

وسهلا

أهلا



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

دكتورة من جامعة كولونيا المانيا

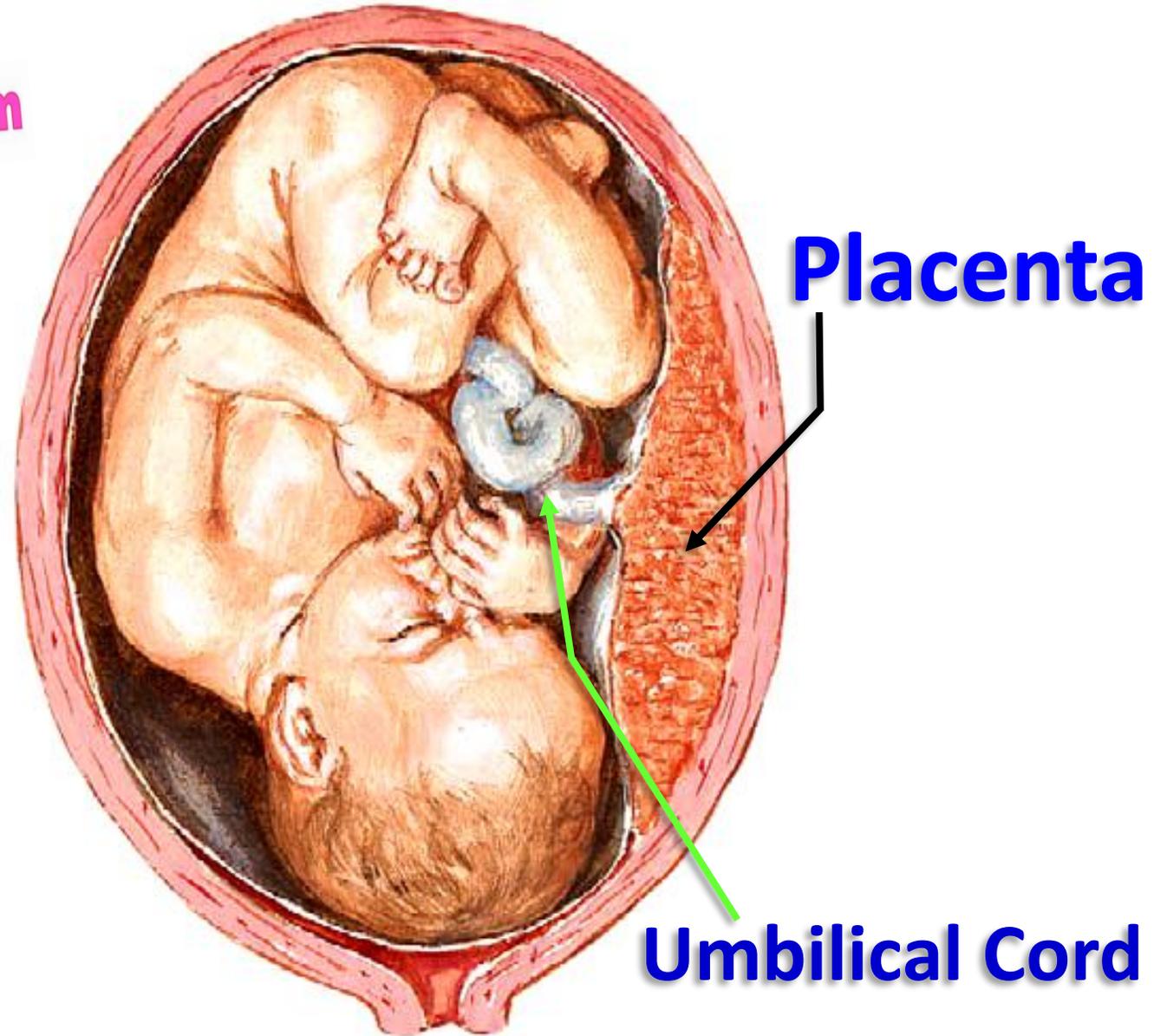
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جروب الفيس د. يوسف حسين (استاذ التشريح)

Development of Umbilical cord

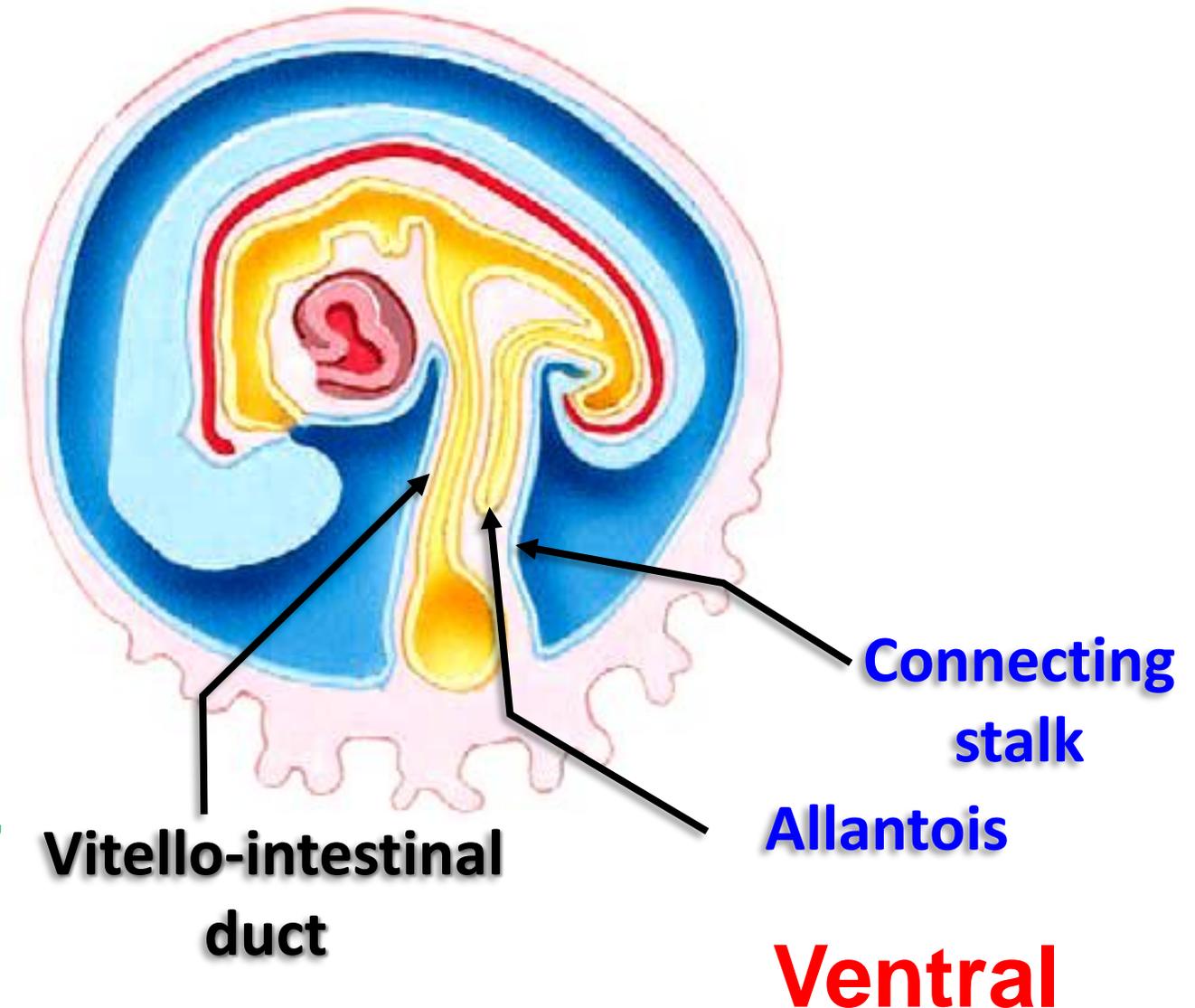
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- It is a cord-like structure connects the placenta (fetal surface) with the umbilicus of the fetus



** Formation of the primitive umbilical cord

- As the results of the tail folding, The connecting stalk (**Future umbilical cord**) becomes ventral to embryo and containing **Allantois** and **Vitellointestinal duct**



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** Formation of the primitive umbilical cord

1- Vitello-intestinal duct (VID) between gut and definitive yolk sac and surrounded by 2 vitelline arteries and 2 vitelline veins.

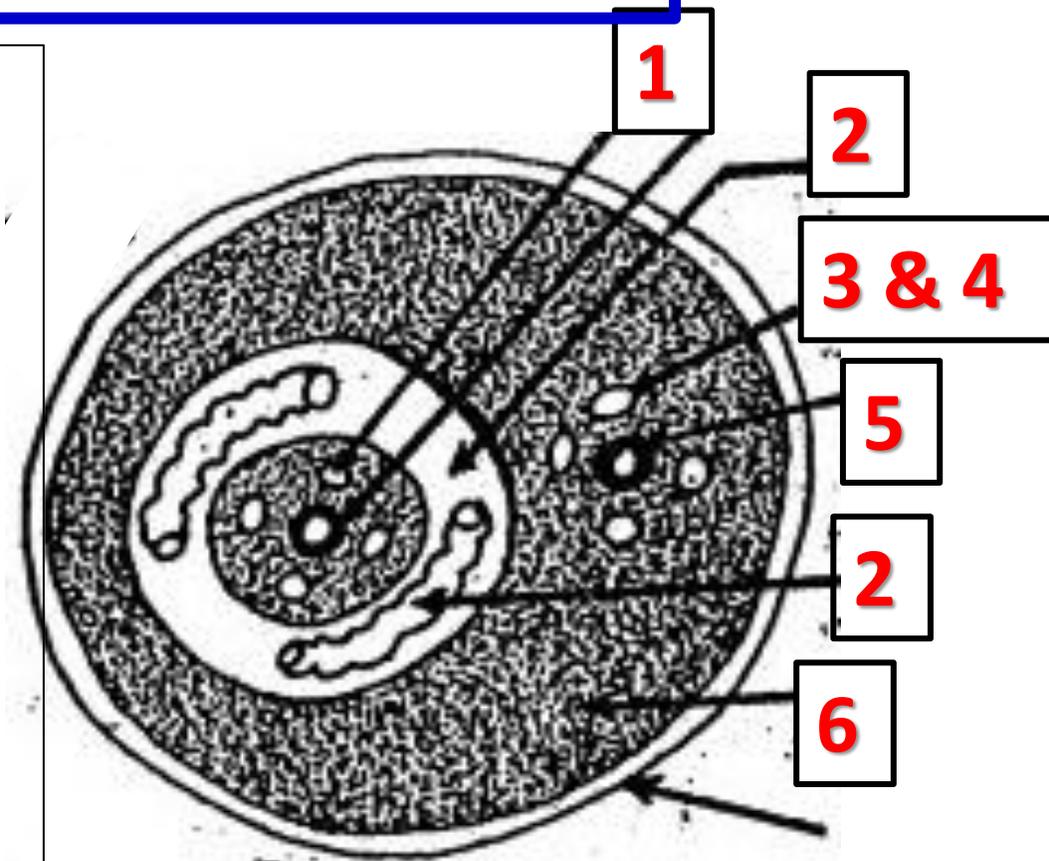
2- Loops of intestine (physiological hernia) in the extra-embryonic coelom.

3- 2 umbilical arteries carry **non-oxygenated** blood from the fetus to the mother.

4- 2 umbilical veins carry **oxygenated** blood to the fetus.

5- Allantois (urachus) small diverticulum from cloaca and extends into the connecting stalk.
- It connects the apex of the urinary bladder with the umbilicus.

6- Extra-embryonic mesoderm.



Definitive of Umbilical Cord

Remnant of allantois

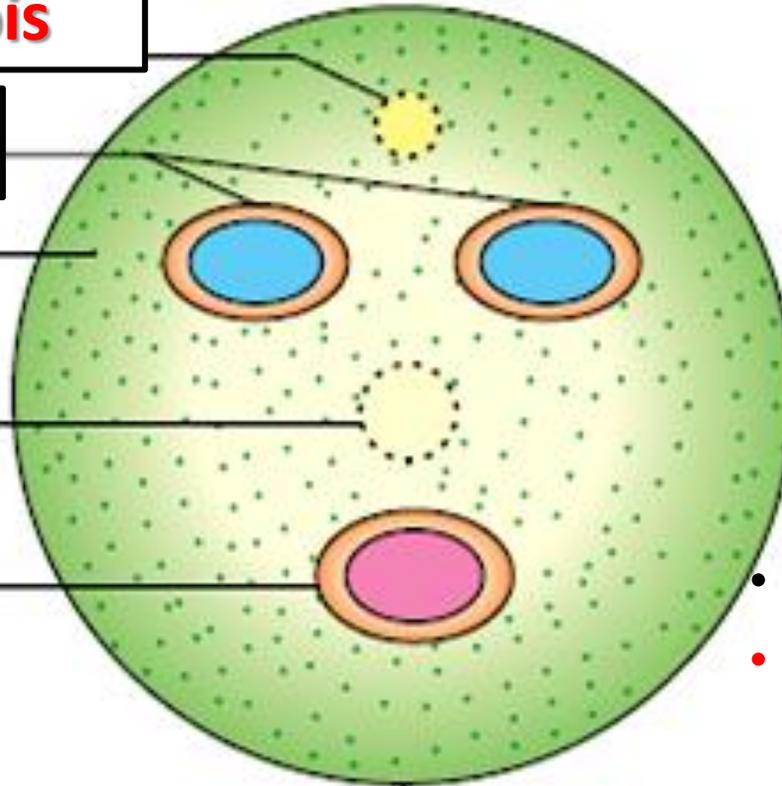
2 Umbilical arteries

Wharton's jelly

Remnant of VID

Left Umbilical vein

Amnion

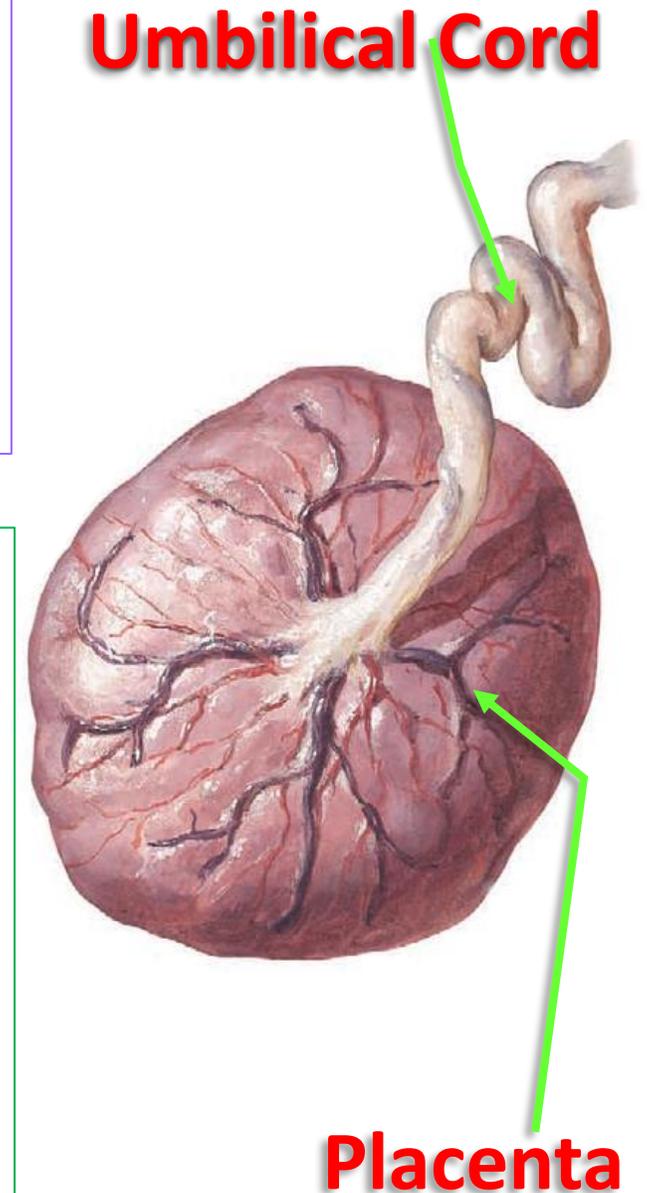


- **2 umbilical arteries** (Right & Left).
- **Left umbilical vein.**
- These structures are embedded in a jelly like material called **Wharton's jelly.**
- It is covered by **amniotic membrane.**

- **Right umbilical vein** is obliterated.
- **VID and vitelline vessels** obliterated and degenerated.
- **Allantois** is obliterated and forms median umbilical ligament of the urinary bladder.
- **Loops of intestine** return to abdominal cavity.
- **Extra-embryonic coelom** is closed.

- The umbilical cord has natural twists (false knotting) because umbilical vein is longer than umbilical arteries
- At Full-term Length: 50–55 cm.
Breadth: 1–2 cm

- Changes of umbilical cord after labor
- Left umbilical vein is obliterated and forms ligamentum teres of the liver.
- 2 umbilical arteries are obliterated and form 2 medial umbilical ligaments of the urinary bladder.
- Allantois is obliterated and forms median umbilical ligament of the urinary bladder
- VID is obliterated and degenerated



- **Congenital anomalies of the umbilical cord**

1) Very long cord: more than one meter.

- It may surround the neck of the fetus leading to death.
- It may turn around limb of the fetus leading to its atrophy.
- Cord prolapse: it prolapse in the vagina during child birth

2) Very short cord: less than 30 cm.

- It limits the movement of the fetus.
- It leads to early separation of the placenta leading to bleeding.

3) Congenital umbilical hernia: failure of reduction of the intestine.

4) True Knotting of the cord: leading to interfere with the blood supply of the fetus.

5) Double or triple cord.

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6) Anomalies in the attachment of the cord:

a- **Battledore** **هامشية** **placenta**, attached to the **margin** of the placenta.

b- **Velamentous** **غلافي** **placenta**, attached to the fetal membranes.

7) Anomalies in the allantois (urachus):

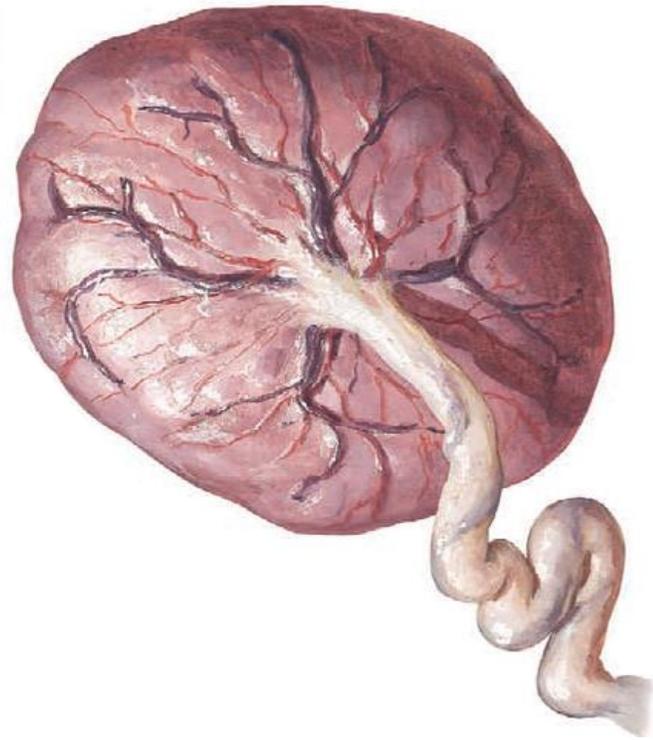
a- **Urachal fistula**: persistence of the urachus. It leads to discharge of urine from the umbilicus of the fetus.

b **Urachal cyst**: persistence of the **middle** part.

c- **Urachal sinus**: persistence of the **distal** end.

7) Anomalies in the vitellointestinal duct (SEE yolk sac)

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Development of Placenta

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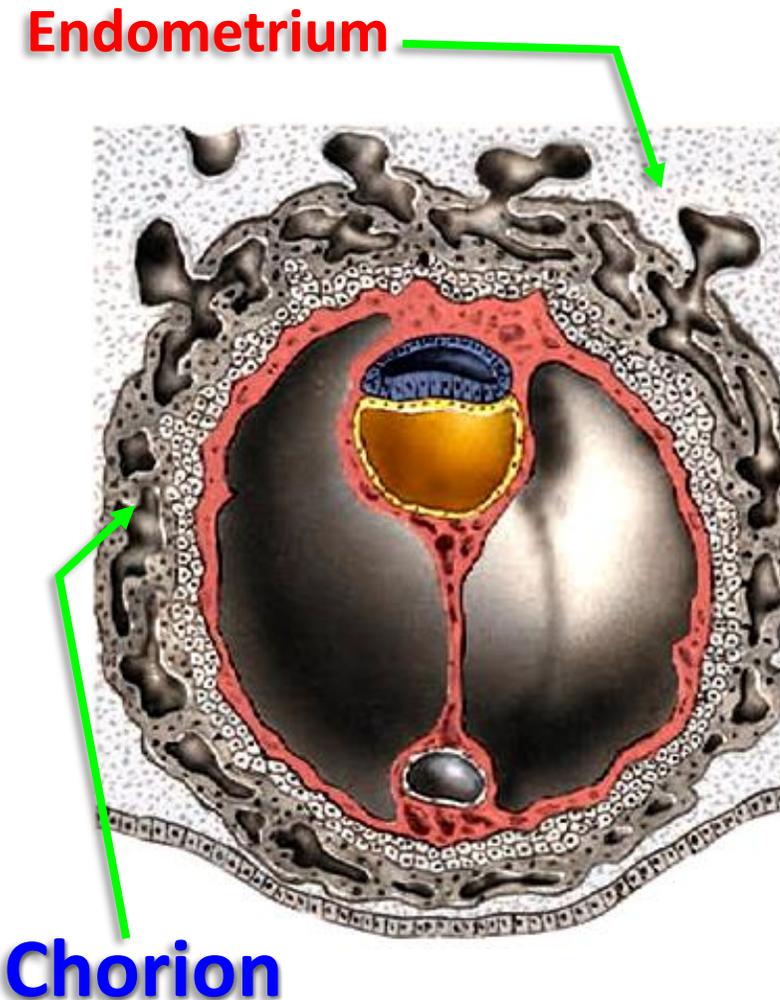
The placenta consists of two components: **maternal** and **fetal**.

A- The **fetal** part develops from **chorion frondosum**

B- The **maternal** part develops from the **decidua basalis** (**endometrium** of the uterus after fertilization and implantation)

The **placenta** is the only organ in the body that develops from two different individuals, fetus (chorion) and mother (endometrium)

Parts of Placenta



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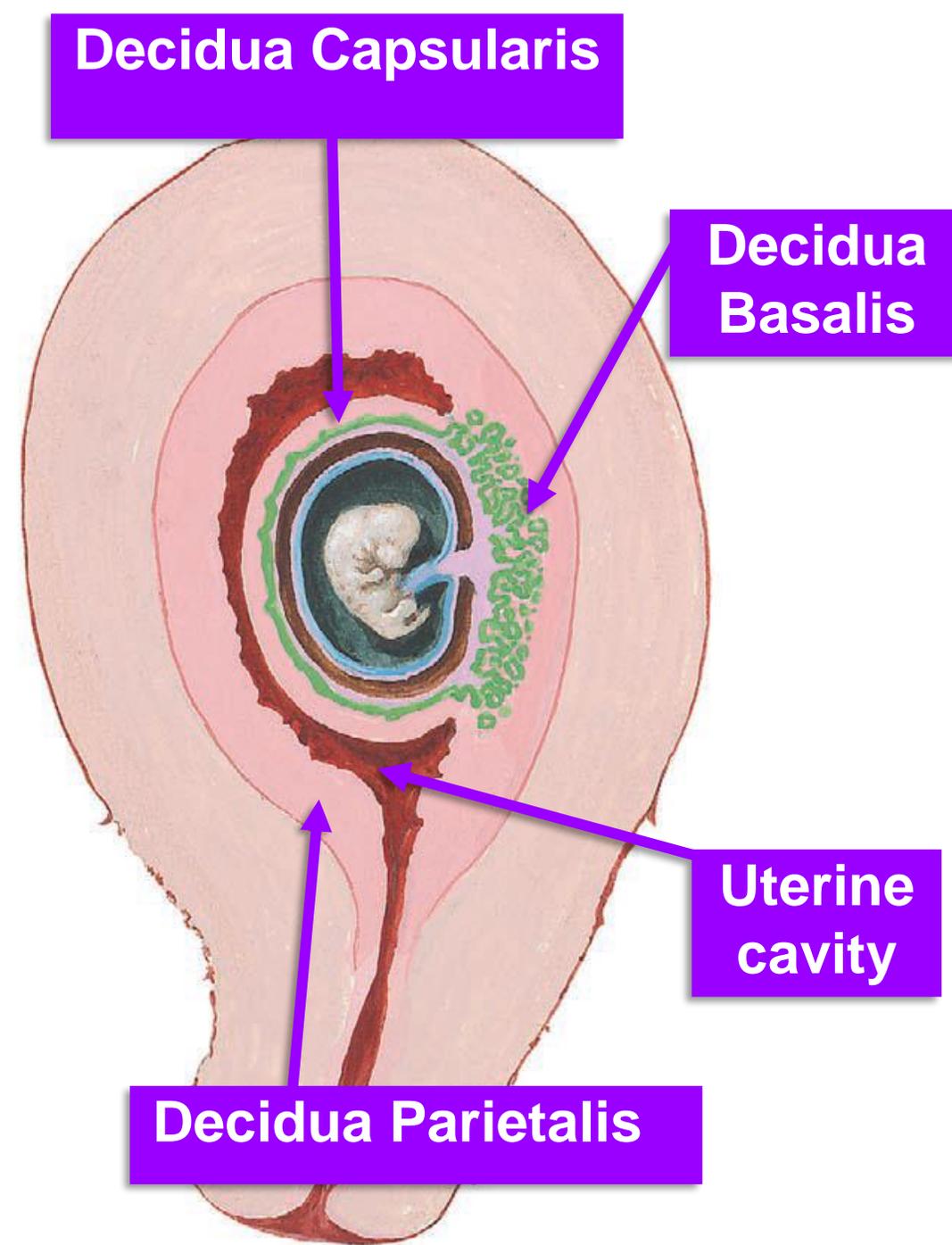
- **Development of decidua (Maternal part)**

- a- The endometrium becomes thicker and more vascular.
- b- Its glands become highly tortuous and filled with secretions.
- c- It contains decidual cells characteristic of pregnancy.

- **Parts of decidua**

- **Decidua basalis:** deep to the embryo (between blastocyst and myometrium). It forms the fetal part of placenta.
- **Decidua capsularis:** covers the blastocyst, later on disappear.
- **Decidua parietalis:** the rest of endometrium that lines uterine cavity, later on disappear.

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Development of Chorionic Villi

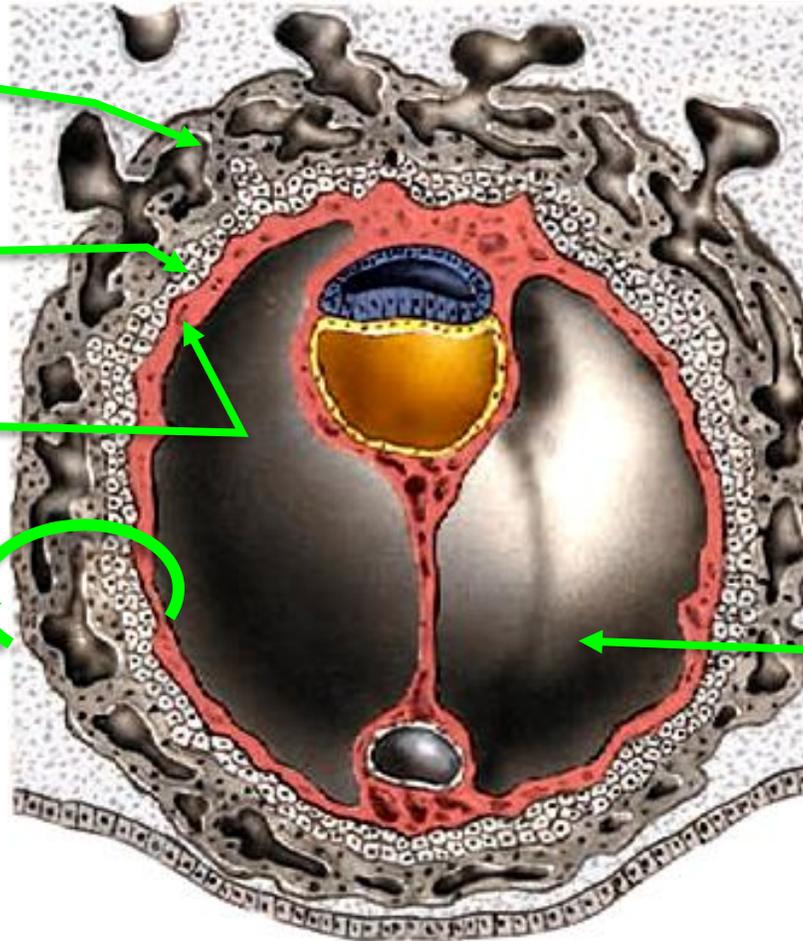
Chorionic Vesicle

Syncytiotrophoblast

Cytotrophoblast

**Somatic layer of
E. E. mesoderm**

Chorion



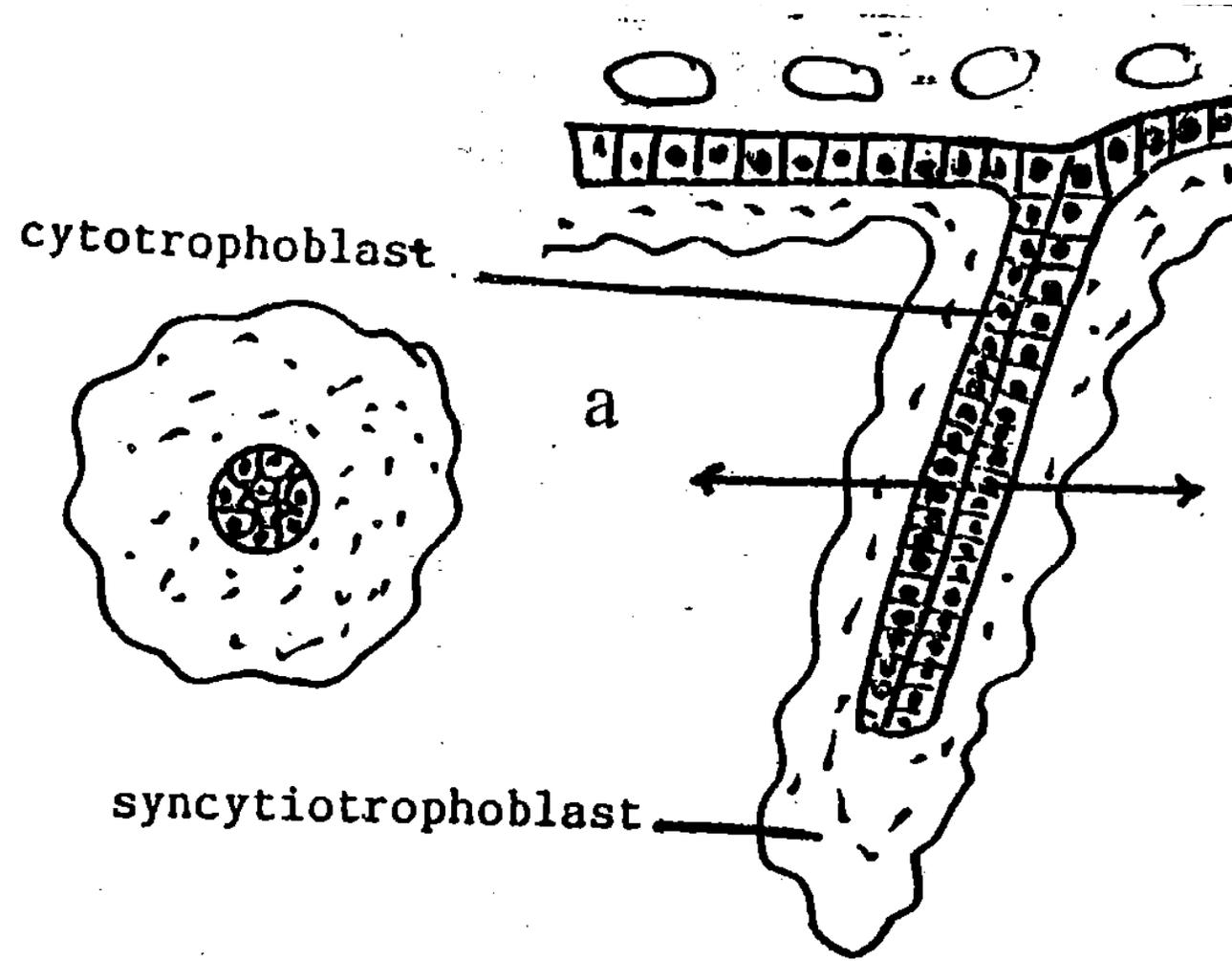
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**Chorionic
cavity**

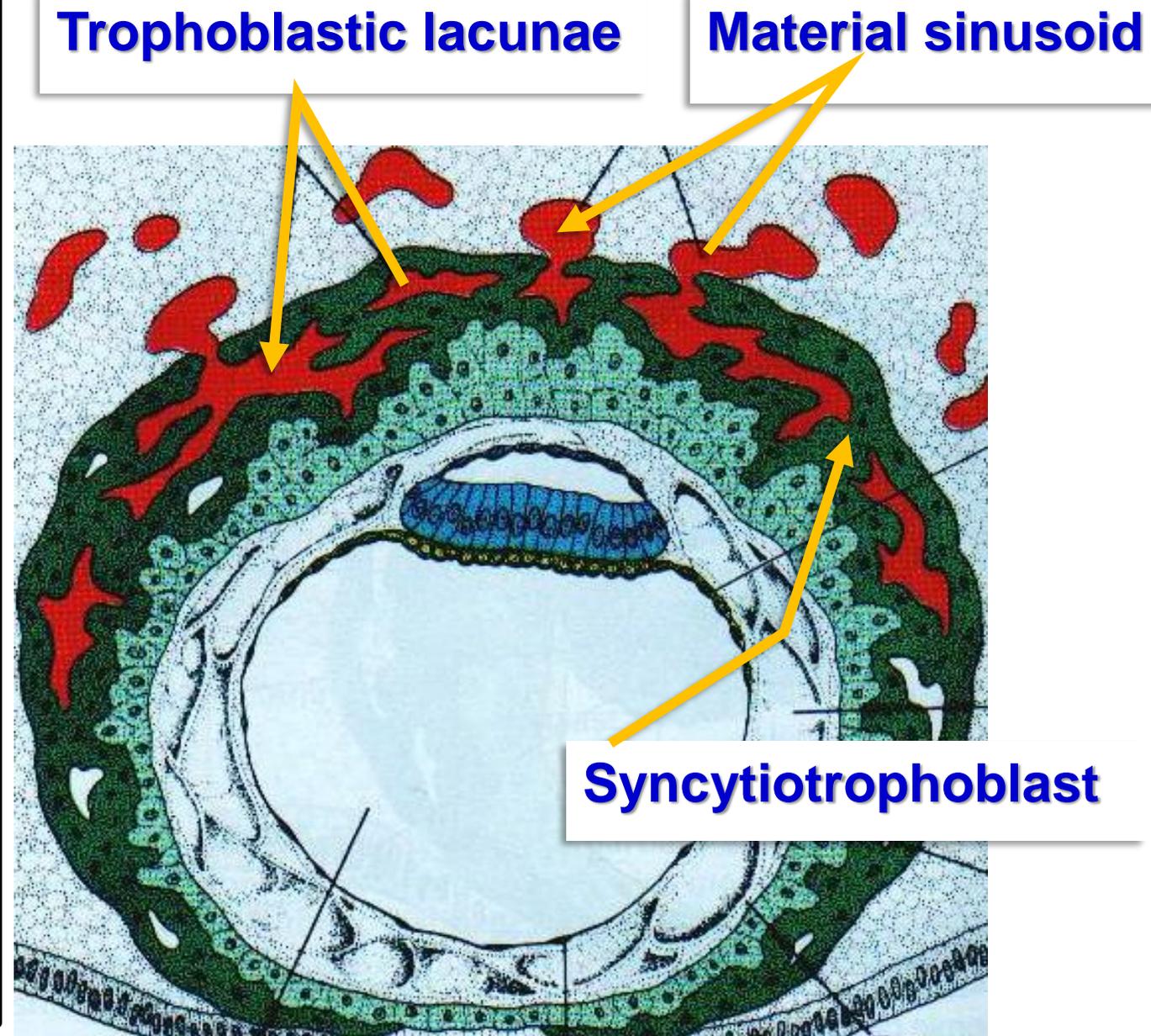
- **By the end of 2nd week**, The blastocyst is called **chorionic vesicle** having large cavity called **chorionic cavity**
- The Chorion (wall) is formed by three layers:
 - 1) Syncytiotrophoblast.
 - 2) Cytotrophoblast.
 - 3) **Somatic layer of extraembryonic mesoderm.**

- **Primary chorionic villi :**
 - The **syncytiotrophoblasts** form finger-like projections.
 - The **cytotrophoblasts** migrate into center of the projections.
 - The **villi** are separated from each other by spaces called **lacunae** filled with maternal blood due to erosion of the uterine vessels by syncytiotrophoblast.

Primary chorionic villi



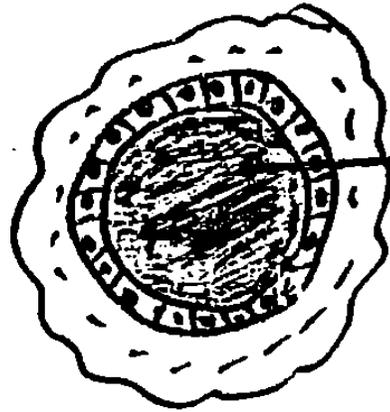
- **Trophoblastic lacunae** appeared in syncytiotrophoblast at embryonic pole of the disc
- The syncytiotrophoblast cells **penetrate** (phagocytosis) deeper into maternal endometrium and **invade its capillaries**
- The lacunae become **filled with maternal blood**
- **S**o, maternal blood begins to flow through **lacunar system** of trophoblast and this is called **uteroplacental circulation.**



Secondary chorionic villi

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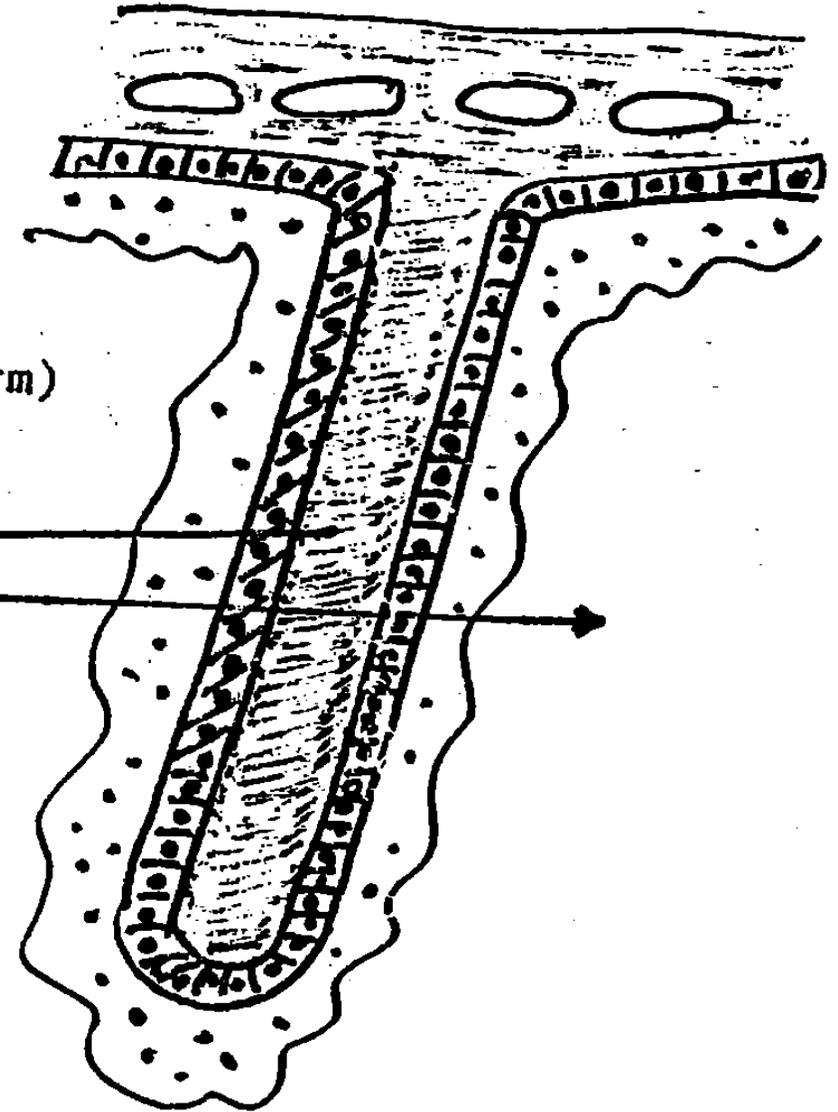
Secondary villus (has a core of mesoderm)



extra-embryonic
mesoderm (core of
the villus).

b

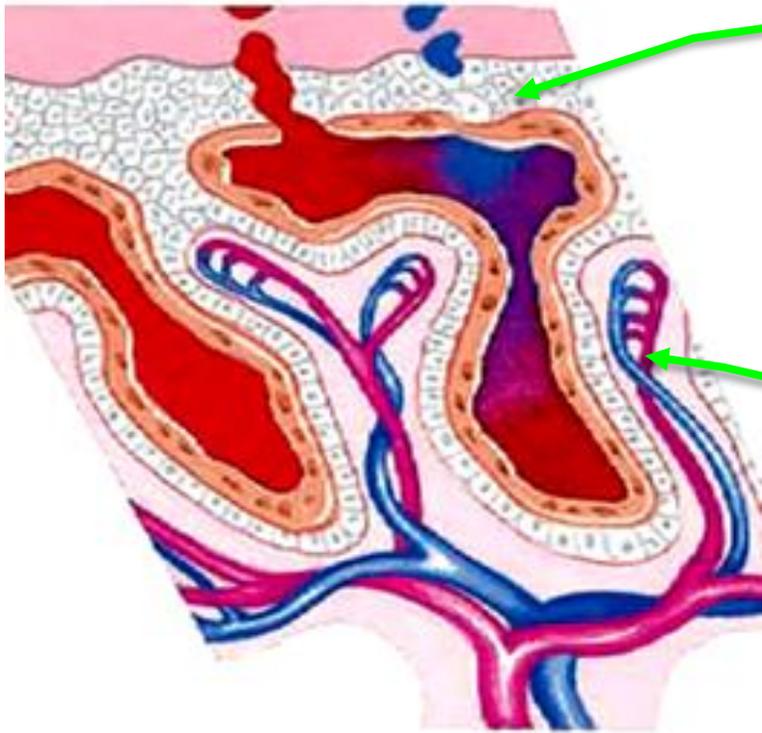
syncytiotrophoblast



- **Secondary chorionic villi**

- The **extra-embryonic mesoderm (EEM)** proliferates and migrates into the center of the cytotrophoblastic cells.

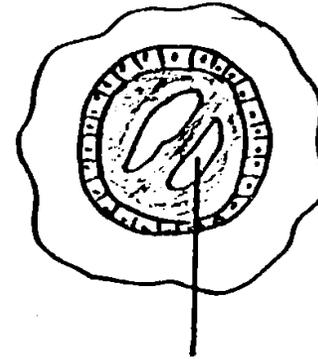
Tertiary chorionic villi



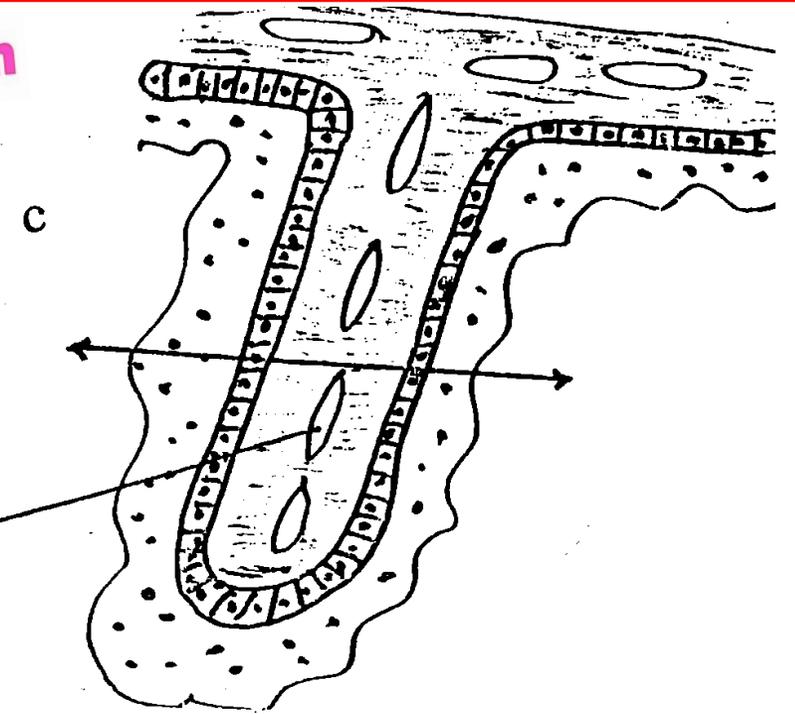
Shell

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Fetal blood vessels



blood vessel in the mesodermal core.



• Tertiary chorionic villi

- The cells of the **extra-embryonic mesoderm** give rise to fetal **blood vessels**.
N.B: The cytotrophoblast cells of the apical region pierce the syncytiotrophoblast cells to meet and fuse with the adjacent one forming **cytotrophoblastic shell** to prevent further erosion of the endometrium by the syncytiotrophoblast and fixes all the villi in the decidua (**Anchoring villi**) .

Placental barrier

Placental barrier (Membrane)

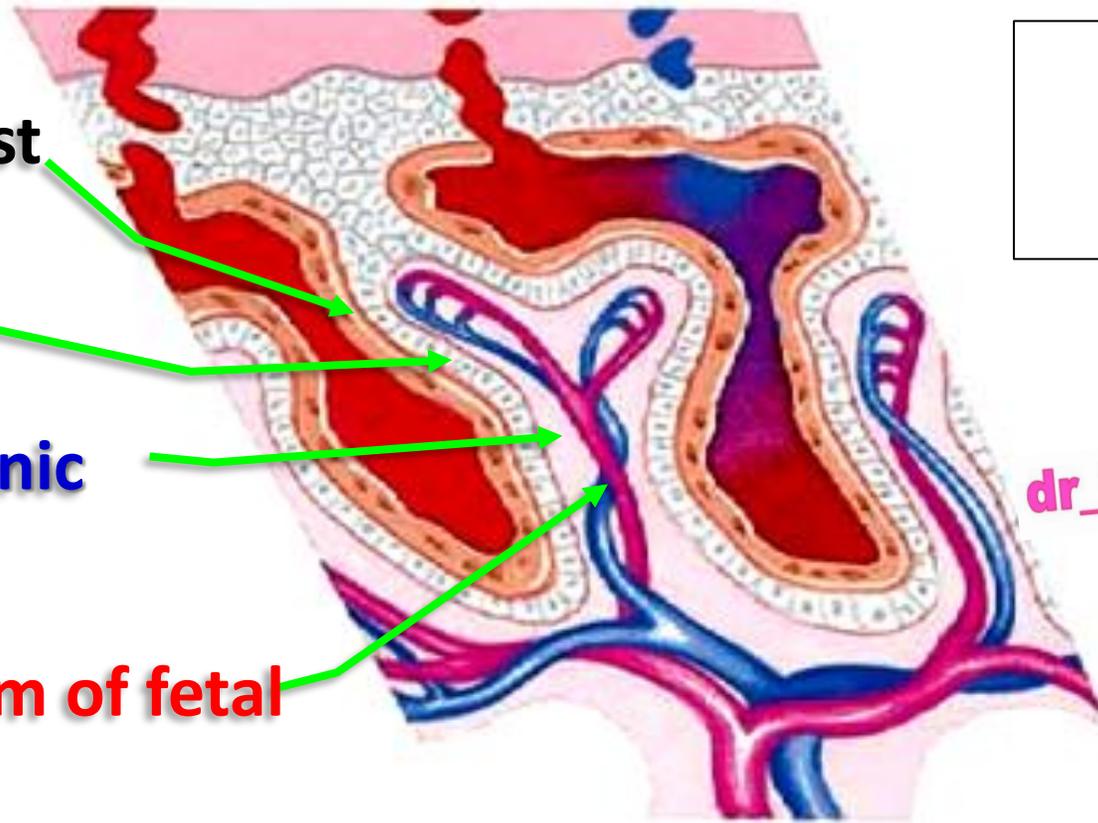
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1- Syncytiotrophoblast

2- Cytotrophoblast

3- Extraembryonic
mesoderm

4- Endothelium of fetal
blood vessels



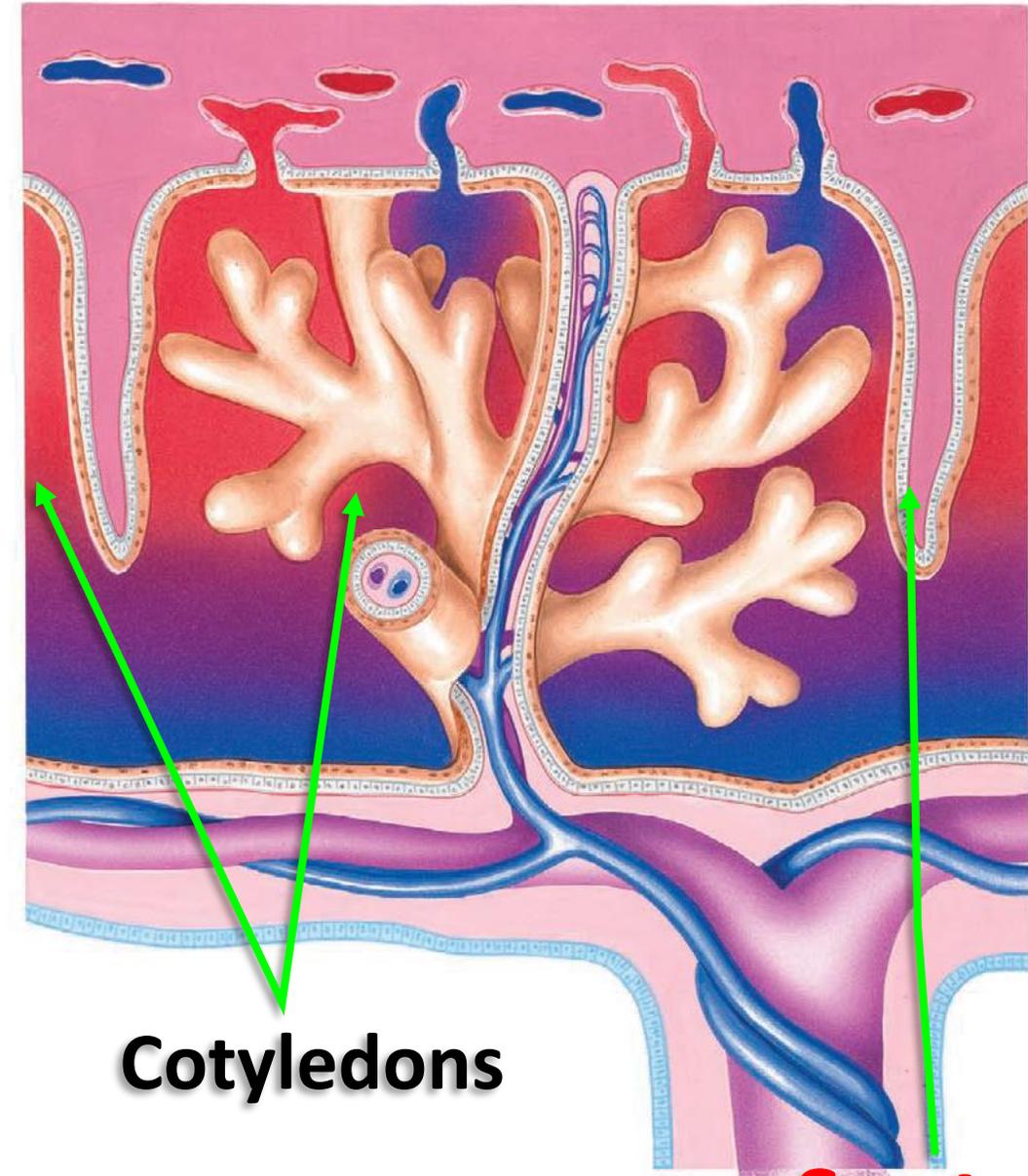
- In early pregnancy, the **placental membrane** is made up of **four layers**, its thickness is **about 25 micron**

- **After the 3rd month**, the nutritional demands increase so the placental membrane becomes thin to increase the efficiency of transport of nutrients, its thickness is **about 1-2 micron**. It is made of **two layers syncytiotrophoblast and endothelium of the fetal blood vessels**

Lobulation of Placenta

** Development of decidual septa:

- The **decidua basalis** forms many **septa** that protrude into the **intervillous spaces** aiming to increase the surface area of the decidua.
- These septa divide the placenta into 15-20 lobes called **cotyledons** الفلقات.



Cotyledons

Septa

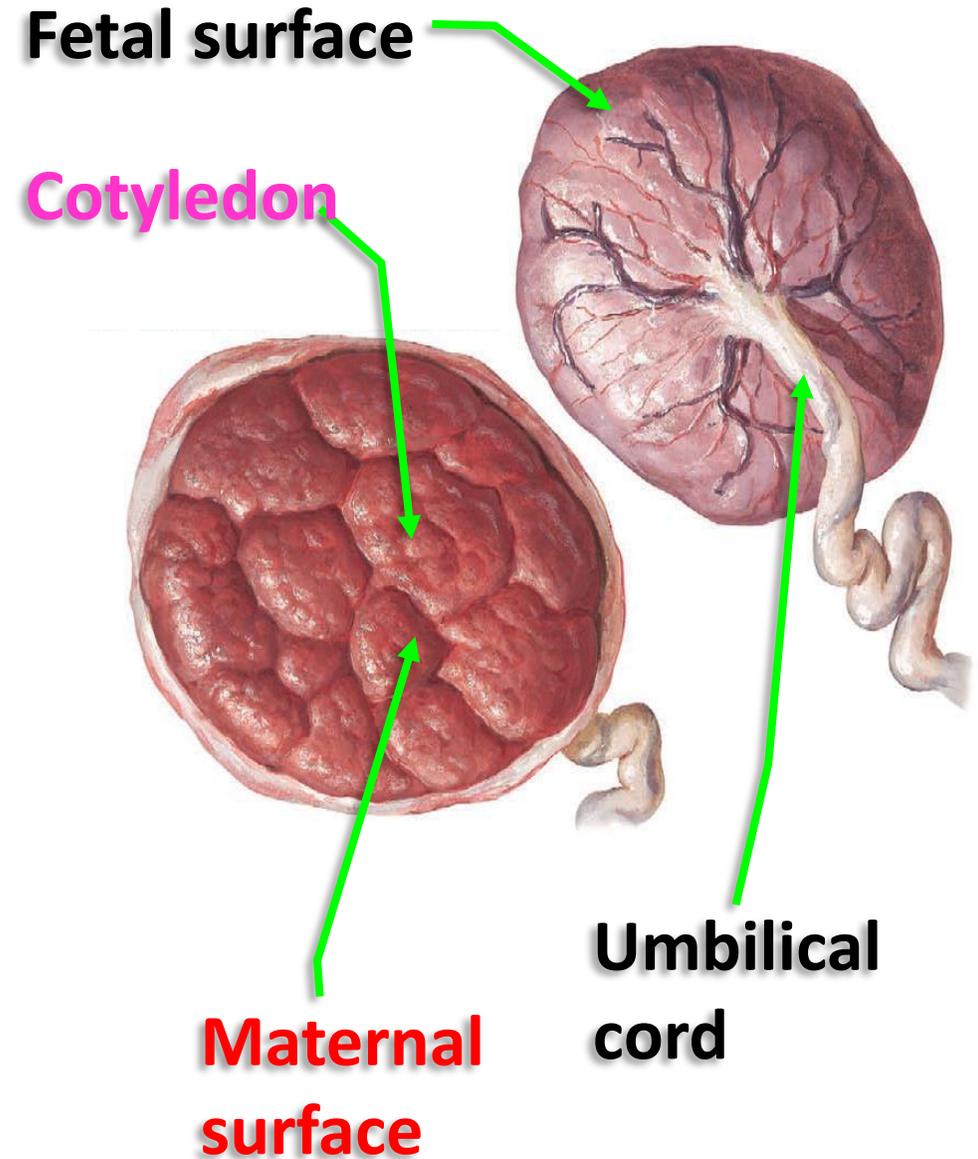
Morphology (Gross features)

- **Shape**; disc shaped.
- **Diameter**; about 15-20 cm.
- **Weight**: about 500 gm at birth.
- **Thickness**; its center about 3 cm and its margins about 1 cm

• Surfaces

A- maternal: Rough. It is segmented into 15-20 lobes (cotyledons). الفلقات

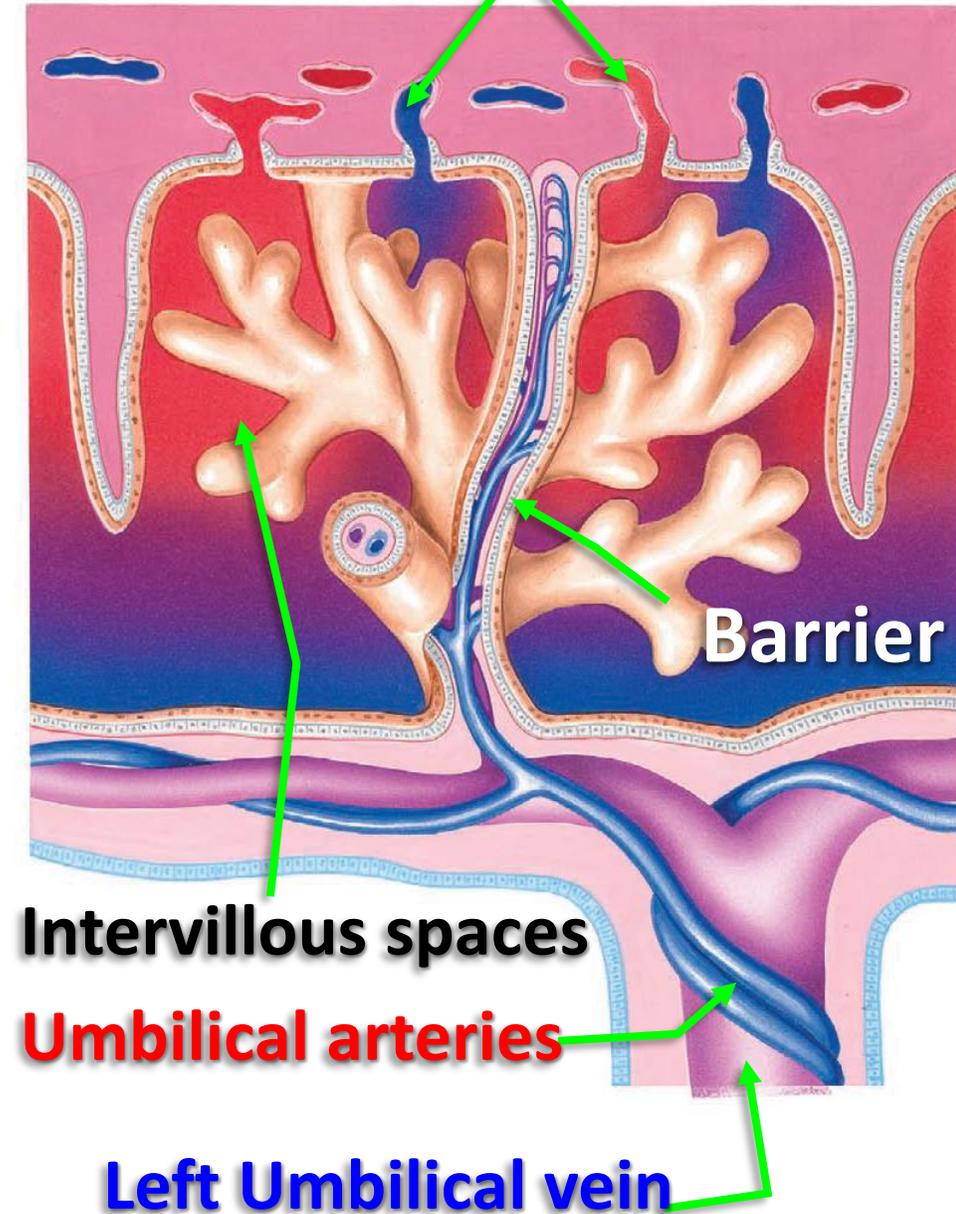
B- Fetal: Smooth and covered by amniotic membrane. The umbilical cord attached to the center of the fetal surface.



- **Placental circulation:**

- The fetal non oxygenated blood reaches to the placenta by **2 umbilical arteries** → where gas exchange occurs with the maternal blood in the **intervillous spaces** through **spiral arteries and veins** of the decidua basalis.
- Exchange between the 2 blood streams occurred across the **placental barrier**.
- The oxygenated blood returns to the fetus by **left umbilical vein**.

Spiral arteries & veins



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