أهلا وسهلا

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Development of Umbilical Cord

Prof. Dr. Youssef Hussein Anatomy - YouTube

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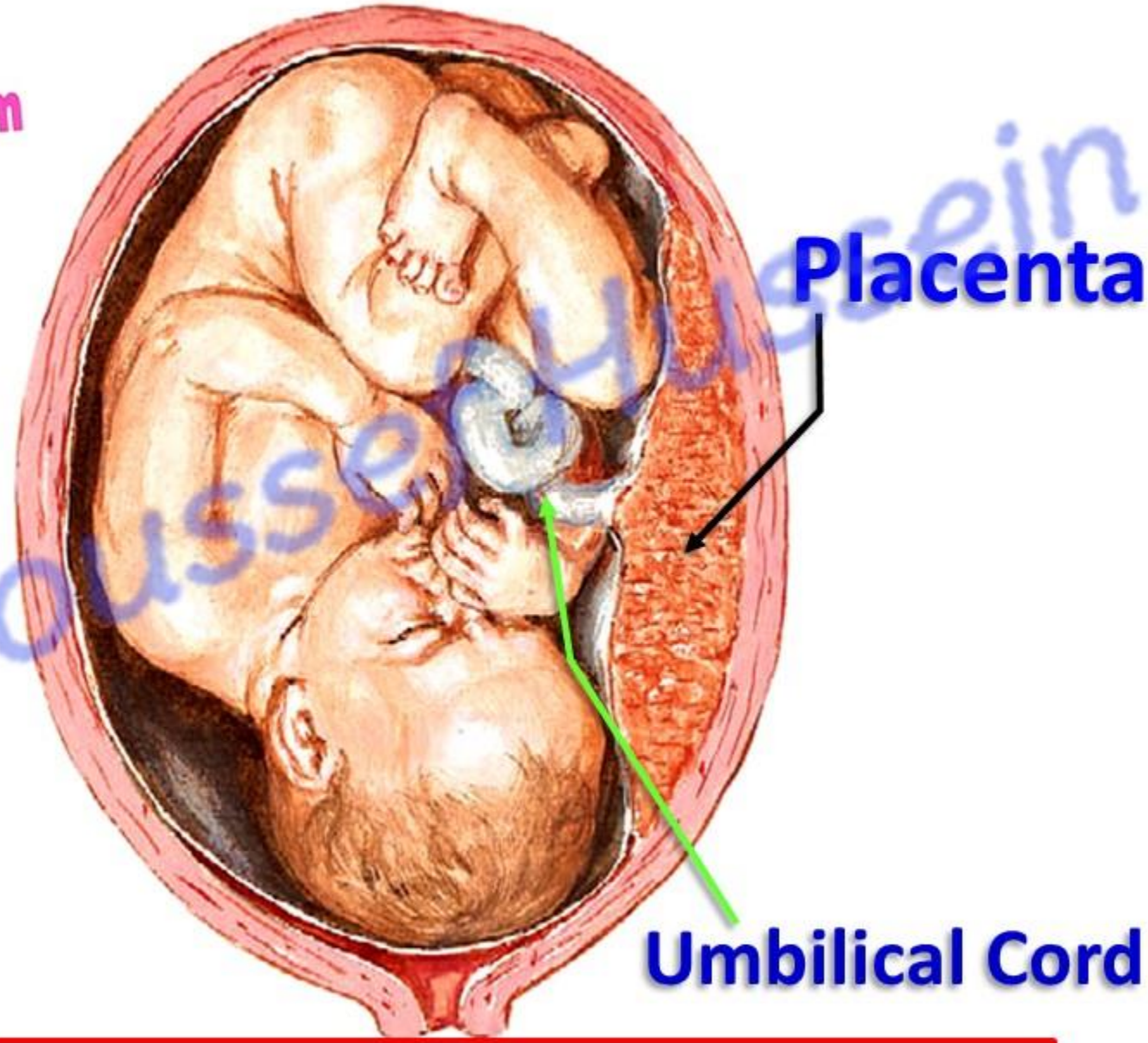
- It is a cord-like structure connects the placenta (fetal surface) with the umbilicus of the fetus



** 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

** Formation of the primitive umbilical cord

1- Vitello-intestinal duct (VID) between midgut 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.***

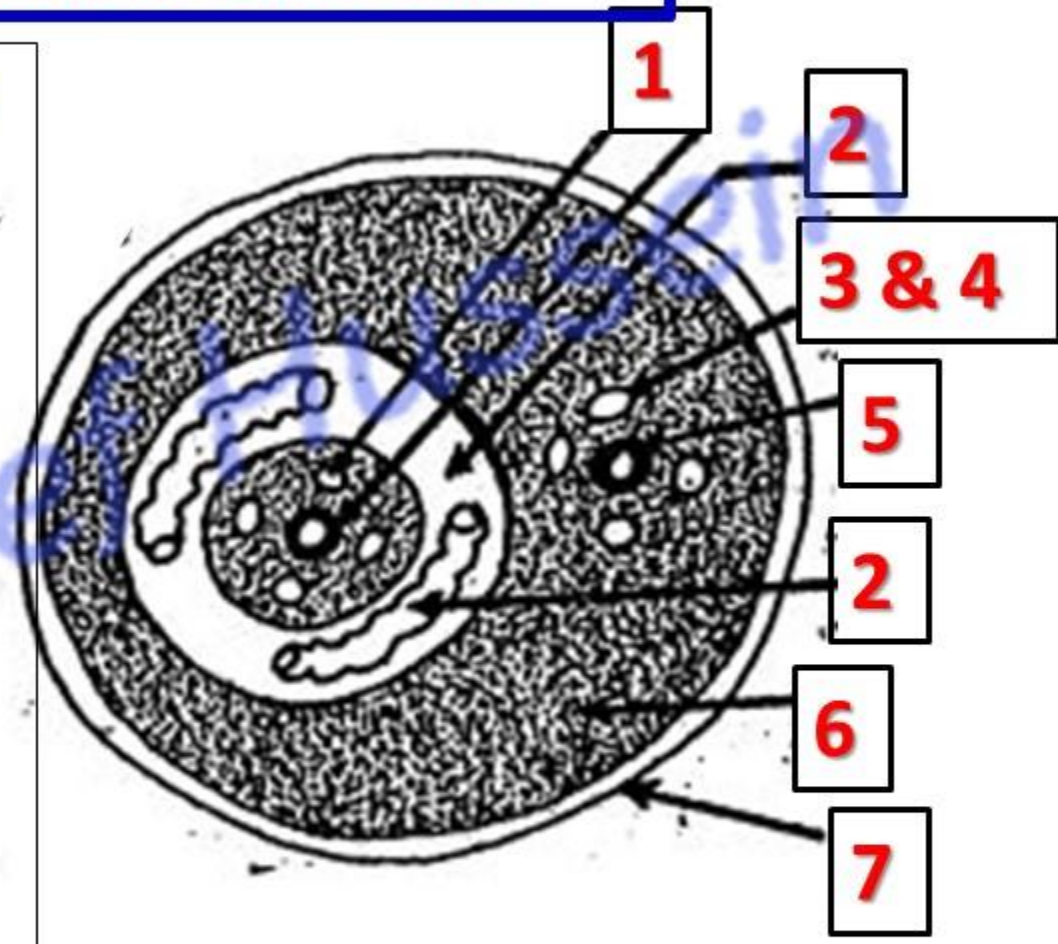
3- 2 umbilical arteries carry **non-oxygenated** blood from the fetus to the mother.

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

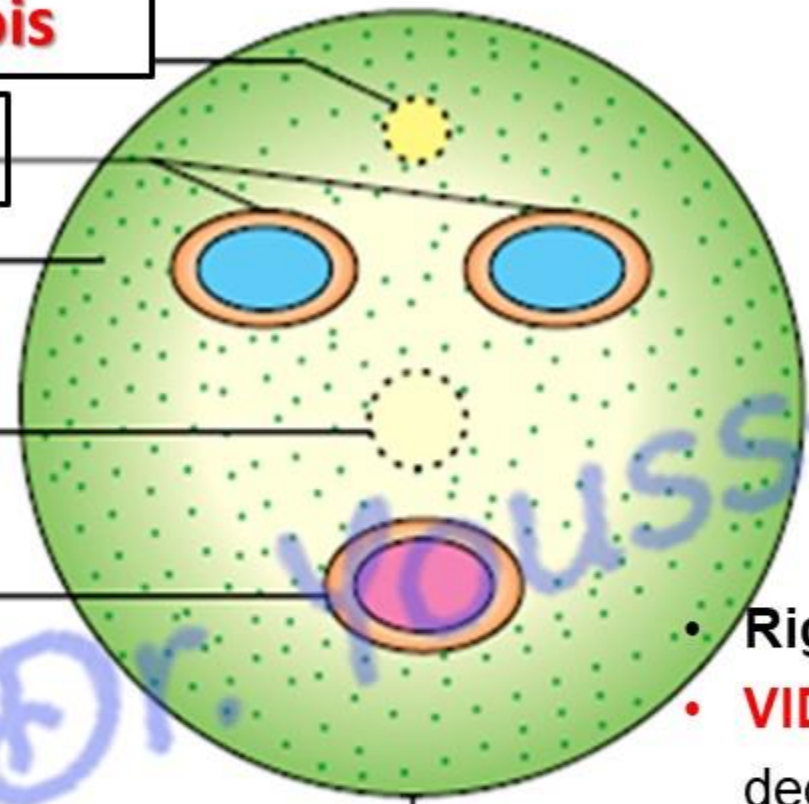
5- Allantois (urachus) small diverticulum from cloaca and extends into the connecting stalk.
- It connects the apex of the urinary bladder with the umbilicus.

6- Extra-embryonic mesoderm.

7- It is covered by **amniotic membrane**.



Definitive of Umbilical Cord

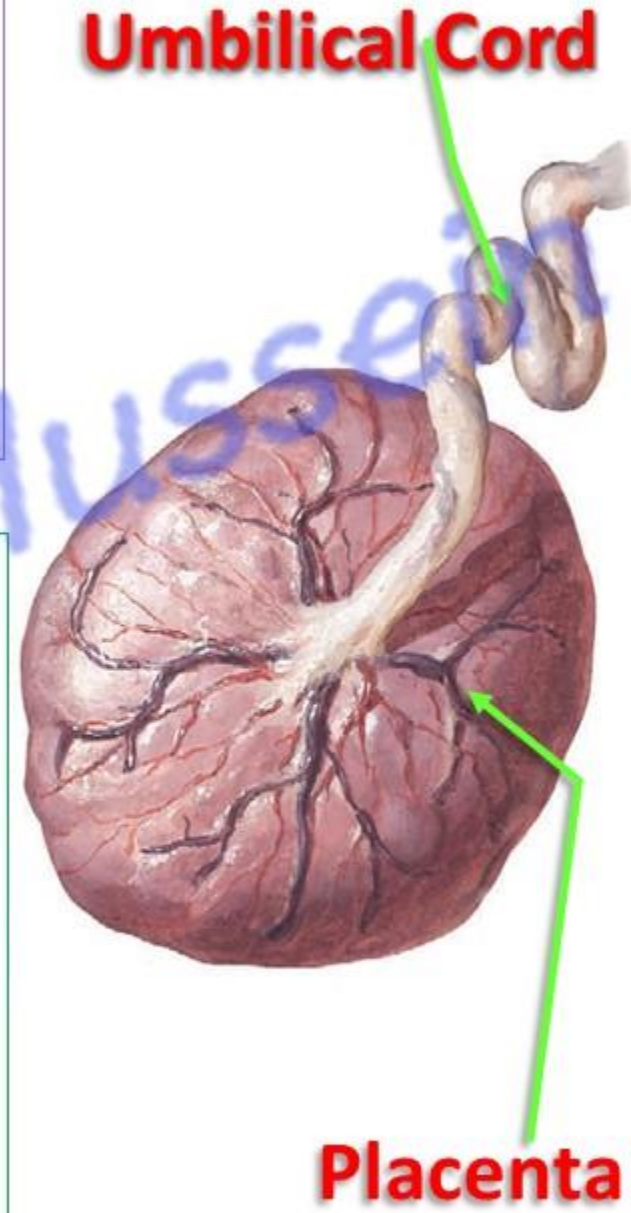


- **2 umbilical arteries** (Right & Left).
- **Left umbilical vein**.
- These structures are embedded in a jelly like material called **Wharton's jelly**.
- It is covered by **amniotic membrane**.

- **Right umbilical vein** is obliterated.
- **VID and vitelline vessels** obliterated and degenerated.
- **Allantois (urachus)** obliterated and forms median umbilical ligament of urinary bladder.
- **Loops of intestine** return to abdominal cavity.
- E**xtra-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 in the vagina during childbirth

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.

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.

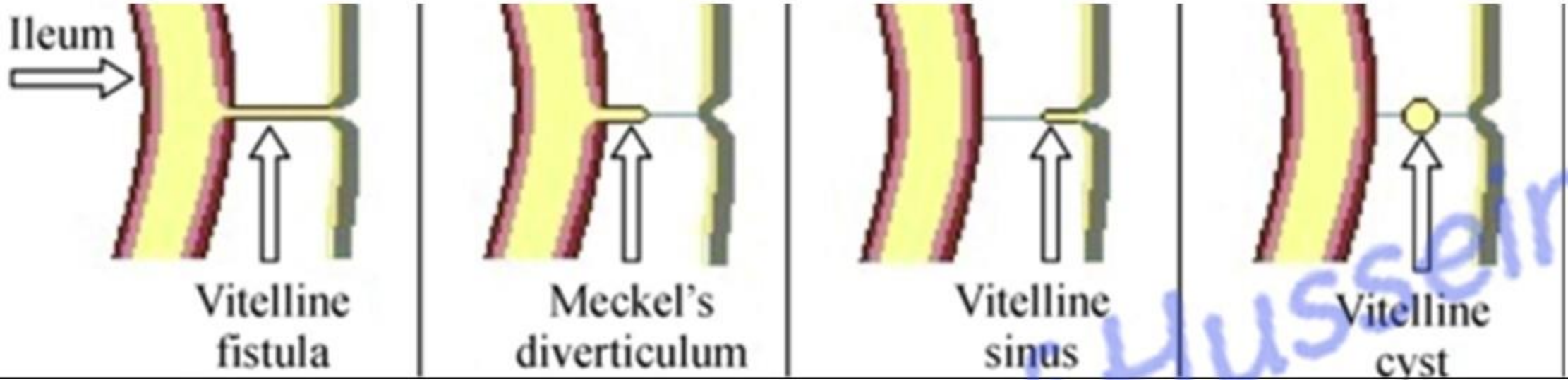
7) Anomalies in the allantois (urachus):

a- Urachal fistula: persistent 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)



** Congenital anomalies of Vitellointestnial duct:

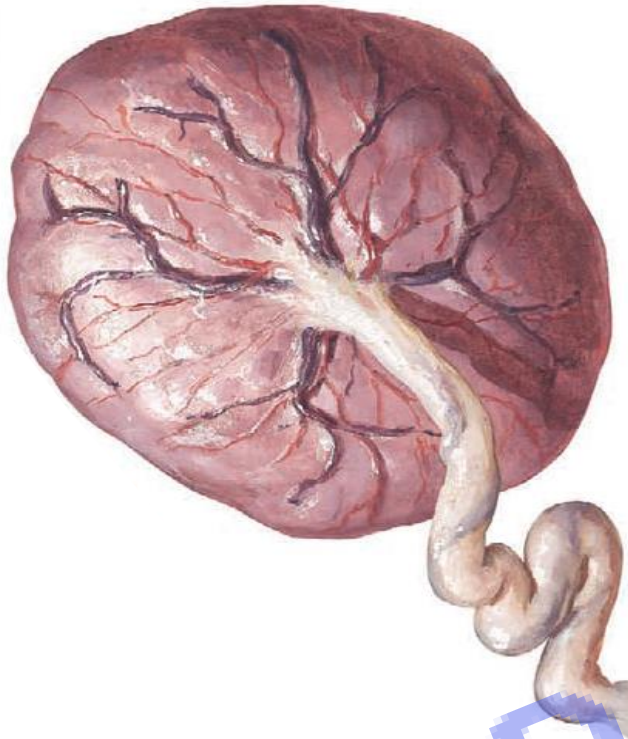
i) Vitelline fistula (patent VID): persistence of the duct leading to discharge of the intestinal contents through the umbilicus.

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.



Development of Placenta

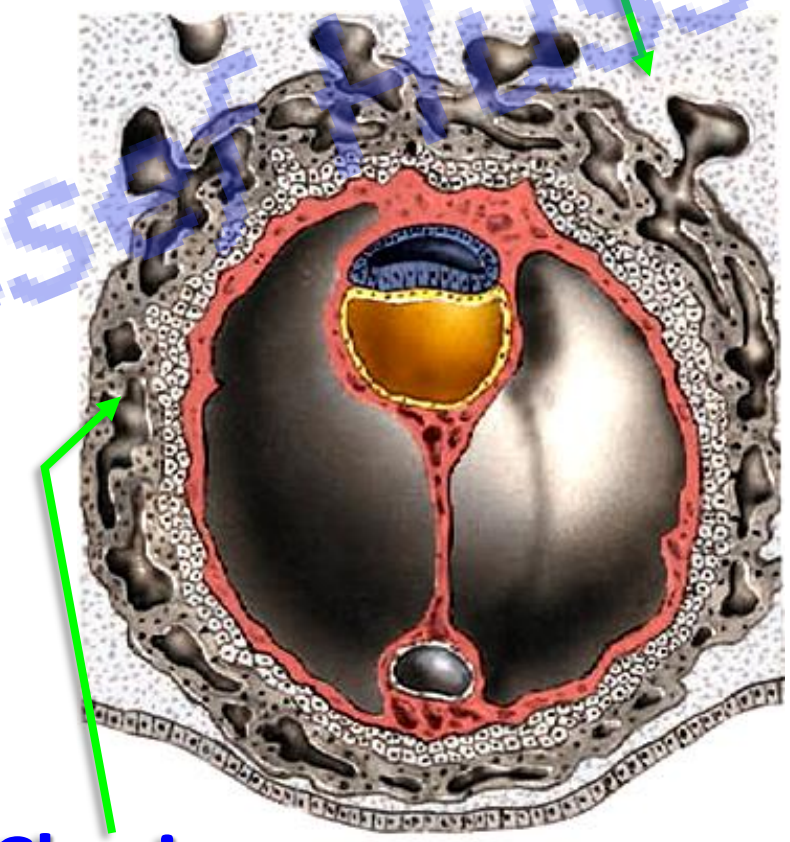
Parts of Placenta

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)

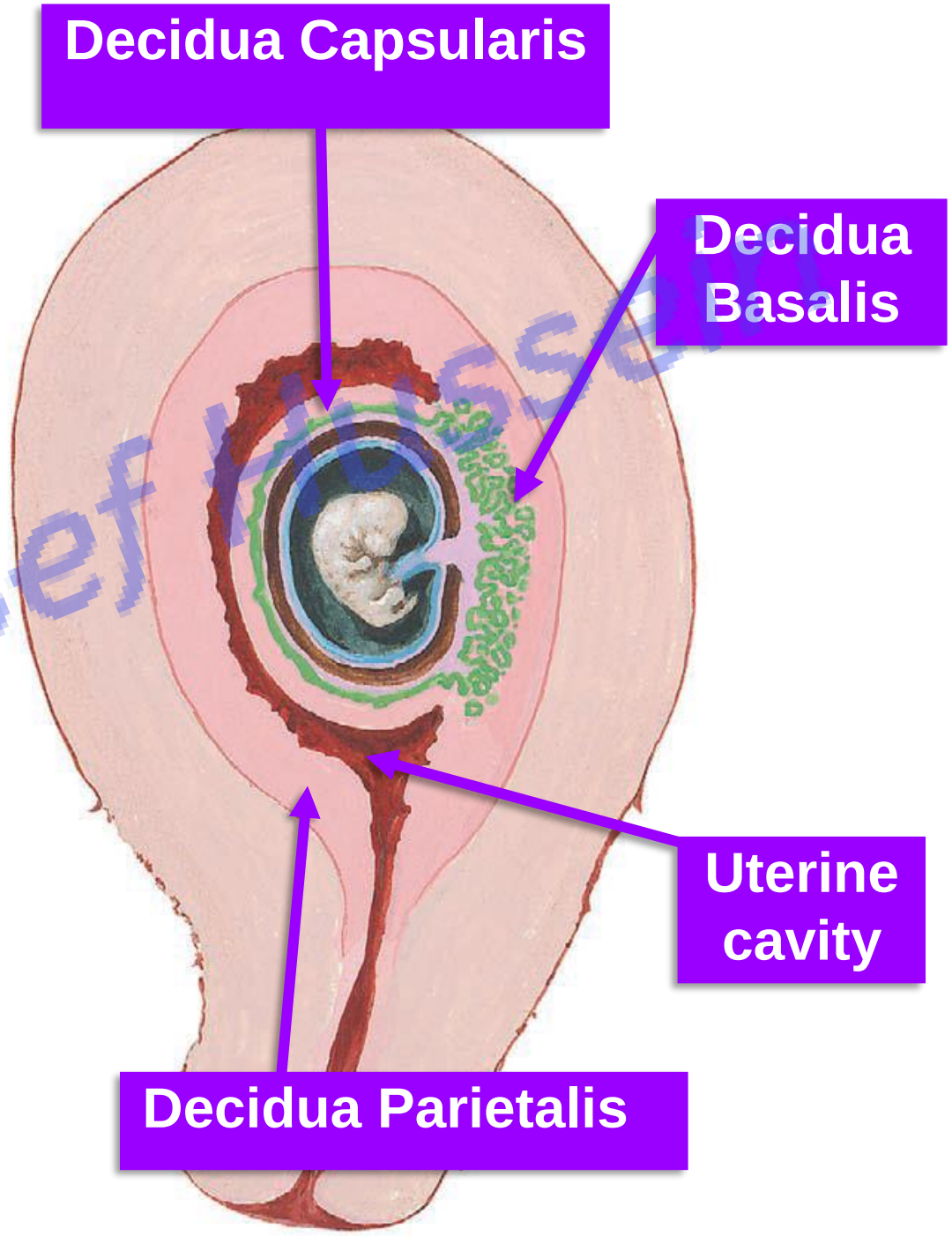


- **Development of decidua (Maternal part)**

- 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 maternal 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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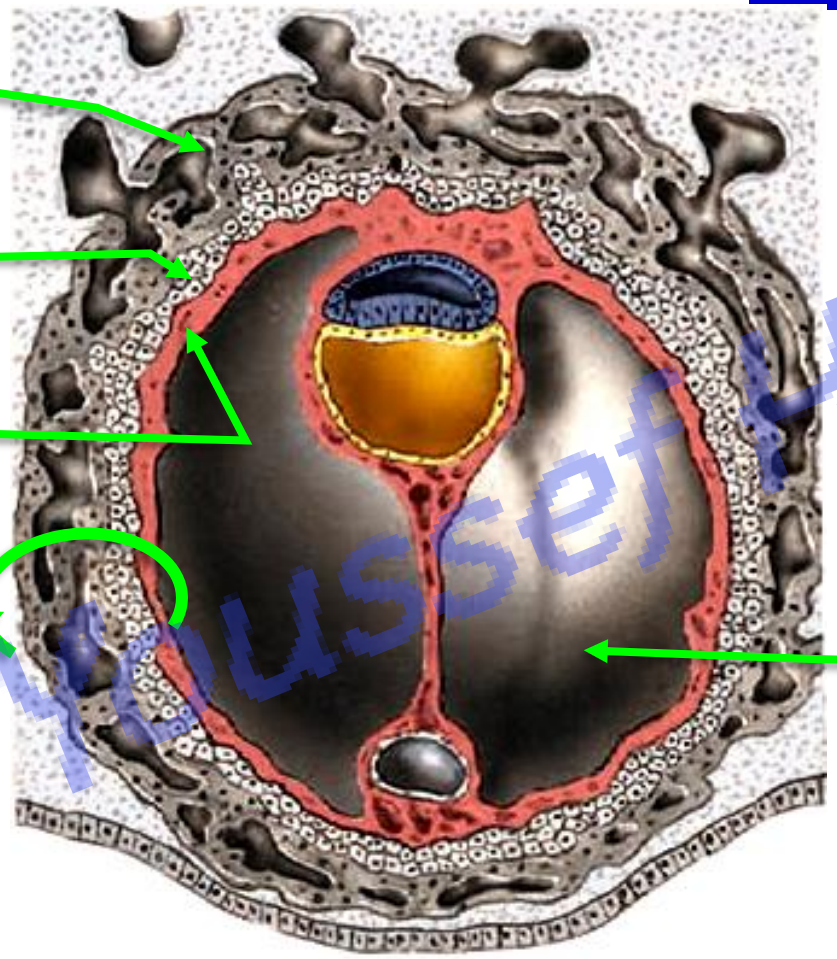
Development of Chorionic Villi

Chorionic Vesicle



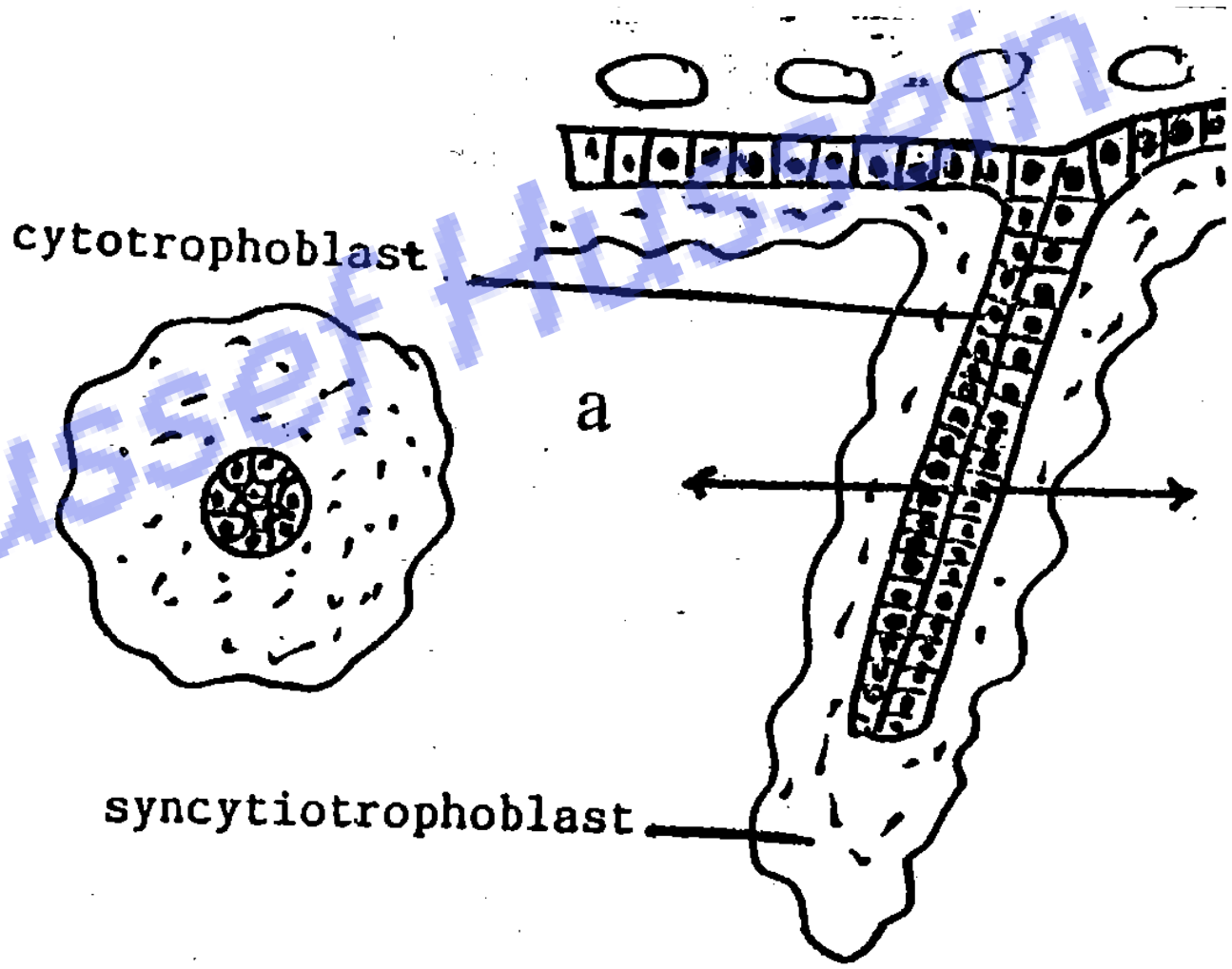
- By the end of 2nd week, The blastocyst is called chorionic vesicle having large cavity called chorionic cavity
- The Chorion (wall) is formed by three layers: 1) Syncytiotrophoblast.

2) Cytotrophoblast. 3) Somatic layer of extraembryonic mesoderm.

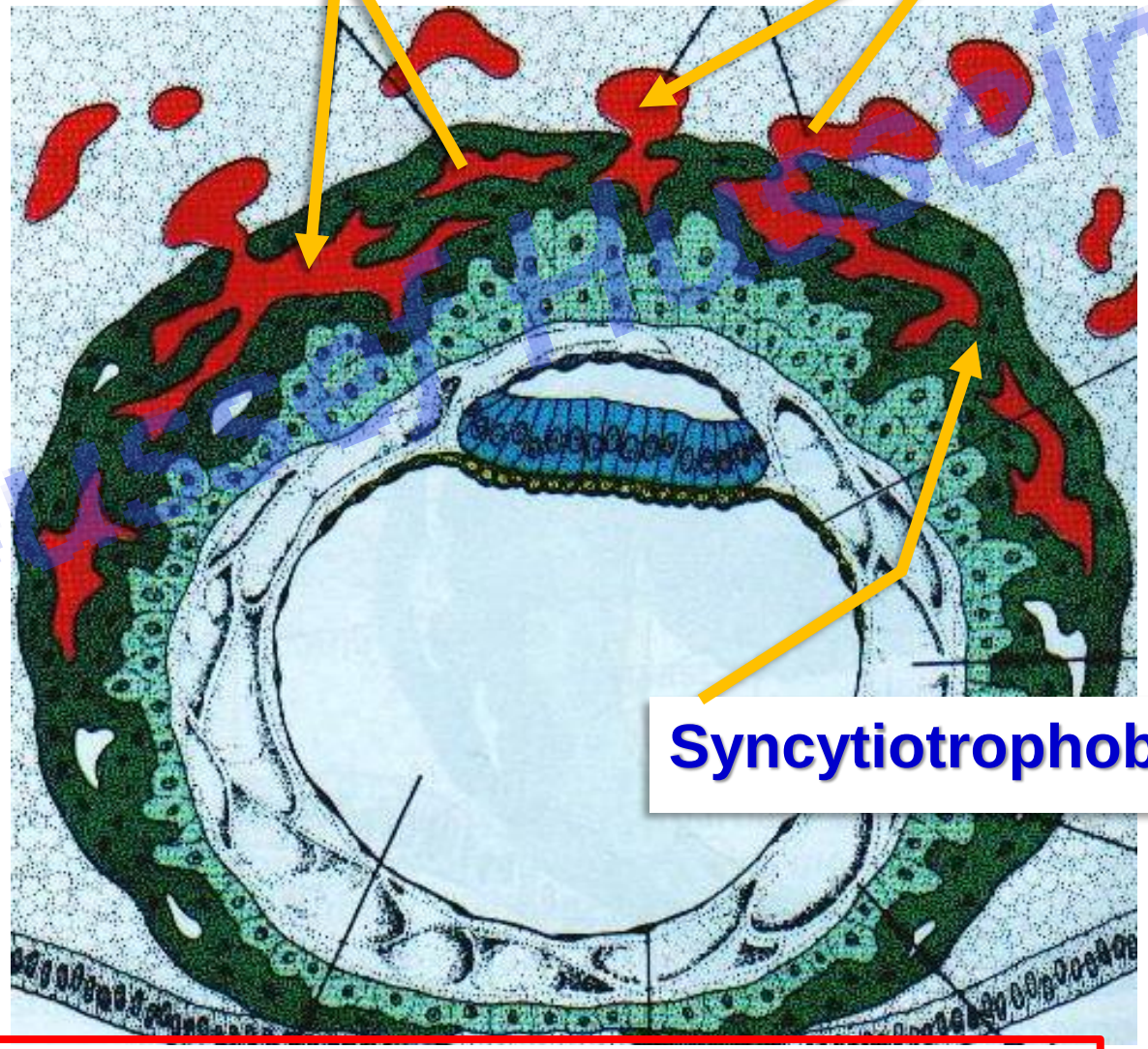
Primary chorionic villi

- **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.



- **Trophoblastic lacunae** appeared in syncytiotrophoblast at embryonic pole of the disc
- The syncytiotrophoblast cells **penetrate** (phagocytosis) deeper into maternal endometrium and **invade its capillaries**
- **T**he 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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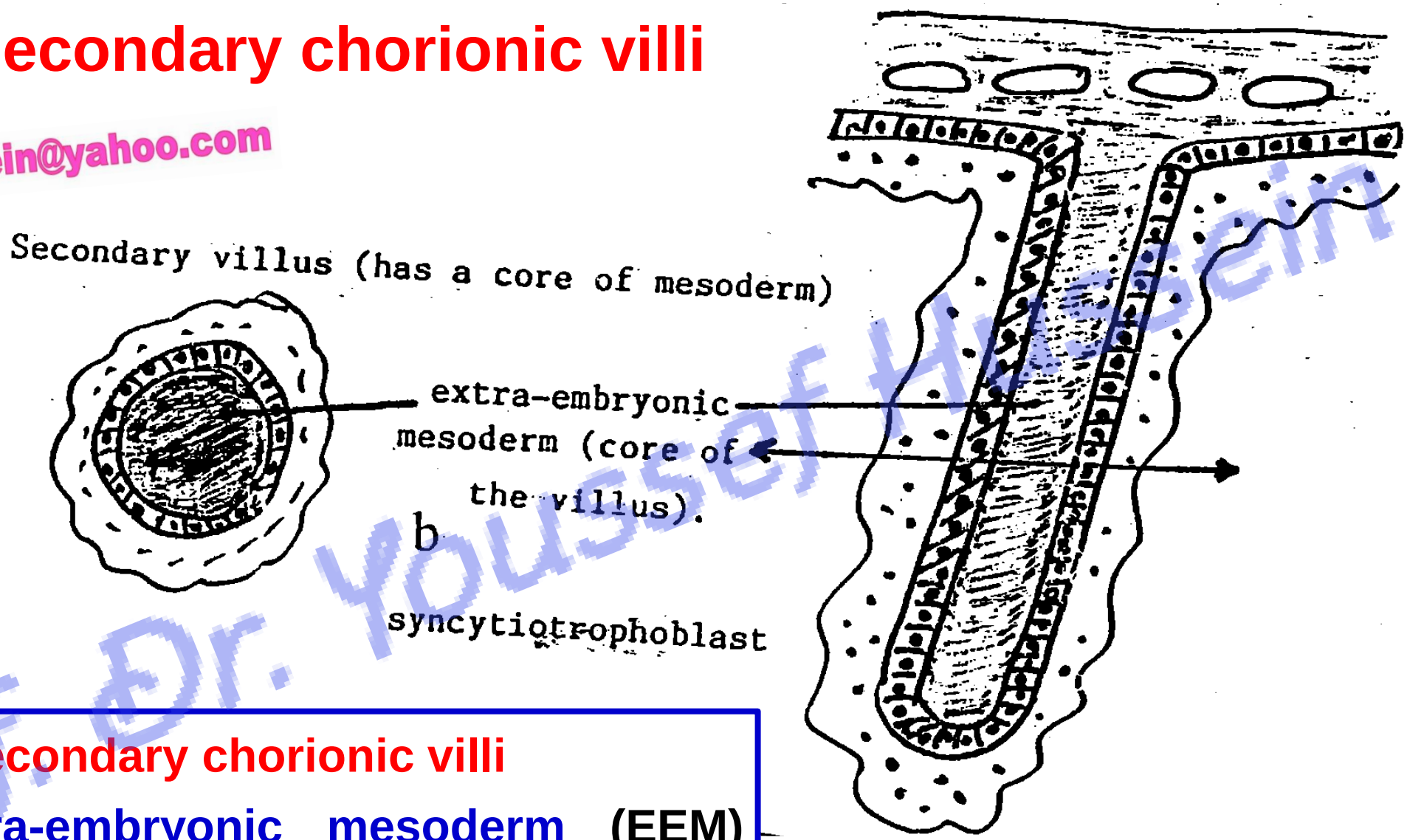
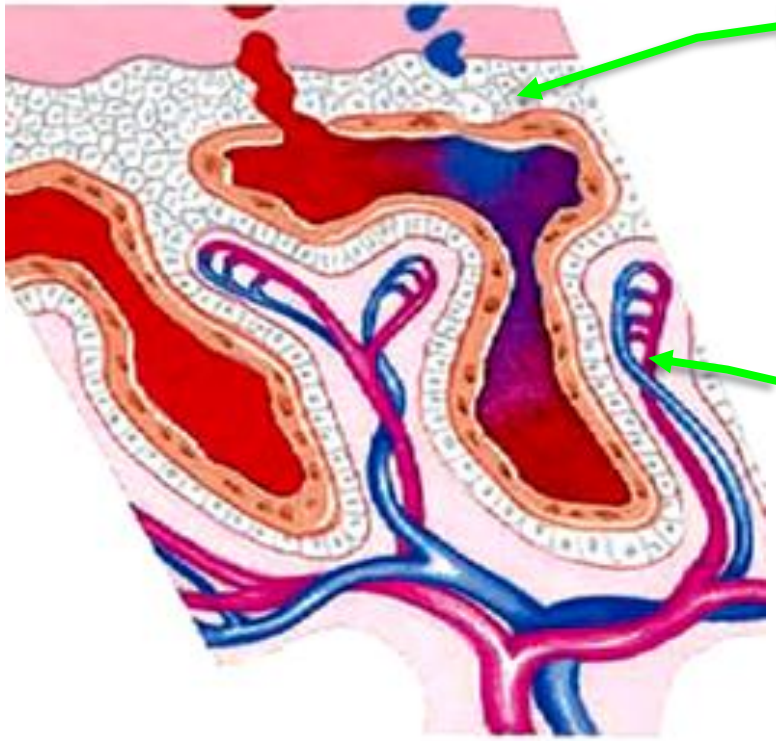


- **Secondary chorionic villi**

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

Tertiary chorionic villi



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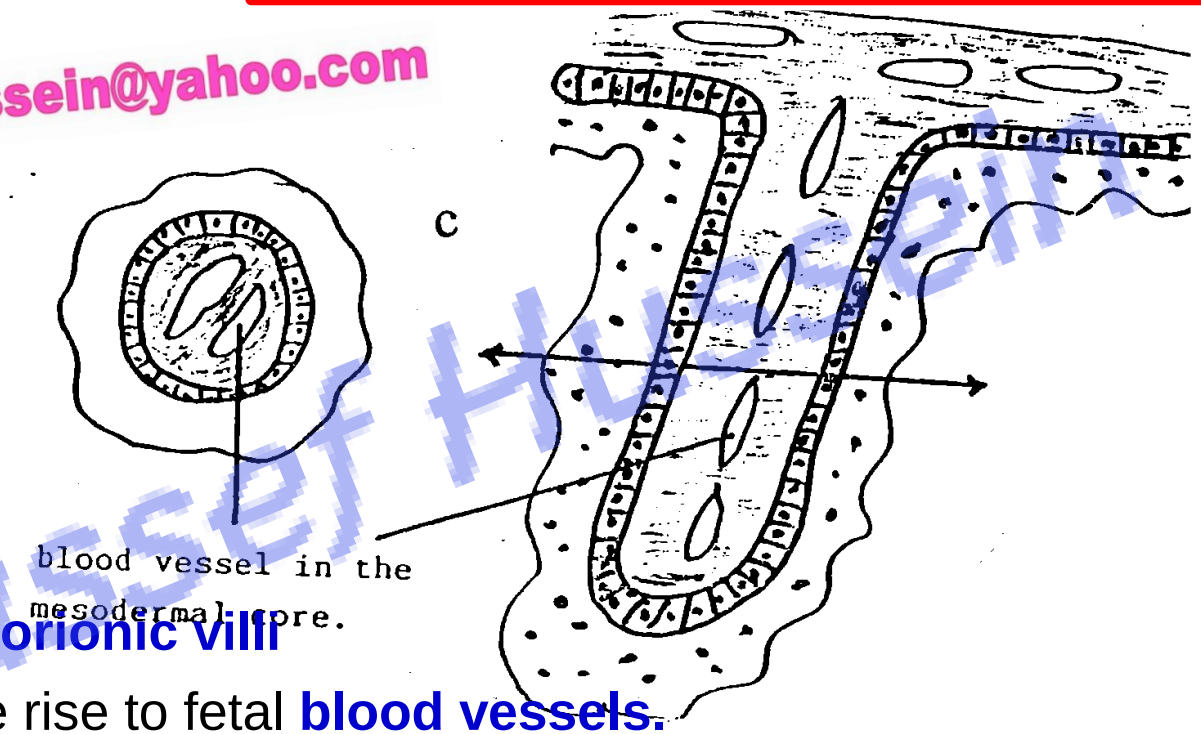

- **Tertiary chorionic villi**

- 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**) .

Fate of the chorionic villi

- The villi related to decidua basalis called **chorion frondosum** and forms fetal part of the placenta
- The villi related to the decidua capsularis called **chorion laevae** and later on degenerated**.**

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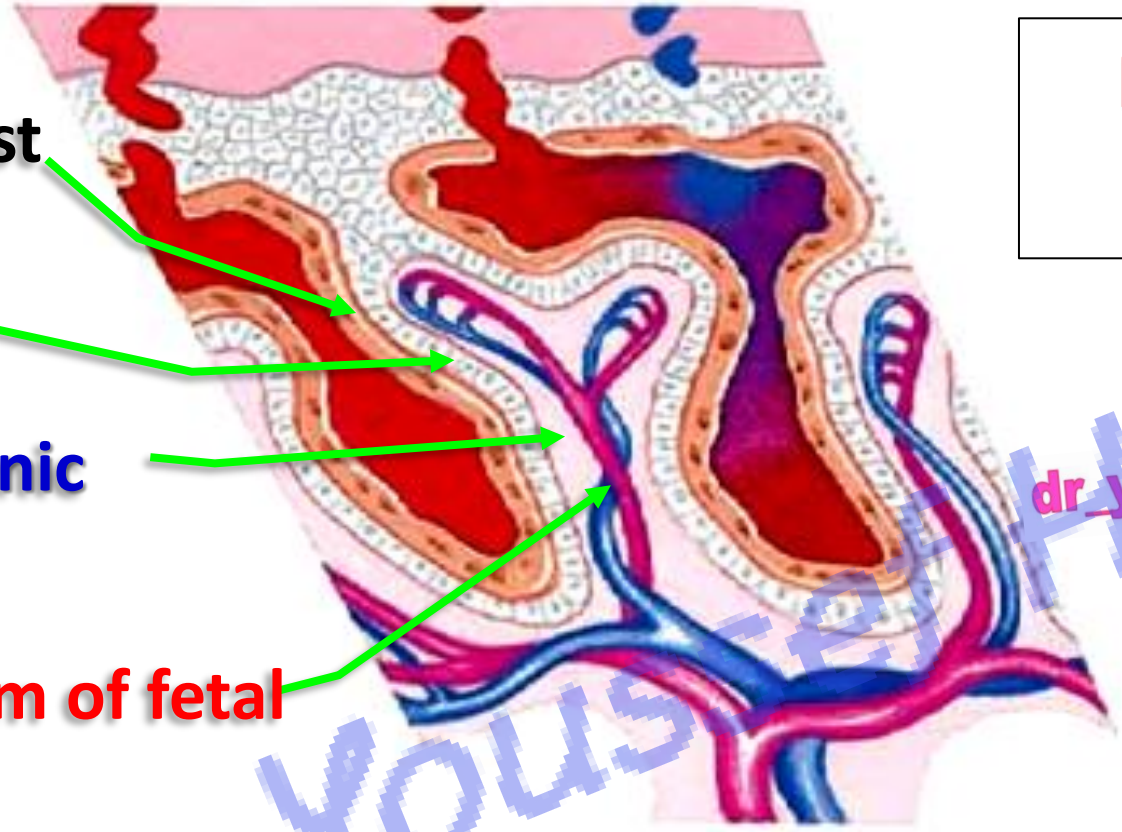
Placental barrier

Placental barrier (Membrane)



1- Syncytiotrophoblast

2- Cytotrophoblast

3- Extraembryonic mesoderm

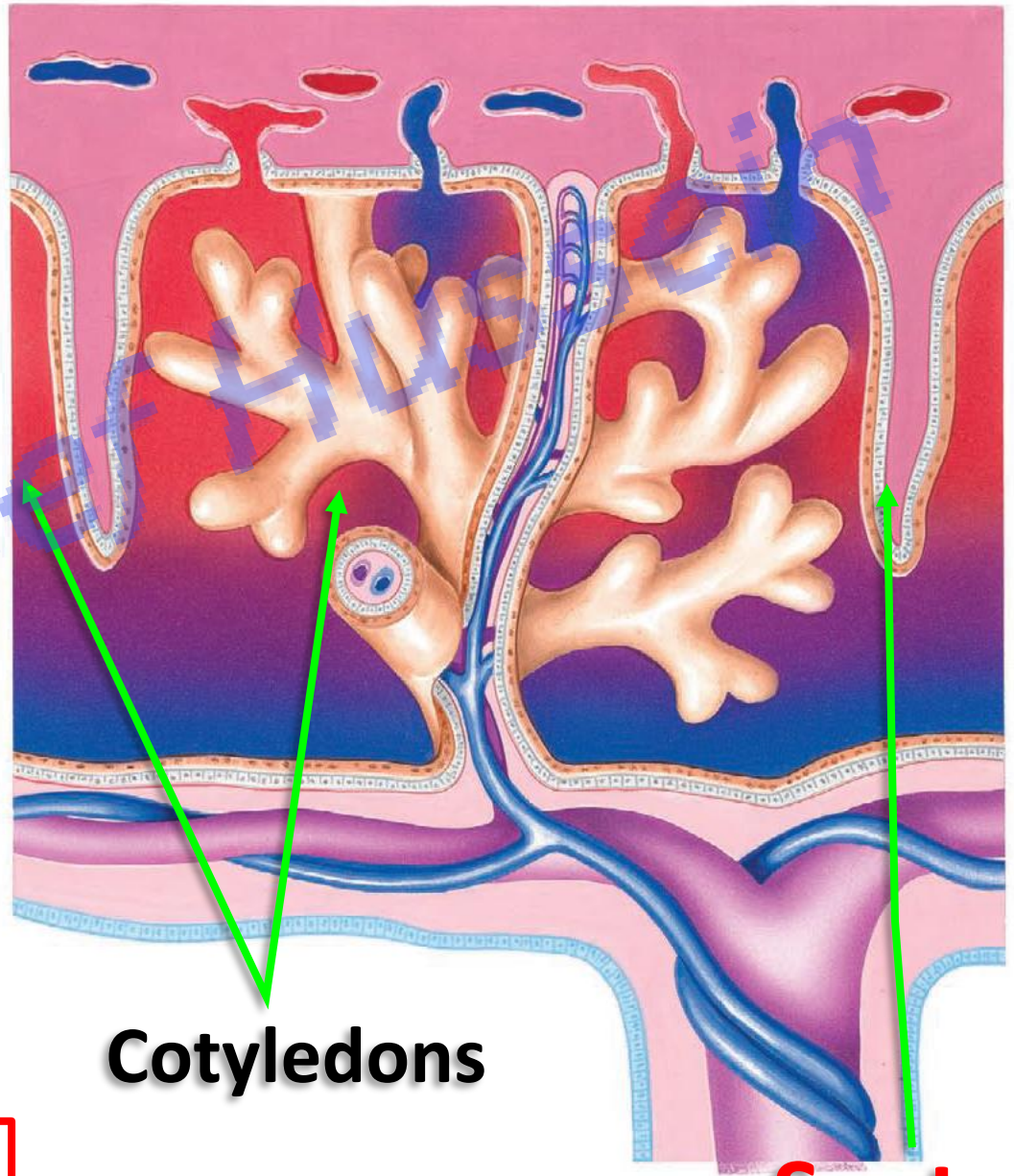
4- Endothelium of fetal blood vessels

- 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.

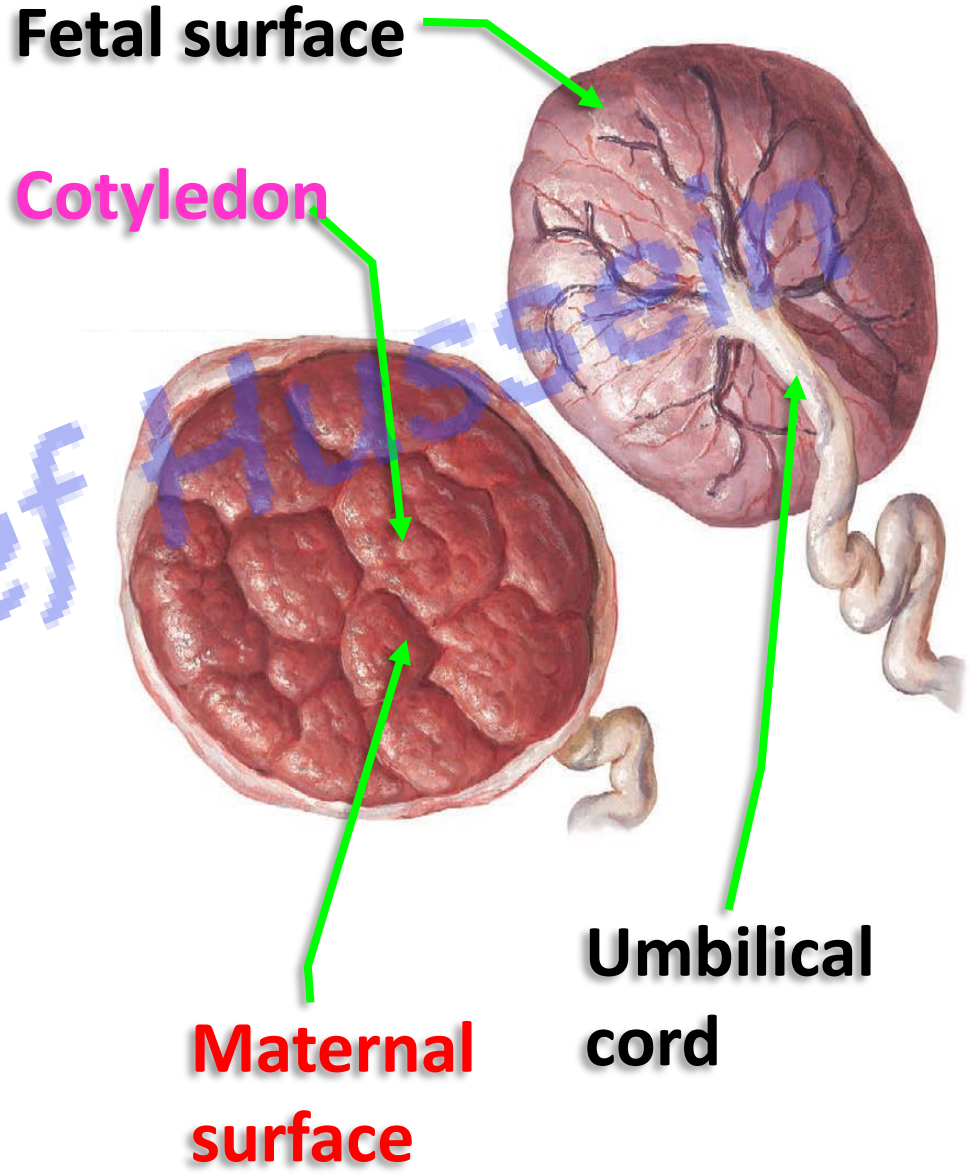


Morphology (Gross features)

- **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**

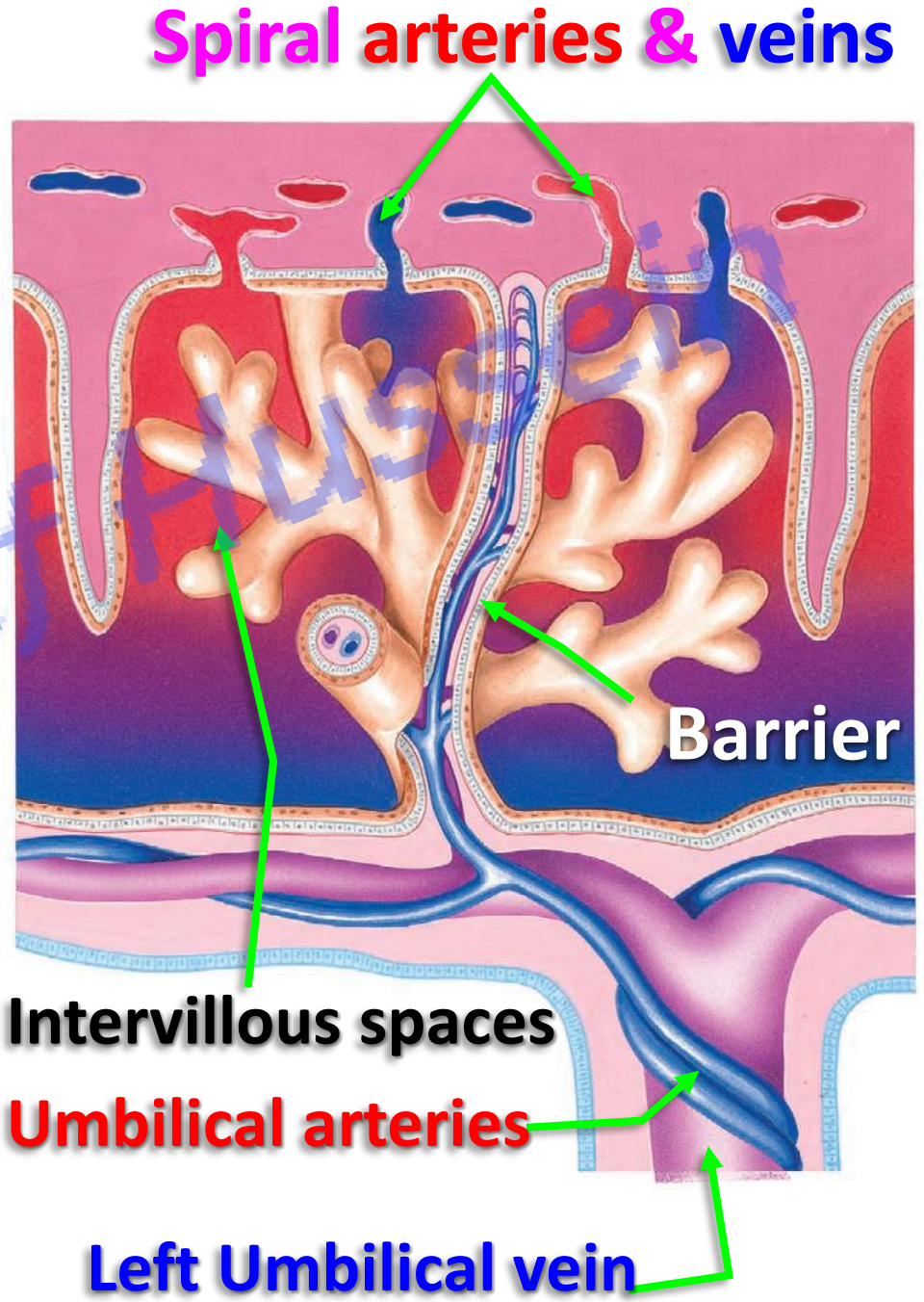
A- maternal: Rough. It is segmented into 15-20 lobes (cotyledons). الفلقات

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**.



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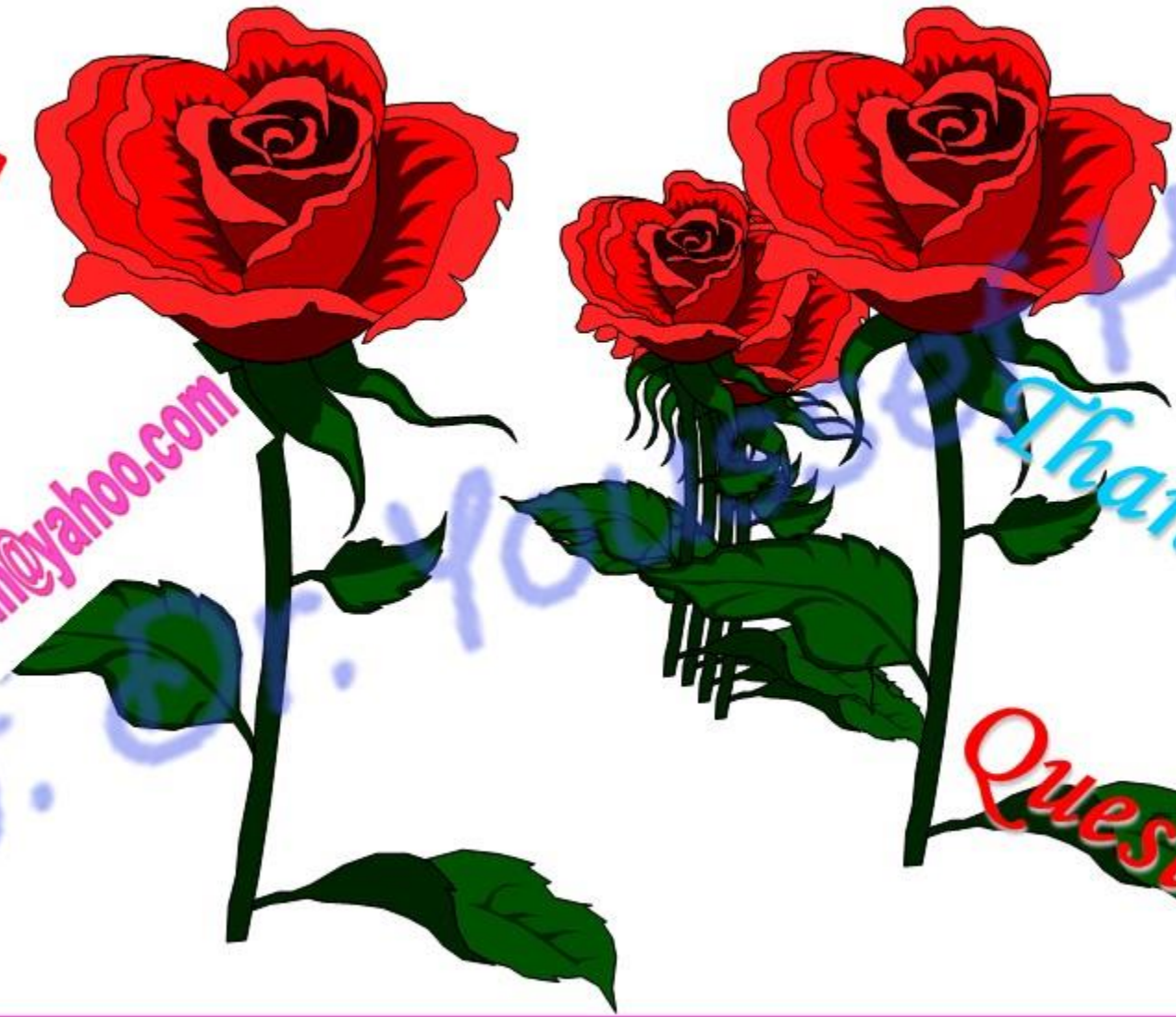

Thank you

Questions

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