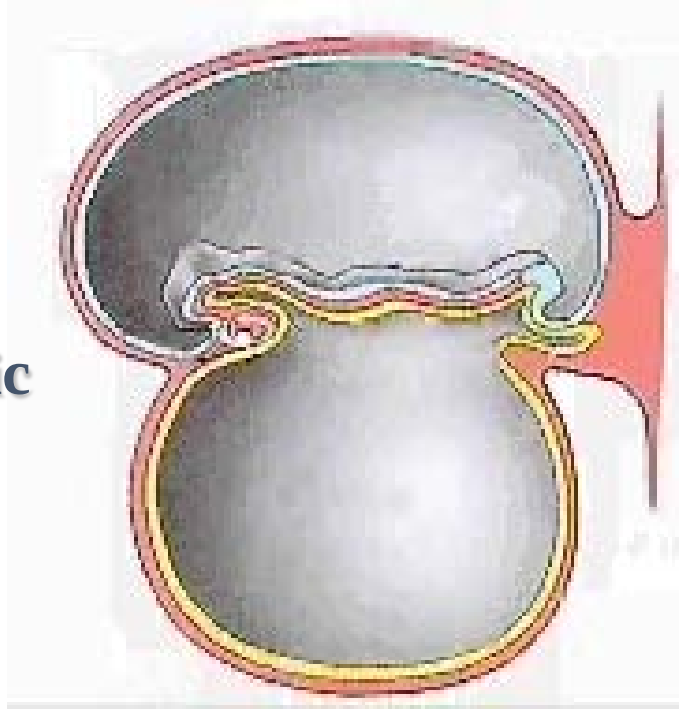
Formation of Embryoid Body

- middle axle grows faster than edge
- ectoderm grows faster than endoderm
- cephalic region grows faster than caudal region
- cephalocaudal and lateral folding

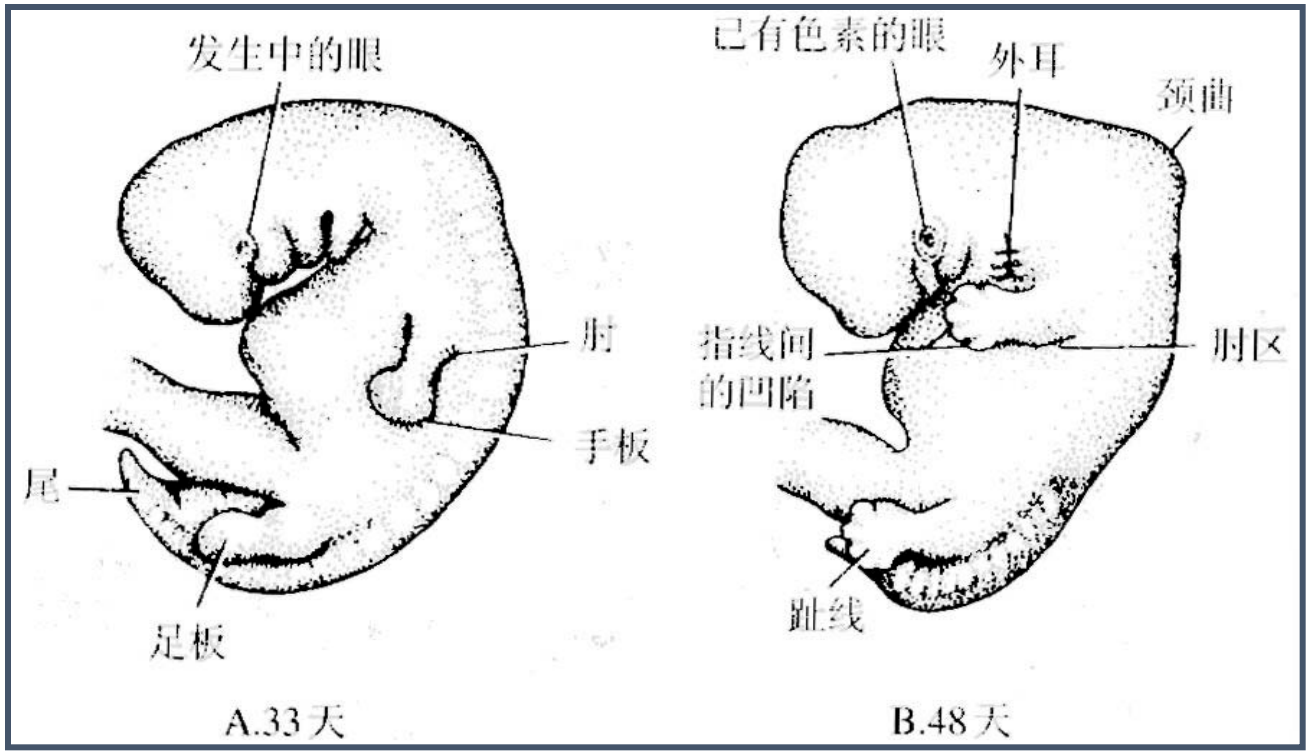


Embryonic folding

- ectoderm covers the entire surface of embryo
- amnion encloses the connecting stalk and yolk sac neck in a sheath of amniotic membrane → umbilical cord
- cylindrical embryoid body forms



Formation of Embryoid Body



- **Limbs develop by limb bud form.**

Home work

1. Describe the component of trilaminar germ disc and its differentiated organs and tissues.

2. Describe the component and formation of blastocyst.

3.The main differentiated organs and tissues of trilaminar germ disc.