أهلا وسهلا

الأستاذ الدكتور يوسف حسين

أستاذ التشريح وعلم الأجنة - كلية الطب – جامعة الزقازيق – مصر

رئيس قسم التشريح و الأنسجة و الأجنة - كلية الطب - جامعة مؤتة - الأردن

دكتوراة من جامعة كولونيا المانيا

اليوتيوب Dr. Youssef Hussein Anatomy

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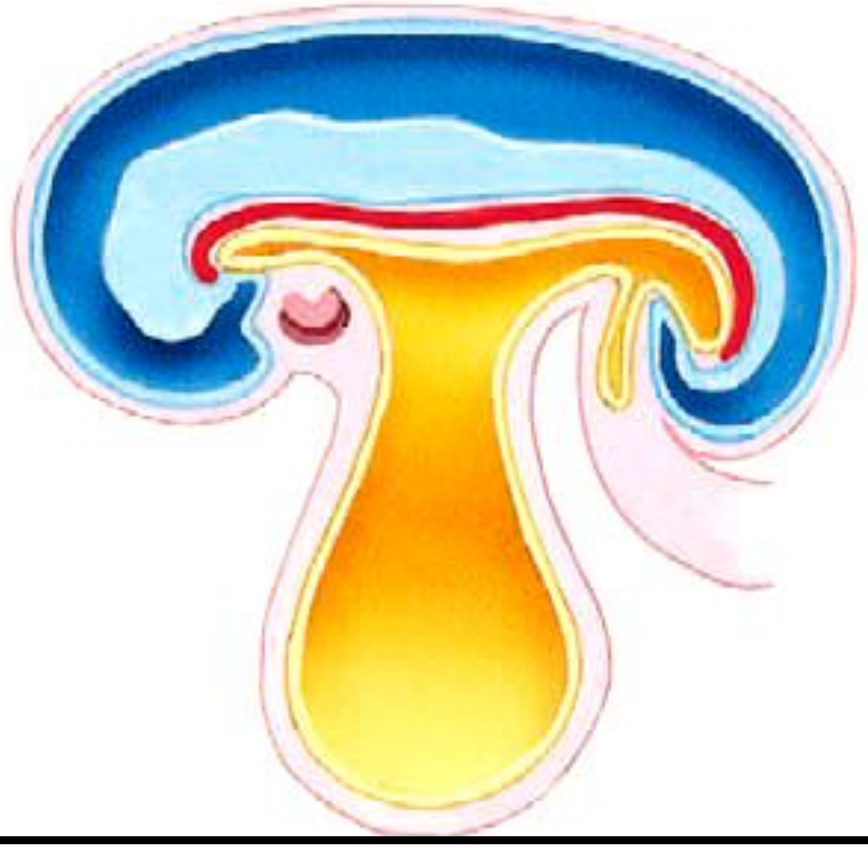
- The third week
- Folding of Embryo

- **Folding of the embryo**
- **begins during 3rd week and completed at 4th week**



**** Causes of folding:**

1. The most common cause is growth and development of the somites.
2. Rapid increase in the amount of amniotic fluid around the embryo.
3. Rapid growth of the cranial part of the neural tube than its caudal part.
4. Unequal rate of growth and development of the internal organs.

Types of folding

Craniocaudal folding

- **Head fold**, cranial part of the embryo bends ventral to the cranial end of the notochord.
- **Tail fold,** caudal part of the embryo bends ventral to the caudal end of the notochord.

Lateral folding

- **Right and left Lateral folding:** The margins of the embryo bend ventrally.

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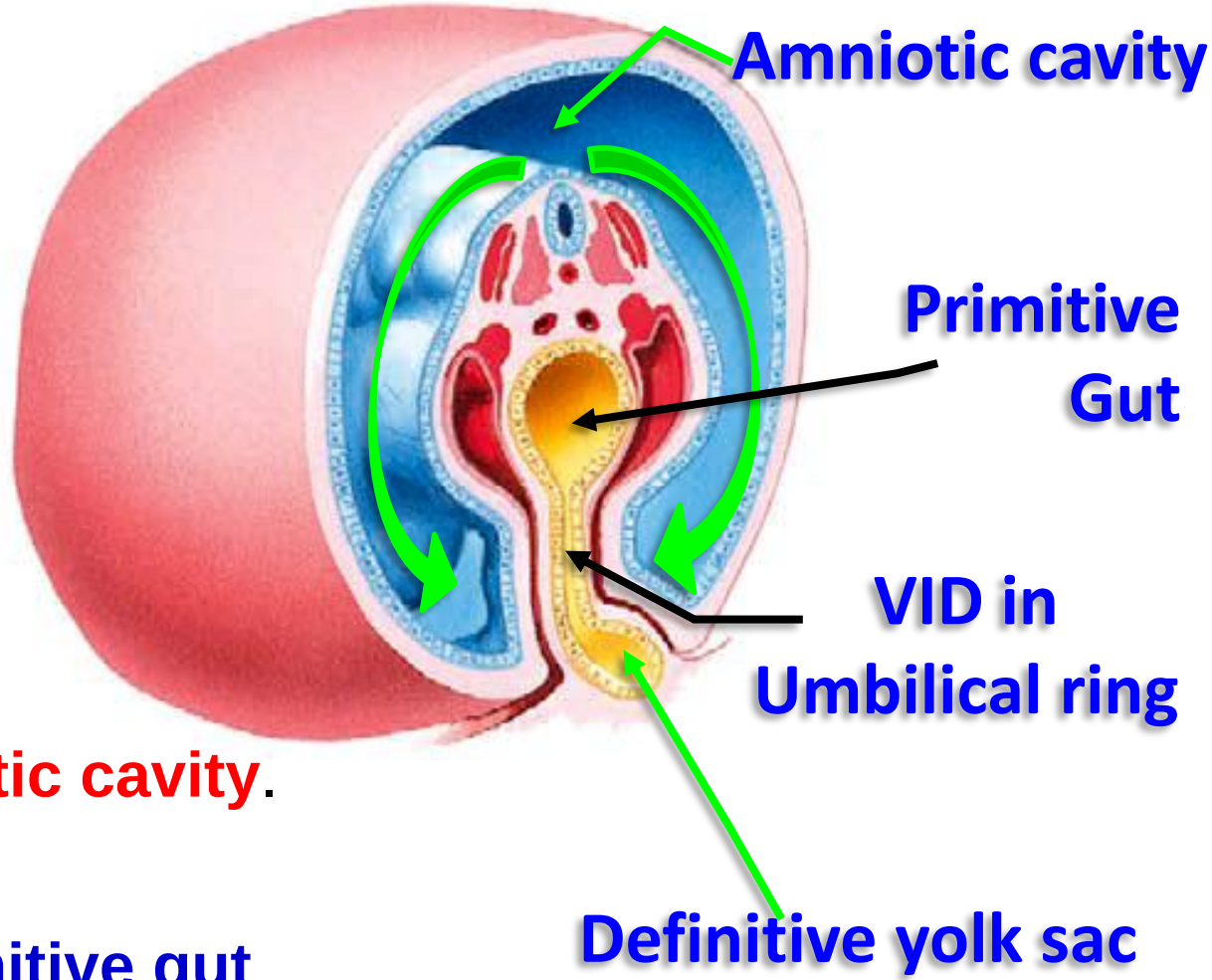
** Results of the folding



- The embryo becomes cylindrical in shape.
- The embryo is **surrounded by the amniotic cavity**.
- **The 2ry yolk sac** divides into**:**

  a- Part inside the embryo forming the **primitive gut**.

  b- Part remains outside the body called the **definitive yolk sac**.

- The 2 parts are connected at the **umbilical ring** by vitellointestinal duct (V.I.D).
- **The point of meeting** of the folds is the umbilical ring.

➢ Results of head Folding

- The part of the gut is called foregut
- The heart tube lies ventral to foregut and dorsal to the pericardial cavity

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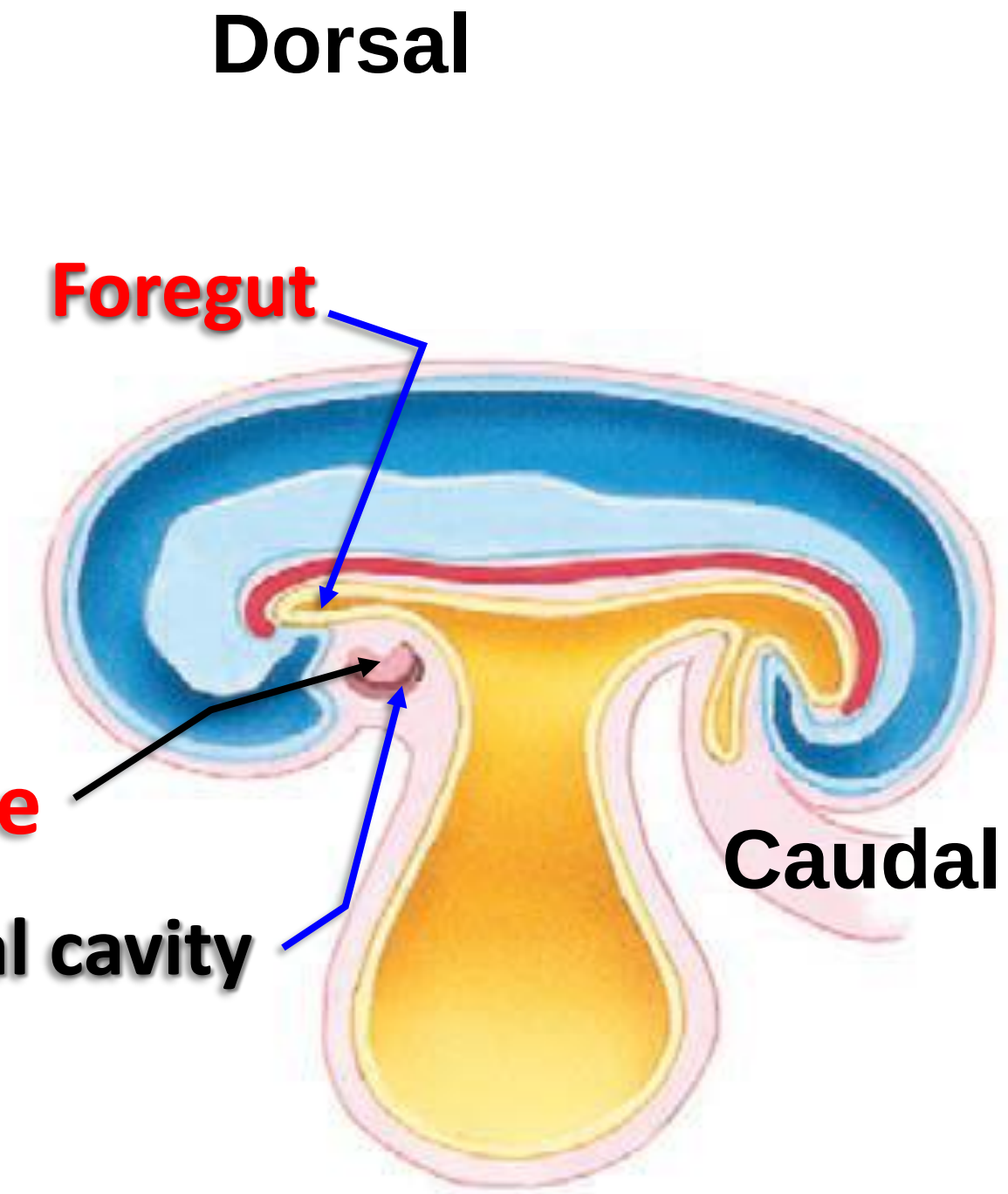

➢ Results of head Folding

- The septum transversum lies caudal to the heart tube and pericardial cavity
- The oral membrane and Stomodeum (Primitive mouth cavity) ventral to the Heart tube & pericardial cavity
- The head containing forebrain become the most ventral and cranial part of the embryo.

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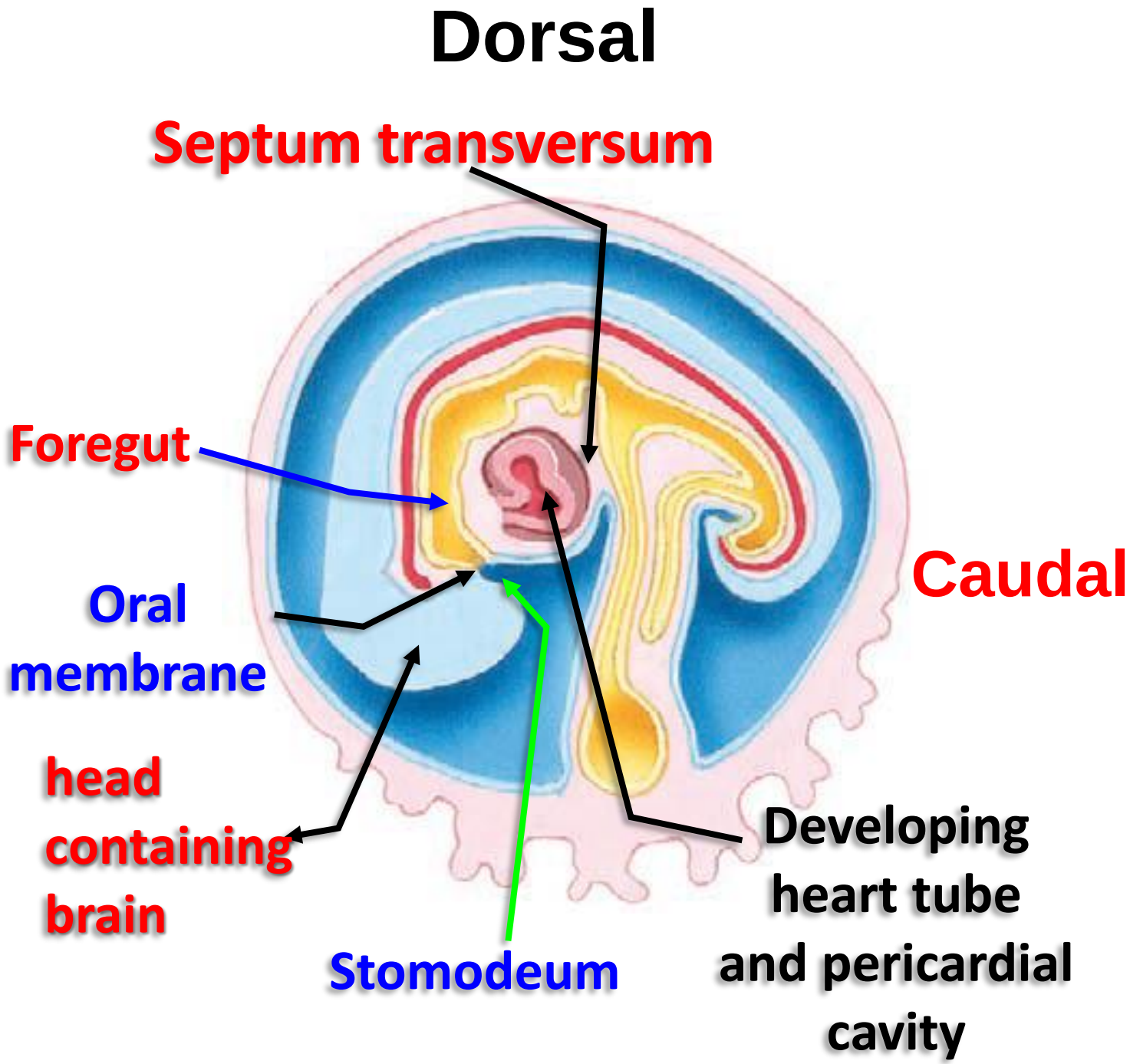
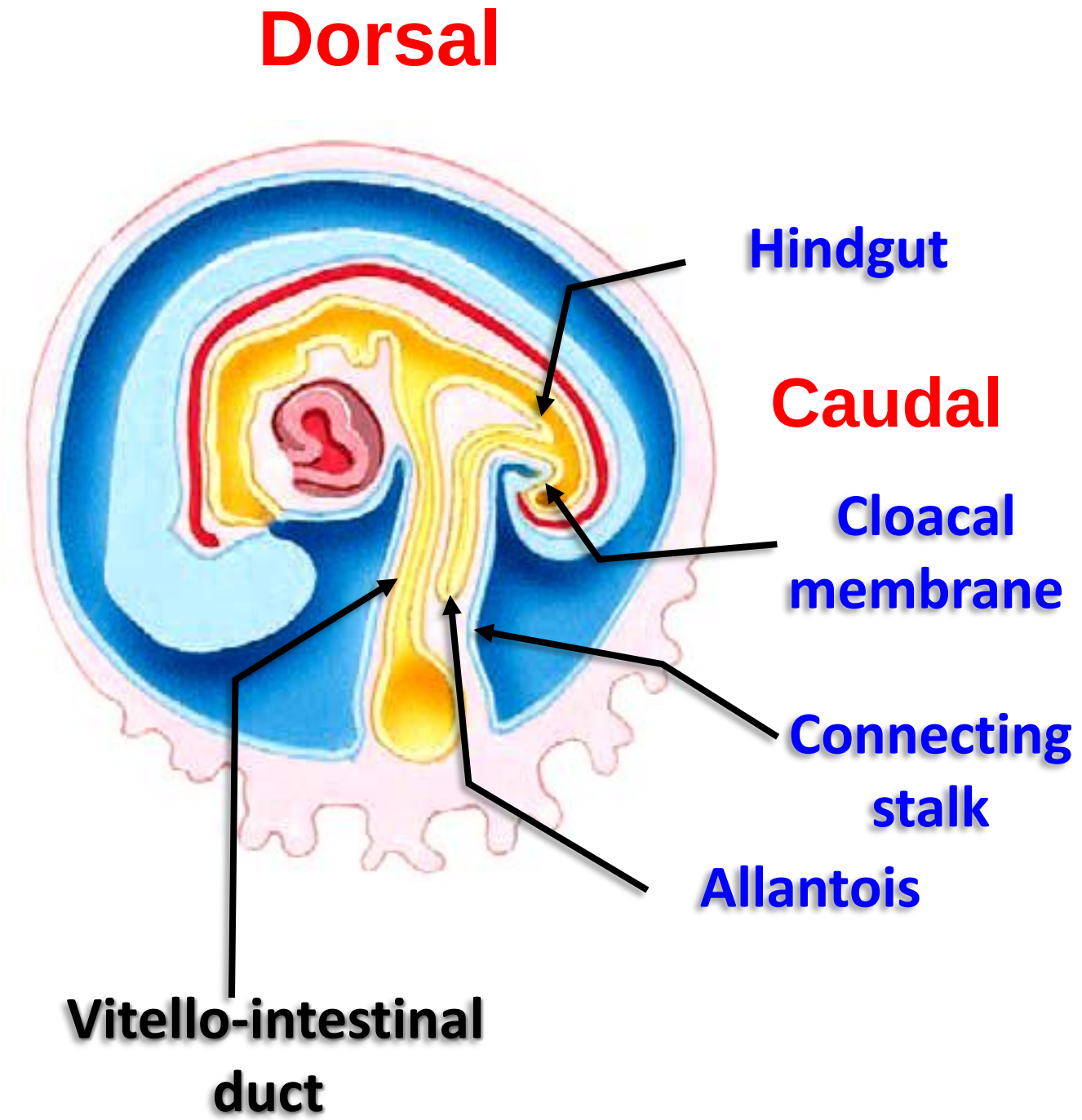
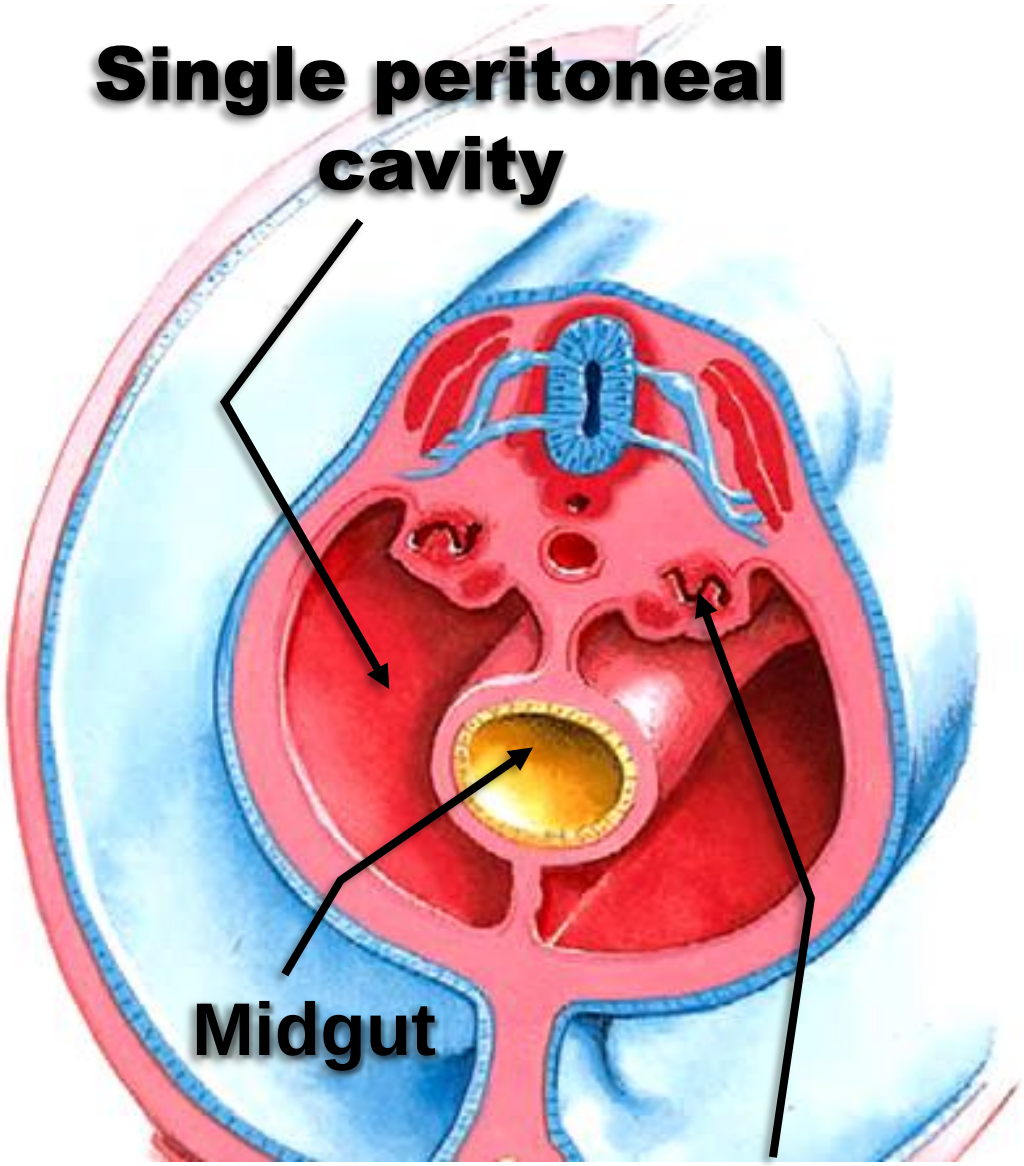


➢ Results of tail Folding

- The part of the gut is called hindgut and its terminal dilated part called Cloaca
- The cloacal membrane ventral to caudal end of embryo and caudal to allantois
- The connecting stalk (Future umbilical cord) ventral to embryo and containing allantois (small diverticulum develops from caudal part of hindgut) and vitellointestinal duct





➢ Results of lateral Folding

- The embryo becomes **cylindrical** in shape.
- The part of the gut is called **midgut** and connecting to the dorsal wall of the embryo by dorsal mesentery
- The caudal parts of the intraembryonic coelom fuse together to form **a single peritoneal cavity.**
- The **intermediate mesoderm** becomes dorsal to the peritoneal cavity.

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Development of Amnion

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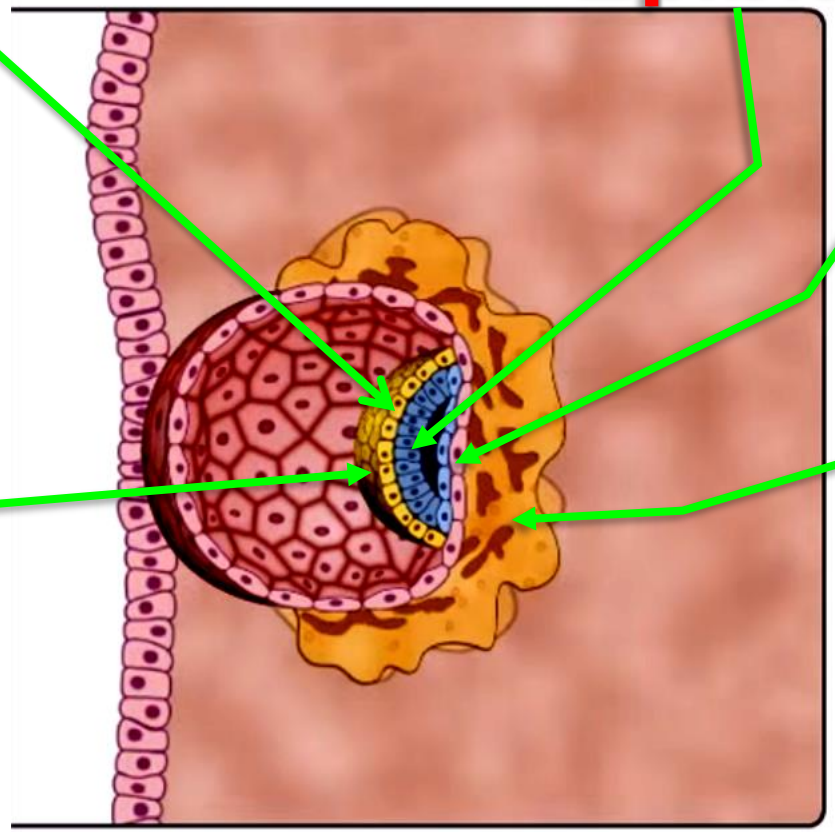
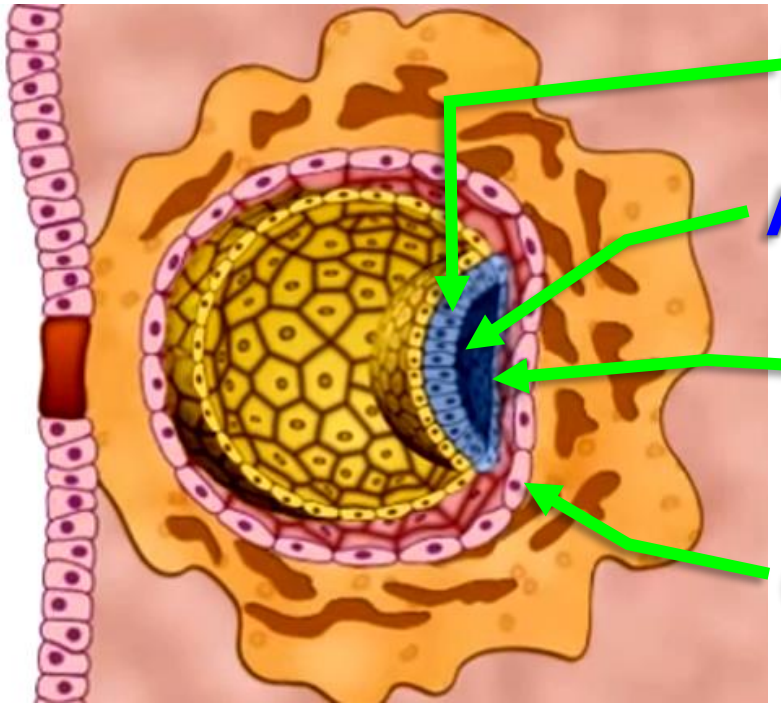


- The inner cell mass proliferates and its shape is **flat circular disc**.
- The cells are differentiated into 2 layers:

1. **Dorsal** columnar layer **(Ectoderm)** called **epiblast.**
2. **Ventral** cuboidal layer **(Endoderm)** called **hypoblast.**



- A small cavity appears within the epiblast. This cavity enlarges to become the **amniotic cavity** **containing** **amniotic fluid**.
- Epiblast cells adjacent to the **cytotrophoblast** are called **amnioblasts.**
- **The amniotic cavity** is lined by **Amniotic membrane**
  - It is a thin, transparent and non-vascular membrane.
  - **After folding** of the embryo, the amnion completely surrounds the embryo and becomes attached to the margins of the umbilical ring.

Amniotic Fluid

- It is a clear, watery fluid containing salt, sugar, urea, and proteins.
- Source of fluid:

A. Secretion of amniotic cells
B. Fetal urine from the kidneys
C. Secretion of lung cells
D. Secretion by placenta.

Amount of amniotic fluid

- **At 10 weeks: 30 ml.**
- **At 20 weeks: 350 ml.**
- **At 36 weeks: 1 liter.**
- **At full term reaches 1-1.5 liters.**

Composition of the amniotic fluid

- **98% water**
- **2% organic and inorganic salts, protein, carbohydrate, fat, urea, enzymes, hormones, desquamated fetal epithelial cells and fetal urine.**
- **All are important for growth of the fetus.**

Elimination of the amniotic fluid:

- **The amniotic fluid is swallowed by fetus, absorbed by intestine to fetal blood, then secreted again by fetal kidneys or excreted by placenta to maternal blood.**

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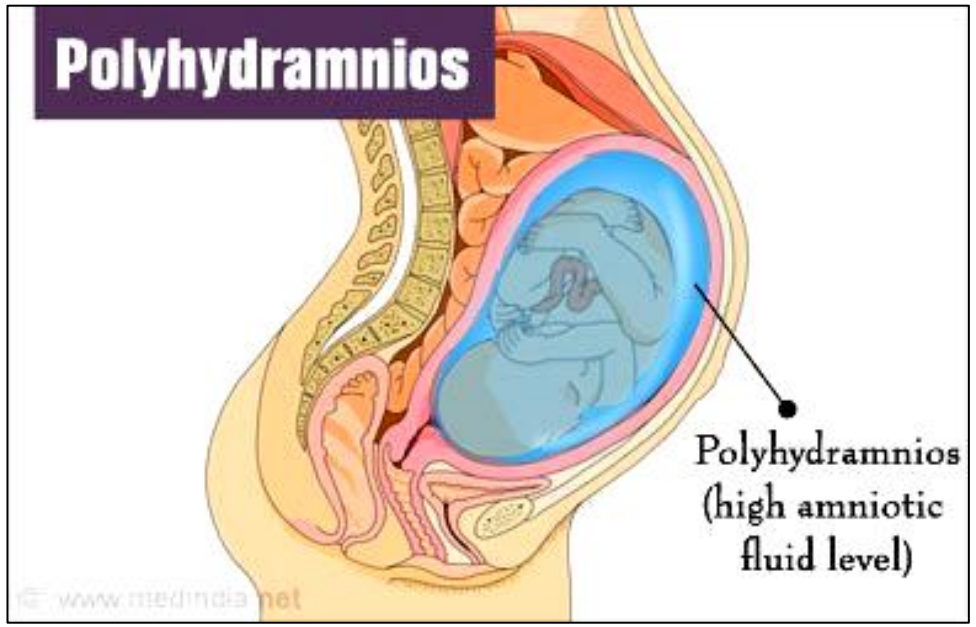
- **Functions of the amnion**

I) During pregnancy:

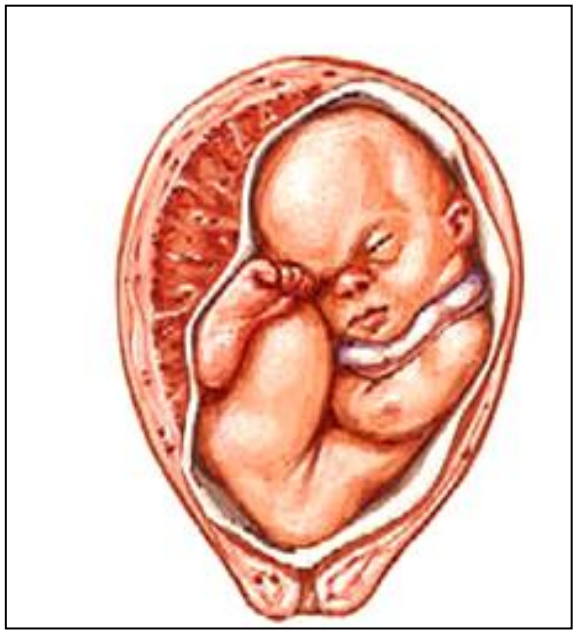
1. **Protection of the fetus** against external trauma.
2. **Nutrition for the fetus**.
3. Medium for **excretion of the fetus**.
4. Allows **free movement of the fetus** helping development of the locomotor system.
5. **Prevents adhesion of the parts of the fetus**.
6. **Keeps a constant temperature** around the fetus.
7. **Development of suckling reflex** due to swallowing of amniotic fluid.

II) During labor:

1) **Dilatation of the cervix of the uterus** at early stage of labor.
2) Acts as **antiseptic medium** for the vagina.
3) Acts as a **lubricant** that facilitates delivery of the fetus.



Congenital anomalies of amnion



- **Polyhydramnios** **The excessive accumulation of amniotic fluid (2000 ml or more) in the amniotic cavity**

•This occurs due to:

- Fetuses of **diabetic mothers**.
- Excess of secretion as **twin pregnancy**.
- Decrease elimination as in **esophageal atresia** and **anencephaly**, because the fetus is unable to swallow the amniotic fluid

- **Oligohydramnios:**

- **the volume of amniotic fluid is less than ½ liter leading to adhesion.**
- This occurs due to decreased secretion as in **bilateral agenesis of the kidneys** Leading to adhesion of the fetus

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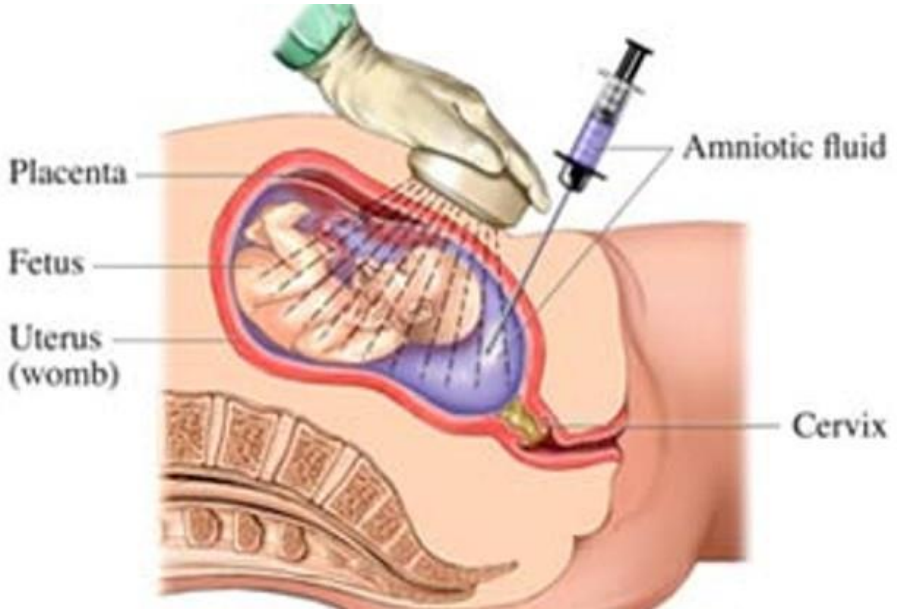
▪ Amniocentesis

- **Aspiration of the amniotic fluid for diagnostic purposes.**

- **It is usually done at 14th or 15th week of pregnancy, when the amniotic sac contains 175–225 ml of amniotic fluid.**

- **detection of the sex of a fetus by chromosomal studies.**
- **it can be used to study fetal enzymes and fetal hormones** (high level of alpha fetoprotein indicating neural tube defects).
- **Chromosomal analysis** to detect the congenital anomalies early (Down syndrome).
- Detection the amount of **surfactant** of the respiratory system**.**
- **Rh–incompatibility** in case of hemolysis**.**



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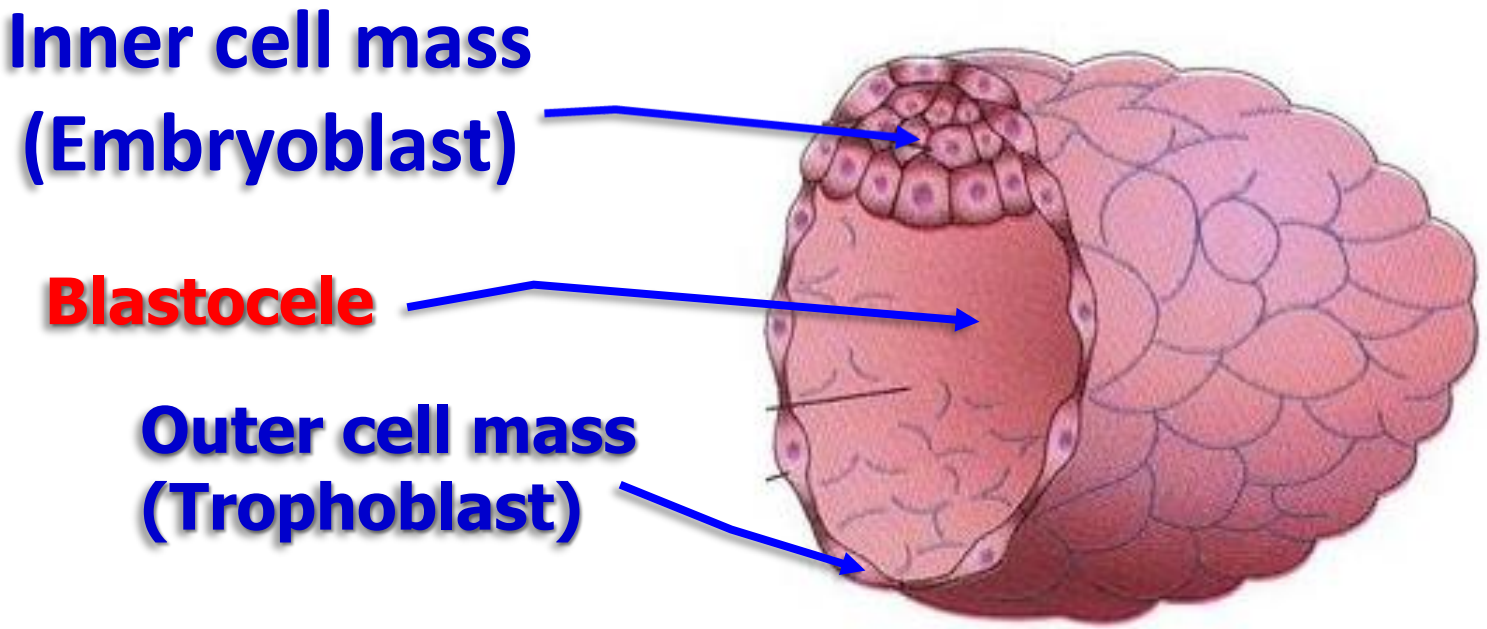
Development of Yolk sac

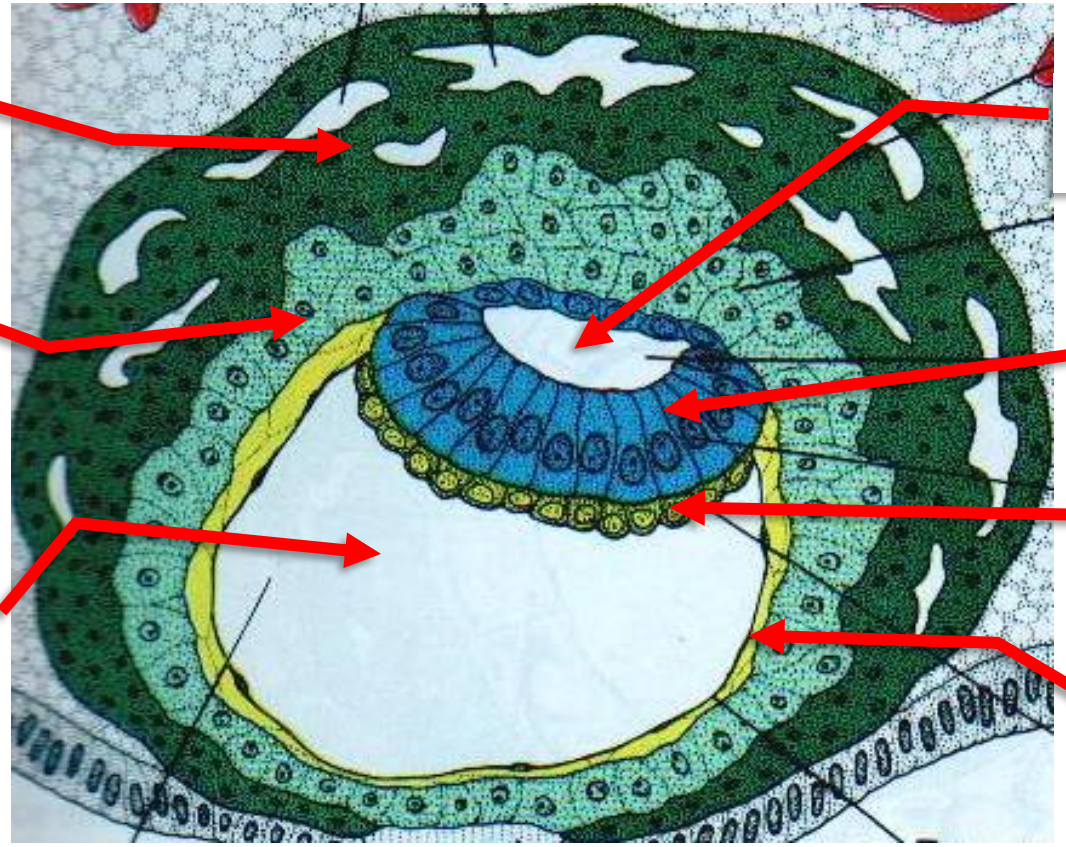


- **Formation of blastocyst**

- The cells of the **morula** rapidly proliferate and forming a large number of cells.
- Fluid collects between the cells and form a single cavity called **blastocele**
- The cystic structure called **blastocyst** at the **5th days** after fertilization.
- The blastocyst is divided by **blastocele** cavity into;

  a- Outer layer of flat cells called **trophoblast** that forms the **placenta**.

  b- Inner cell mass (**embryoblast**). This mass will form the **embryo**.



- **Formation of primitive yolk sac at the 9th day**

- **Blastocele** is lined by a new membrane **exocoelomic (Heuser's) membrane**
- **It** is formed by flattened cells **originate from hypoblast.**
- The cavity is now called **exocoelomic cavity or primitive yolk sac.**

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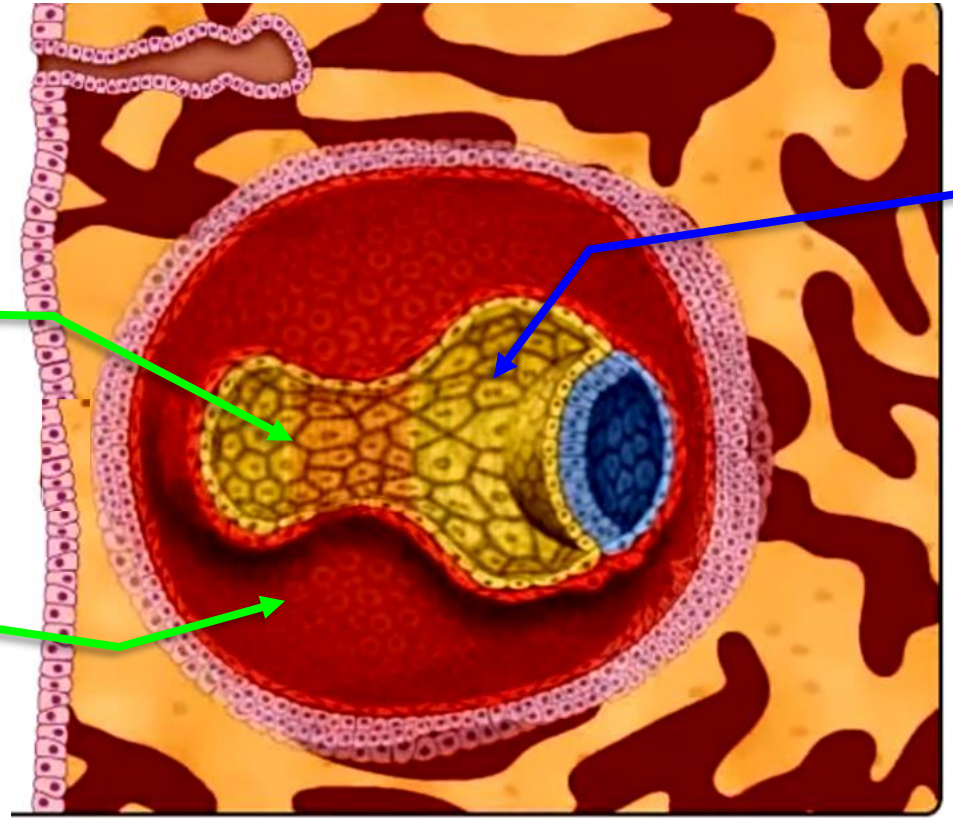
▪ Formation of the secondary yolk sac



- Large portion of primitive yolk sac are pinched off is called Exocoelomic cyst in the extraembryonic coelom.

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▪ Formation of the secondary yolk sac

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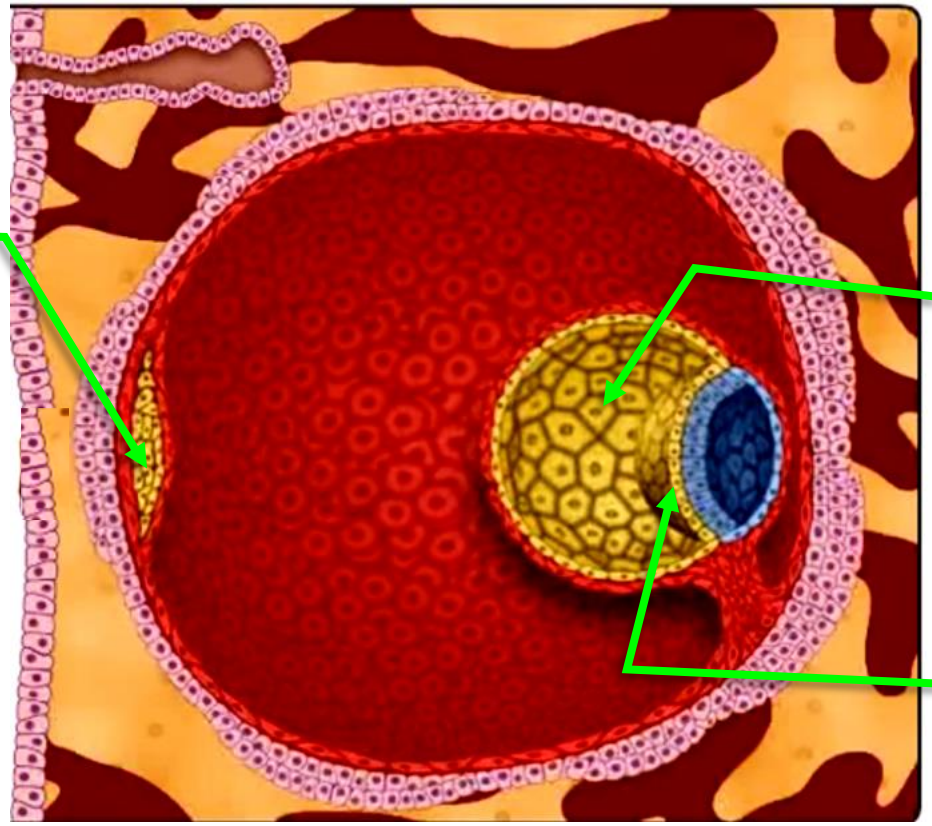


- The **exocoelomic cyst** is separated from **the primitive yolk sac**
- **The endodermal cells from the hypoblast proliferates and migrates to line the Heuser's membrane forming the secondary yolk sac.**
- **The 2ry yolk sac is completely lined by endoderm.**

▪ Formation of the definitive yolk sac

**** After folding of the embryo**

- The 2ry yolk sac divides into:

a- Part of the 2ry yolk sac **inside** the embryo forming the **primitive gut.**

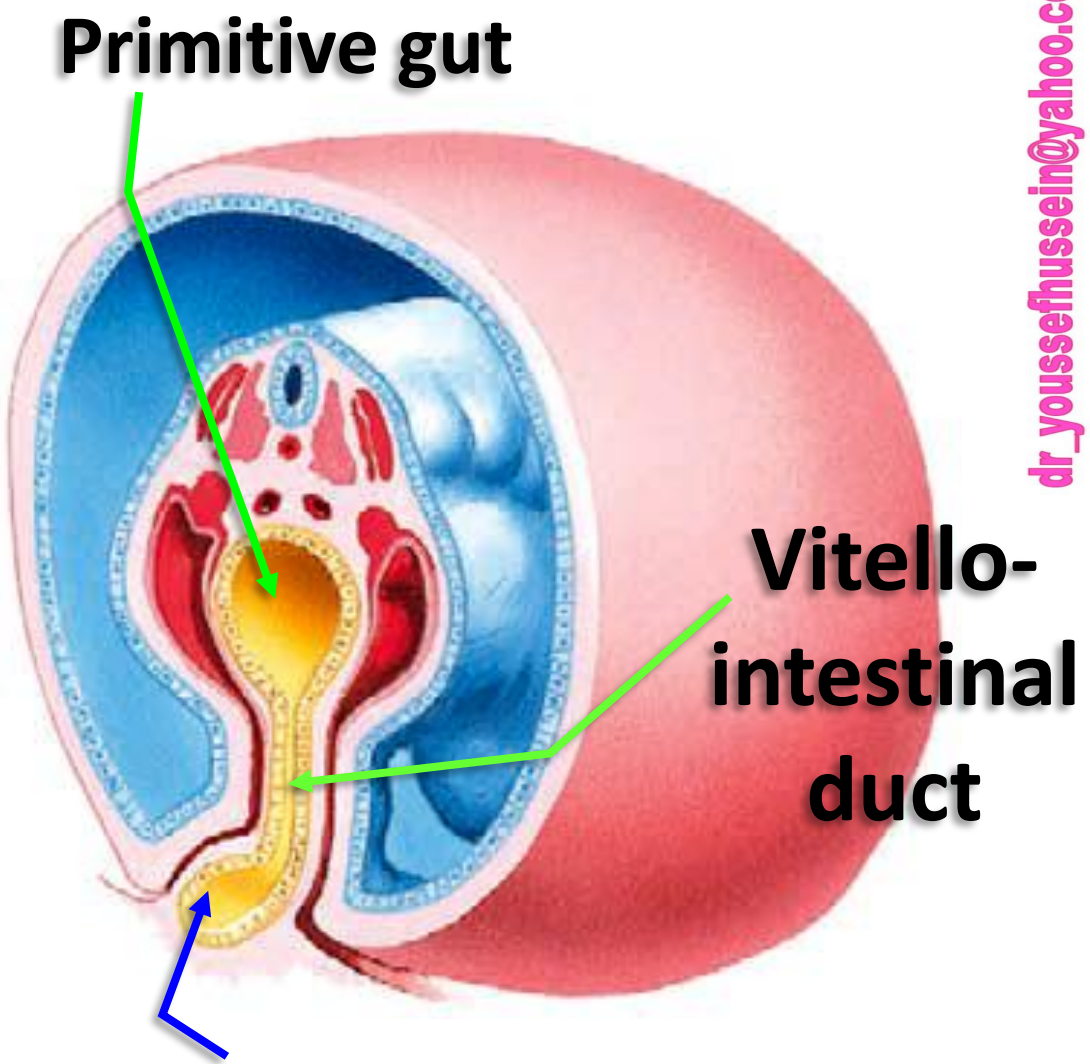
b- Part remains **outside** the embryo called the **definitive yolk sac.**

c- The 2 parts are connected at the umbilical ring by the **vitello-intestinal duct (VID) in the connecting stalk.**

**** Fate of the yolk sac**

1) The **definitive yolk sac** gradually becomes smaller and separated from the body of the embryo.

2) The **VID** will atrophy and degenerate.



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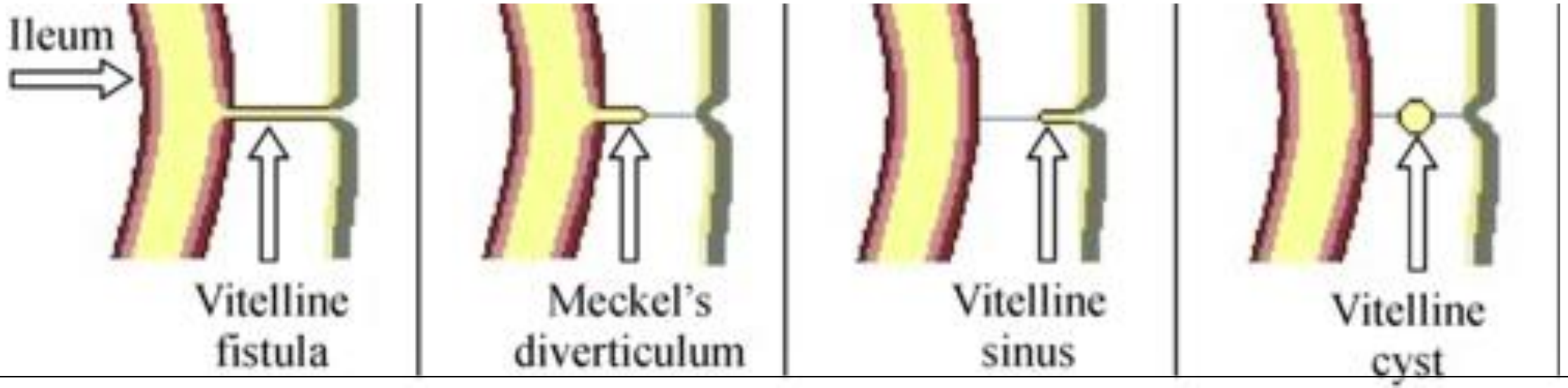
- **Functions of the yolk sac**

1) **Nutrition of the embryo before the development of the placenta**
2) **Formation of the primitive gut except lower part of the anal canal**
3) **Hemopoiesis: formation of embryonic blood cell via blood islands near the sac**
4) **Formation of the primordial germ cells (spermatogonia or oogonia) from the wall of the yolk sac and migrate to the developing gonads (testes or Ovary) during the fourth week,**



**** Congenital anomalies of Vitellointestnial duct:**

i) **Vitelline fistula (patent VID): persistence of the duct leading to discharge of the intestinal contents through the umbilicus.**

ii) **Meckel's diverticulum, persistence of the proximal end of the duct.**

iii) **Vitelline sinus: persistence of distal end of the duct leading to discharge mucus from the umbilicus.**

iv) **Viteline cyst: persistence of the middle part of the duct.**

v) **Fibrous band, The duct completely fibrosed and persistence leading to Volvulus and intestinal obstruction.**

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