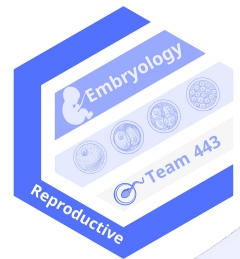


Placenta



Objectives



- No objectives were found in male and female slides -

This lecture was presented by : **DR.Khaleel Alyahya** & **DR.Tahani Al Matrafi**



[Ninja nerd, a little bit detailed but very helpful!](#)



[Video Board](#) , [Notes](#)



[Osmosis video](#)

Editing File

Color index :

Main text (black)

Female Slides (Pink)

Male Slides (Blue)

Important (Red)

Dr's note (Green)

Extra Info (Grey)



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Introduction

It is a fetomaternal structure.

Formed by the beginning of the **4th month**/it is fully formed by the **12th week**. (dr khaleel said: i corrected the 4th month information because i couldn't find a strong evidence to support it, but anyway you won't be asked about it)

The placenta is a vital connecting organ between the maternal uterus and the fetus.

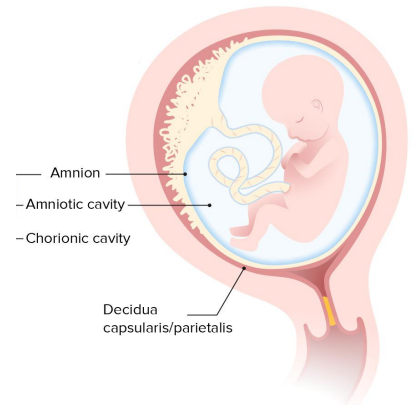
It is the primary site for exchange of gases and nutrients between mother and fetus (**Transporting System**).

Full term placenta :

- Discoid in shape.
- Weighs (500 – 600)g.
- Diameter 15-25 cm.
- Thickness 2-3 cm.
- Umbilical cord is attached to the center.

It has two surfaces:

- Fetal
- Maternal



The placenta ensures fetus get necessary food and oxygen during pregnancy.

male slides

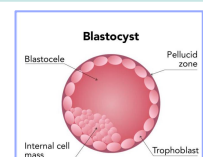
Formation of the placenta:

Pre-implantation

Implantation

Post-implantation

- The placenta begins during implantation of the blastocyst
- The blastocyst contains two distinct differentiated embryonic cell types:
 1. the outer trophoblast cells: the trophoblast cells form the placenta.
 2. the inner cell mass: the inner cell mass forms the fetus and fetal

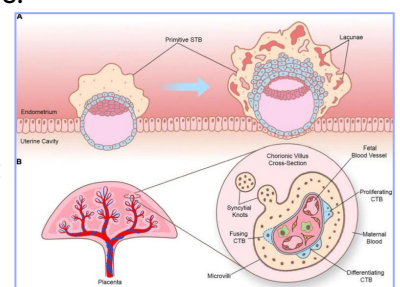


Pre-implantation

Implantation

Post-implantation

- On the 6th day, the trophoblast cells interact with the endometrial decidual epithelia to enable the invasion into the maternal uterine cells.
- The embryo then secretes proteases to allow deep invasion into the uterine stroma.
- Implantation is interstitial and normal implantation occurs on the anterior wall of the body of the uterus.
- On the 8th day of development, the trophoblast cells differentiate into:
 1. the outer multinucleated syncytiotrophoblast, which erodes maternal tissues by sending out projections.
 2. the inner mononucleated cytotrophoblast, which is actively proliferating.





Placenta

male slides

Pre-implantation

Implantation

Post-implantation

- The **syncytiotrophoblast** is responsible for producing hormones such as **Human Chorionic Gonadotropin (hCG)** by the second week, which is used in pregnancy testing.

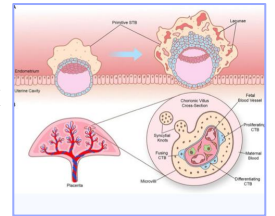
male slides

Pre-implantation

Implantation

Post-implantation

- On 9th day, lacunae or spaces is formed within th syncytiotrophoblast.
- The syncytiotrophoblast also erodes maternal tissues allowing maternal blood from uterine spiral arteries to enter the lacunar network.
- Then the early uteroplacental circulation is established by the end of week 2.
- The cytotrophoblast begins to form primary chorionic villi (finger-like projections) which penetrate and expand into the surrounding syncytiotrophoblast.



Fetal Part

Villous Chorion

- It is the bushy area at the embryonic pole.
- Its villi are more in number, enlarged and branch profusely.

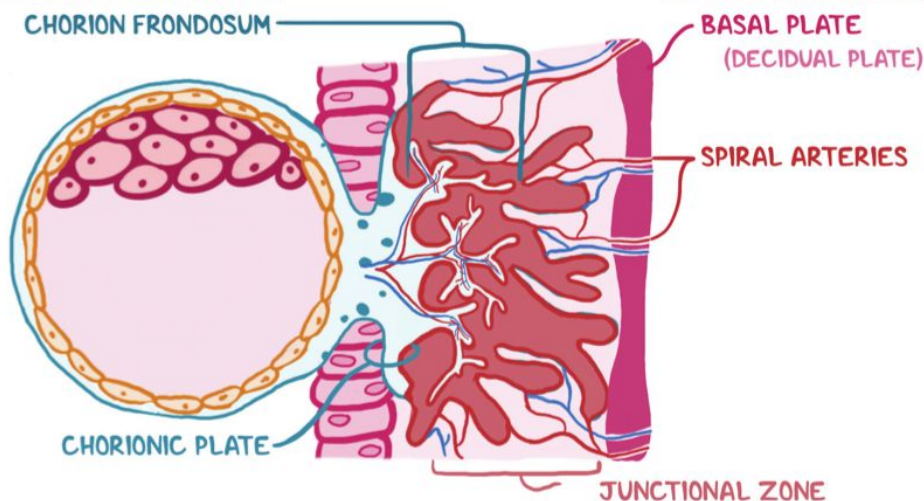
Maternal Part

Decidua Basalis

- Decidua (Gravid Endometrium) : It is the functional layer of the endometrium during pregnancy which is shed after parturition (Childbirth).

FETAL CONTRIBUTION

MATERNAL CONTRIBUTION

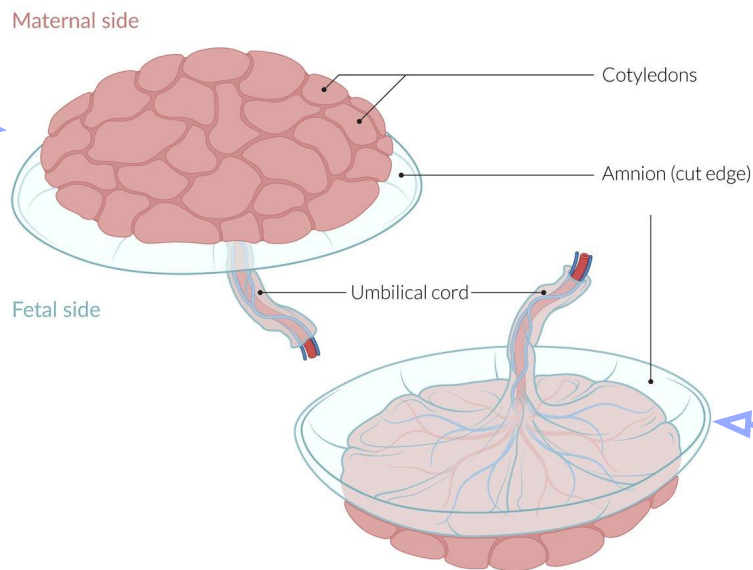




Placenta

Maternal Surface

- Rough & Formed of (15 –20) **irregular convex areas (Cotyledons)** which are separated by grooves (placental septa).
- Each cotyledon is covered by a thin layer of **decidua basalis**



Fetal Surface

- **Smooth because it is covered with the amnion.**
- **The umbilical cord is attached to its center**
- The chorionic vessels are radiating from the umbilical cord

Internally

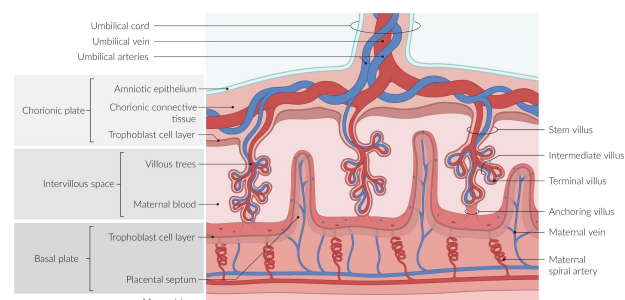
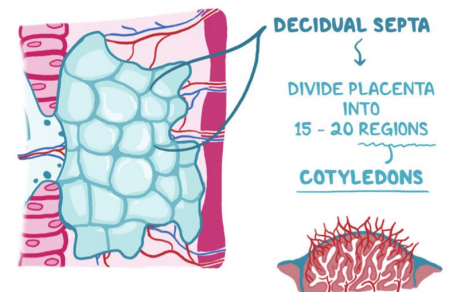
Structure of a Cotyledon :

- It consists of two or more stem villi with their many branch villi.
- It receives (80-100) maternal spiral arteries (have high pressure) that enter the intervillous spaces at regular intervals

Intervillous Space :

- Large blood filled spaces which are freely communicating.
- They receive spiral arteries from the lacunae in the syncytiotrophoblast.
- The spaces are drained through endometrial veins.
- Both arteries and veins pass through pores in the cytotrophoblastic shell.

4TH + 5TH MONTHS





Placental Circulation

Fetal placental circulation

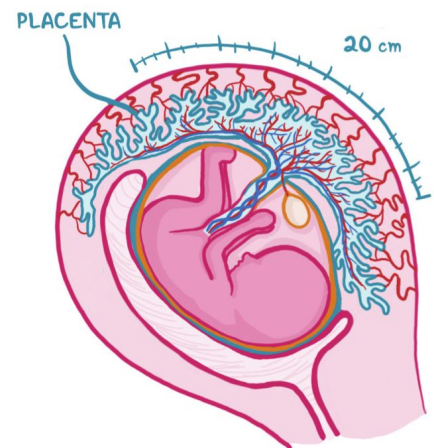
- Two Umbilical Arteries: Carry poorly oxygenated blood from the fetus to the placenta. Within the branch chorionic villi, they form :

Arterio-capillary venous network

1. it brings the fetal blood extremely close to the maternal blood.
2. The well oxygenated fetal blood in the capillaries passes into veins accompanying the chorionic arteries.

At the umbilical cord, they form the One Umbilical Vein.

That will go to the fetal circulation !



Maternal placental circulation

- 80 –100 spiral endometrial arteries discharge into the intervillous space.

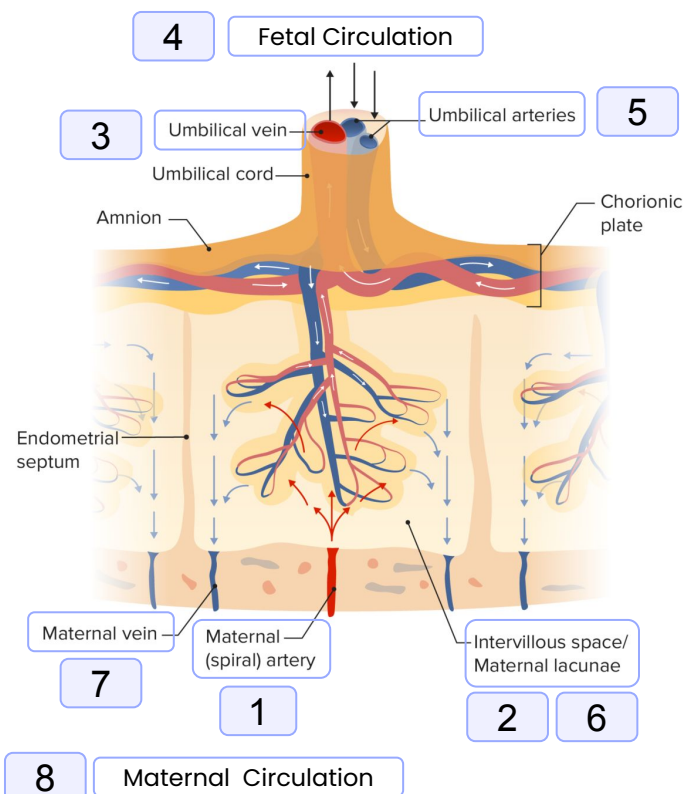
- The blood is propelled in jet like fountains (مثل النافورة) by the maternal blood pressure.

- The pressure of this entering blood is higher than that in the intervillous space.
- It forms a roof of the space.

- As the pressure **decreases/dissipates** يتبدد (when it goes through the umbilical vein), the blood flows slowly around the branch villi.

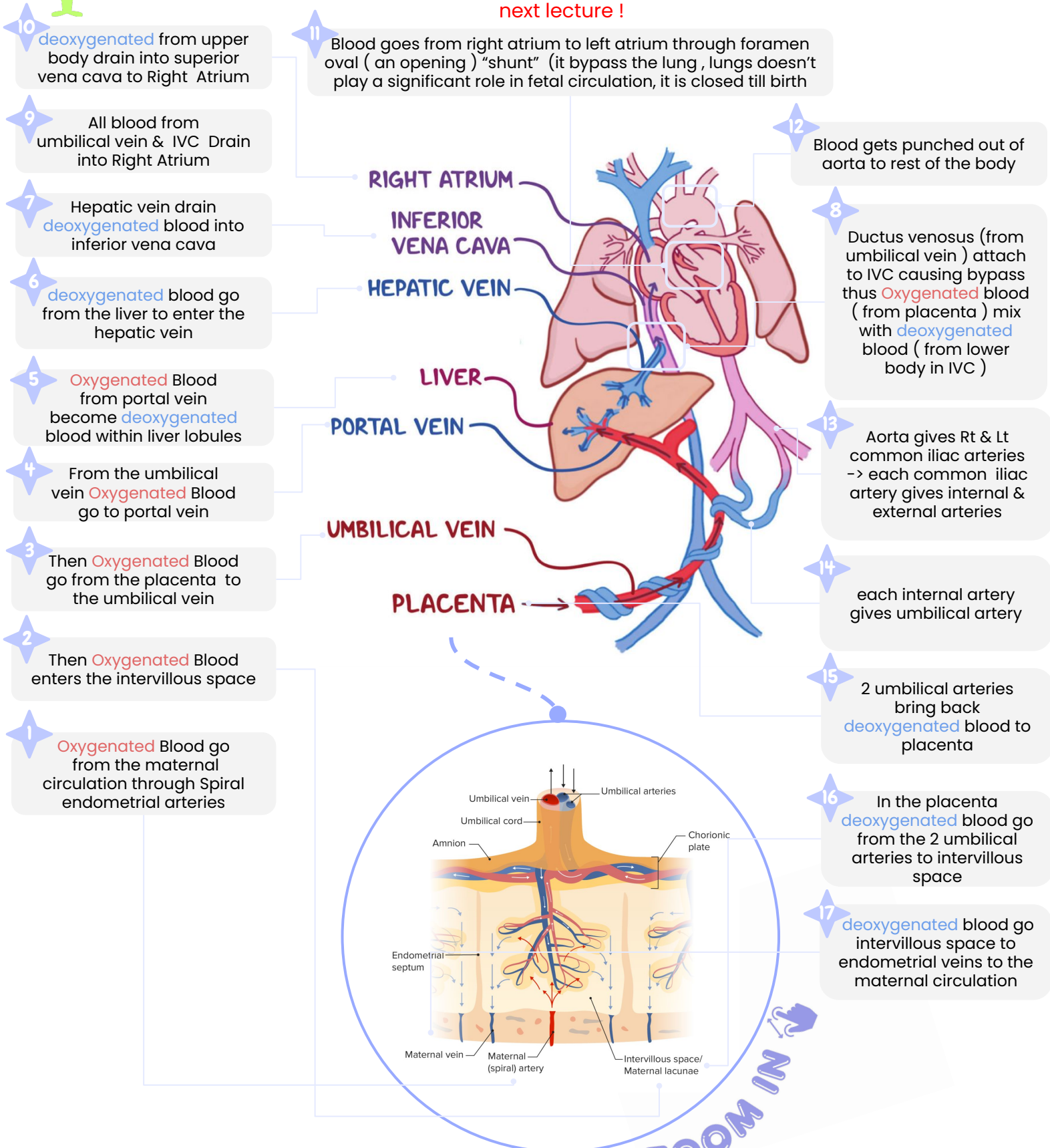
- Exchange of metabolites and gases with the fetal blood.

- As the pressure decreases, the blood flows back from the chorionic plate and enter the endometrial veins to the maternal circulation.



Fetal & Placental Circulation

Pathology Alien : Here is a diagram combining both placental & fetal circulation to get the bigger picture , **we highly recommend you read it so you get a very good understanding of the next lecture !**



- 10 deoxygenated from upper body drain into superior vena cava to Right Atrium
- 9 All blood from umbilical vein & IVC Drain into Right Atrium
- 7 Hepatic vein drain deoxygenated blood into inferior vena cava
- 6 deoxygenated blood go from the liver to enter the hepatic vein
- 5 Oxygenated Blood from portal vein become deoxygenated blood within liver lobules
- 4 From the umbilical vein Oxygenated Blood go to portal vein
- 3 Then Oxygenated Blood go from the placenta to the umbilical vein
- 2 Then Oxygenated Blood enters the intervillous space
- 1 Oxygenated Blood go from the maternal circulation through Spiral endometrial arteries

11 Blood goes from right atrium to left atrium through foramen oval (an opening) "shunt" (it bypass the lung , lungs doesn't play a significant role in fetal circulation, it is closed till birth

- 12 Blood gets punched out of aorta to rest of the body
- 8 Ductus venosus (from umbilical vein) attach to IVC causing bypass thus Oxygenated blood (from placenta) mix with deoxygenated blood (from lower body in IVC)
- 13 Aorta gives Rt & Lt common iliac arteries -> each common iliac artery gives internal & external arteries
- 14 each internal artery gives umbilical artery
- 15 2 umbilical arteries bring back deoxygenated blood to placenta
- 16 In the placenta deoxygenated blood go from the 2 umbilical arteries to intervillous space
- 17 deoxygenated blood go intervillous space to endometrial veins to the maternal circulation

ZOOM IN



Placental Membrane

Placental Membrane It is a composition of thin membrane of extra fetal tissues which separates the fetal and maternal bloods.

20 Weeks

Up to (20) weeks, it is composed of four layers :

1. **Cytotrophoblast**
2. **Syncytiotrophoblast**
3. **Connective tissue of the villus.**
4. **Endothelium of fetal capillaries.**

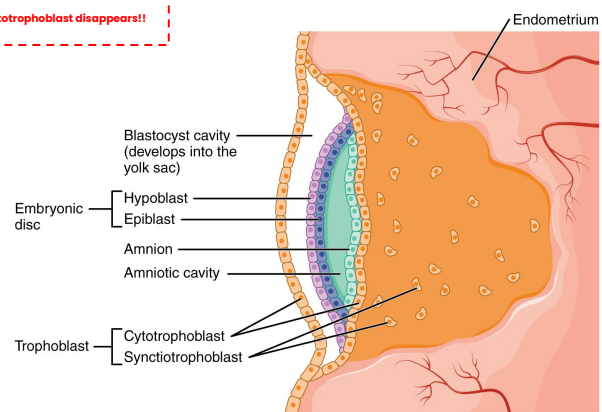
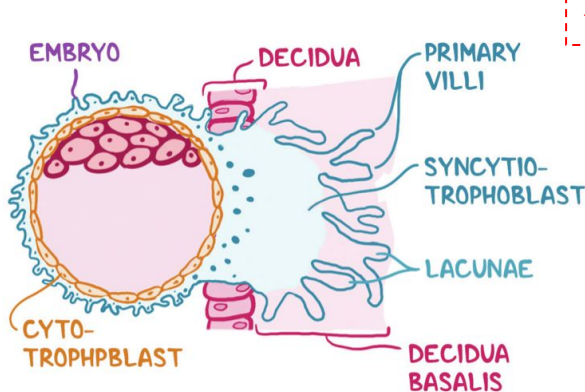
At full term

At full term it becomes thinner and composed of three layers only

1. **Syncytiotrophoblast**
2. **Connective tissue of the villus.**
3. **Endothelium of fetal capillaries.**

Vasculo syncytial

At some sites, the syncytio comes in direct contact with the endothelium of the capillaries and forms Vasculo syncytial placental membrane.



The Alien from the Pathology took a trip to Embryology just to ask you this :
What is the perfusion pressure at the placenta?

- A. Oncotic pressure
- B. Venous + Arterial pressure
- C. Osmotic pressure
- D. Arterial - venous pressure
- E. Venous - Arterial pressure

Answer: D



The Alien from the Pathology took a trip to Embryology just to ask you this :
Which structure gives rise to the placenta?

- A. Trophoblast
- B. Zona pellucidum
- C. Embryoblast
- D. Inner cell mass
- E. Corona radiata

Answer: A



The Alien from the Pathology took a trip to Embryology just to ask you this :
Which statements are true about the placenta? Select all that apply. (Hard)

- A. The umbilical cord has 1 artery and 2 veins.
- B. Maternal and fetal blood do not mix.
- C. The maternal vessels are on the bottom of the placenta.
- D. The amnion is the outer layer of the amniotic sac.
- E. There are chorionic villi that extend from the trophoblasts.

Answer: B,C,E



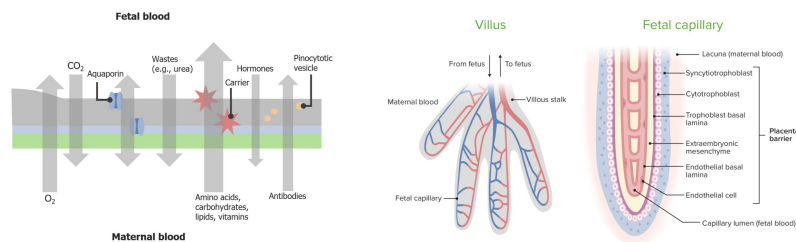
Functions of placenta

Metabolic Function

1. Synthesis of Glycogen, Cholesterol and Fatty Acids.
2. They Supply the fetus with nutrients and energy

Transportation Function

Gases	<ul style="list-style-type: none"> • Exchange of O₂, CO₂ & CO is through simple diffusion • The fetus extract (20-30) ml of O₂/minutes from the maternal blood
Maternal Antibodies	<ul style="list-style-type: none"> • Maternal immunoglobulin G gives the fetus passive immunity to some infectious diseases (measles, small box) and not to others (chicken box).
Nutrients and Electrolytes	<ul style="list-style-type: none"> • Water, Amino acids, Carbohydrates, Vitamins and Free Fatty Acids are rapidly transferred to the fetus.
Drugs and Drug metabolites	<ul style="list-style-type: none"> • They cross the placenta by simple diffusion. • They can affect the fetus directly or indirectly by interfering with placental metabolism.
Hormones	<ul style="list-style-type: none"> • Protein hormones do not reach the embryo in sufficient amounts. • Some of these hormones (Thyroxine promotes the development of CNS & Testosterone which may cause masculinization of a female fetus) can cross the placental membrane.
Waste products	<ul style="list-style-type: none"> • Urea and uric acid pass through the placental membrane by simple diffusion.



Endocrine Synthesis

Progesterone	<ul style="list-style-type: none"> • Maintains pregnancy if the corpus luteum is not functioning well.
Estrogen	<ul style="list-style-type: none"> • Stimulates uterine growth and development of the mammary glands.
hCS Or Hpl	<ul style="list-style-type: none"> • Human placental lactogen (human chorionic somatomammotropin) a growth hormone that gives the fetus the priority on maternal blood glucose. • It promotes breast development for milk production.
hCG	<ul style="list-style-type: none"> • Human chorionic gonadotropin maintains the corpus luteum and used as indicator of pregnancy.



Anomalies Of Placenta



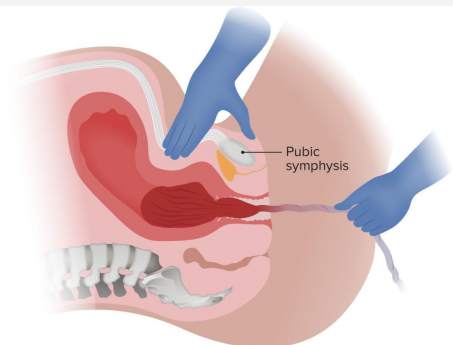
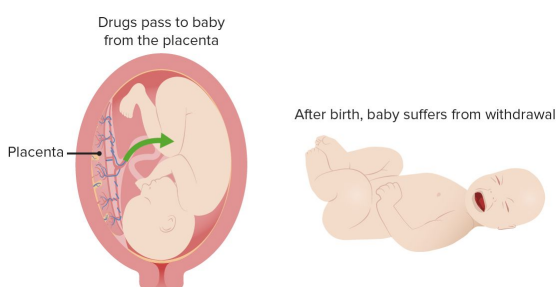
	Placenta Accreta	Placenta Percreta	Placenta Previa
Definition	Abnormal absence of chorionic villi with partial or complete absence of the decidua basalis.	Chorionic villi penetrate the myometrium to the perimetrium	The blastocyst is implanted close to or overlying the internal uterine os.
Management	In the case of extensive placenta accreta, a C-section followed by the surgical removal of the uterus (hysterectomy) might be necessary.	Termination of pregnancy may be considered. The method for termination should be by hysterotomy with consultation regarding the need for possible hysterectomy.	Delivery is through cesarean section.
Presentation	The most common presenting sign of these two anomalies is trimester bleeding		It is associated with late pregnancy bleeding
Picture			

Drug Addiction

- Fetal drug addiction can be due to some drugs as Heroin
- All sedatives and analgesics can affect the fetus to some degree.
- Drugs used for management of labor can cause respiratory distress to the newborn.
- Heroin use could cause Neonatal abstinence syndrome (NAS) occurs when in-utero addictive substances are suddenly discontinued due to birth.

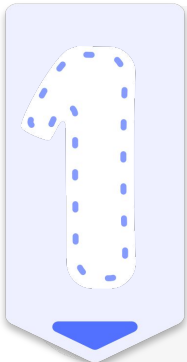
Fate of placenta

Within 15 minutes after birth of the infant, the strong uterine contractions that continue after birth compress uterine blood vessels to limit bleeding & cause the placenta to detach from the uterine wall.





MCQ



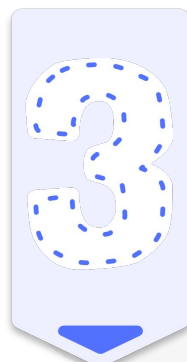
Which of the following is not present in a full term placenta?

- A** Cytotrophoblast
- B** Endothelium of fetal capillaries.
- C** Syncytiotrophoblast
- D** Connective tissue of the villus.



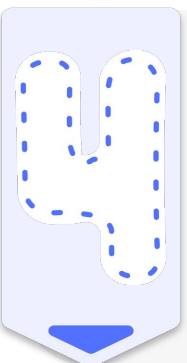
Which of the following is a characteristic of maternal surface placenta?

- A** Smooth
- B** Covered by amnion
- C** Umbilical cord attached to its center
- D** Formed of Cotyledons



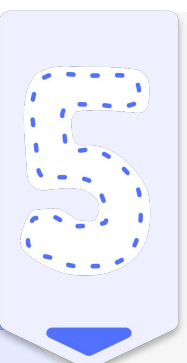
Which of the following anomalies characterized by Chorionic villi penetrate the myometrium to the perimetrium?

- A** Placenta Accreta
- B** Placenta Previa
- C** Placenta Percreta
- D** Placenta atresia



hCG is produced by?

- A** Cytotrophoblast
- B** Endothelium of fetal capillaries.
- C** Connective tissue of the villus.
- D** Syncytiotrophoblast



Which of the following is not true about the transport function of the placenta?

- A** Urea can pass through by simple diffusion
- B** Drugs can cross by simple diffusion
- C** Maternal antibodies give the fetus active immunity
- D** Exchange of CO₂&O₂ happens by simple diffusion

Embryology Team



Leader

سلطان البقمي

Leader

رهف الشويهي



أبو عويد



ريناد صالح الشهري



عبدالله الكودري



ريوف الأحمري



خالد العنزي



ريماس المحمود



فراس مازن



شادن الهزاني



زياد العتيبي



ريناد محمد الشهري



فيصل الشويعر



لمى العتيبي



ريم العمير

Special thanks and gratitude to the amazing Lama Alotaibi for this fabulous designing of the theme