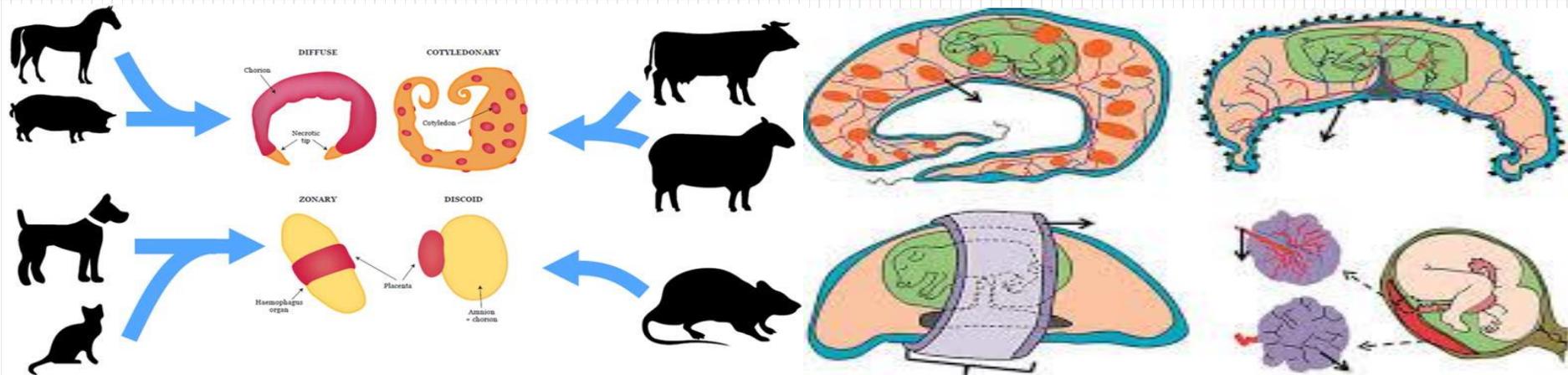


Placentation



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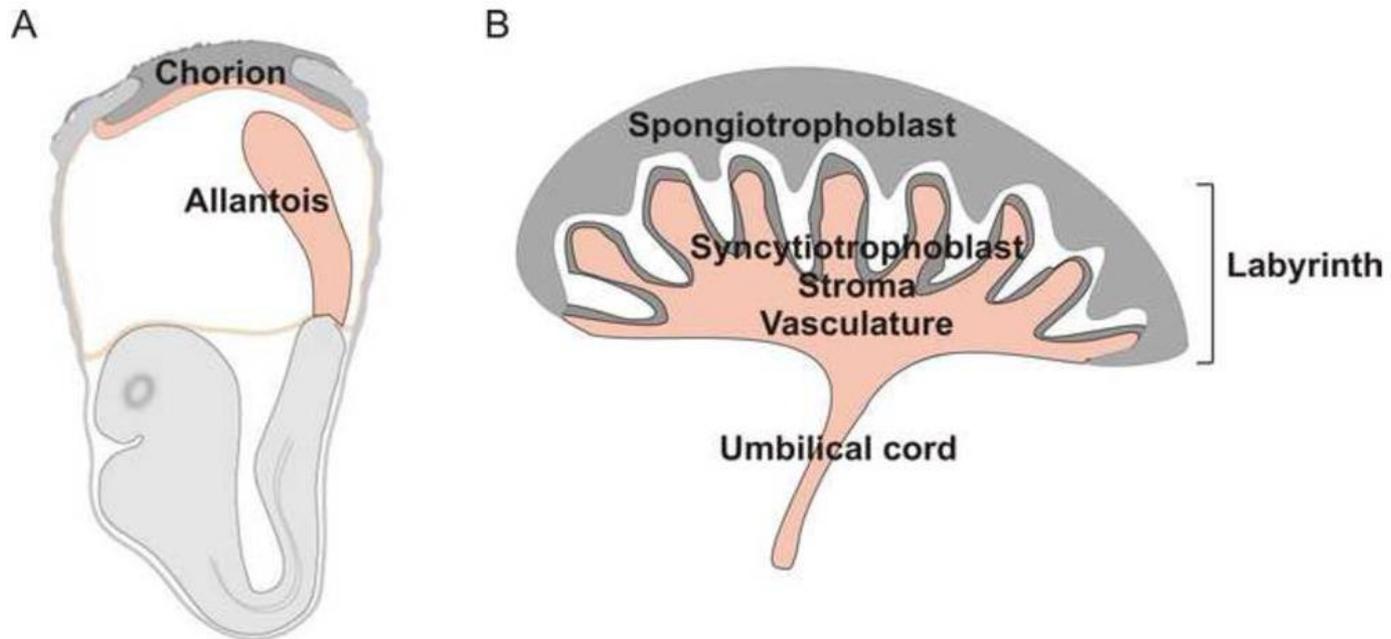
Bihar Veterinary College, BASU, Patna

- Placenta is an apposition or fusion of the fetal membranes to the endometrium to permit physiologic exchange between fetus and mother.
- Originates as a result of various degrees of fetal maternal interactions and is connected to the embryo by a cord of blood vessels.
- Size and functions of placenta changes continuously during gestation and the organ is finally expelled at the time of parturition.

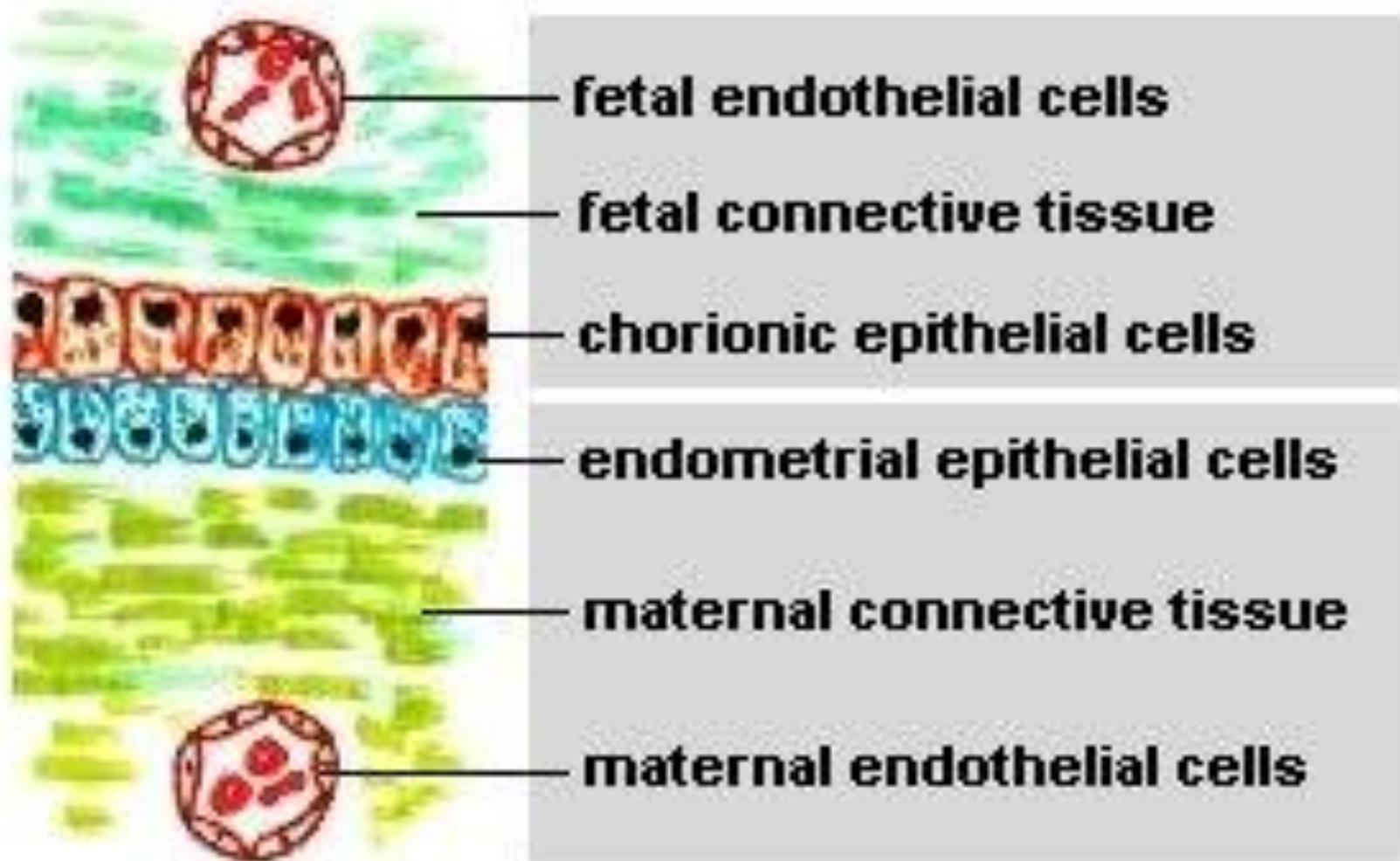
- **Decidua-** The maternal placenta
- The fetal placenta consists of chorion, allantois, amnion & vestigial yolk sac.
- **Chorion**, outermost membrane which remains in contact with maternal uterus.
- **Allantois** is a continuous layer consisting of a sac, allantoic cavity.
- **Amnion**, inner most membrane, nearest to fetus is a fluid filled cavity contains fetus.
- The allantoic cavity is called as 1st water bag while the amniotic cavity or sac is termed as 2nd water bag.
- The umbilical arteries & veins run through the CT between the allantois & chorion.

- The morphogenesis of the placenta during early gestation is closely related to the extra embryonic or fetal membranes that are differentiated into the yolk sac, amnion, allantois and chorion.
- Fetal membranes participate in the formation of the placenta, either separately or in combination and give rise to three basic types of placentation-
 1. Chorionic type
 2. Chorio-allantoic type
 3. Yolk sac type

- Chorio-allantoic placentation is characteristic of all farm animals.
- Highly increased area of feto-maternal junction, either by forming chorionic villi protruding into uterine crypts or by formation of chorionic labyrinths.



- Six tissue layers that separate the maternal and fetal blood in most primitive placentas are:
 - 1. Uterine vascular endothelium
 - 2. Uterine stroma/ Connective tissue.
 - 3. Uterine epithelium
 - 4. Fetal trophoblast (Allanto-chorionic epithelium)
 - 5. Fetal stroma/ Connective Tissue
 - 6. Fetal capillary endothelium



fetal endothelial cells

fetal connective tissue

chorionic epithelial cells

endometrial epithelial cells

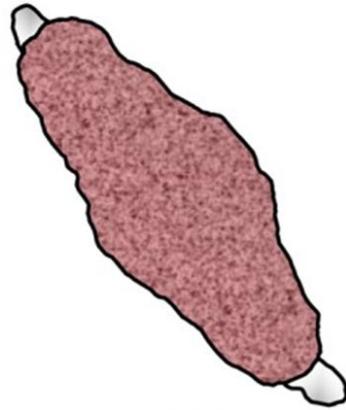
maternal connective tissue

maternal endothelial cells

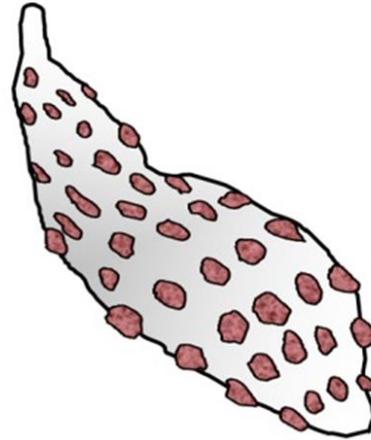
According to morphology, microscopic characteristics of the maternal-fetal barrier and loss of maternal tissues at birth.

S.no.	Placenta class	Shape of Attachment	Species	Layers	Maternal-fetal barrier
1.	Epitheliochorial	Diffused	Pig, Horse & Donkey	6	Epitheliochorial
2.	Syndesmochorial	Cotyledonary	Sheep & goat	5	Syndesmochorial
3.	Endotheliochorial	Zonary or discoid	Dog, Cat & ferret	4	Endotheliochorial
4.	Hemochorial	Zonary or discoid	Primates (Monkey)	3	Hemochorial
5.	Hemoendothelial	Discoid or spheroidal	Rat, Rabbit & guinea Pig	1	Endothelium of fetal blood vessels

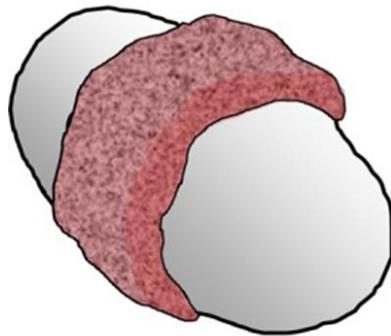
Based on placental shape and contact points



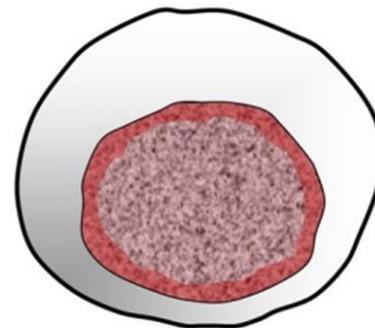
a. Diffuse



b. Multicotyledonary



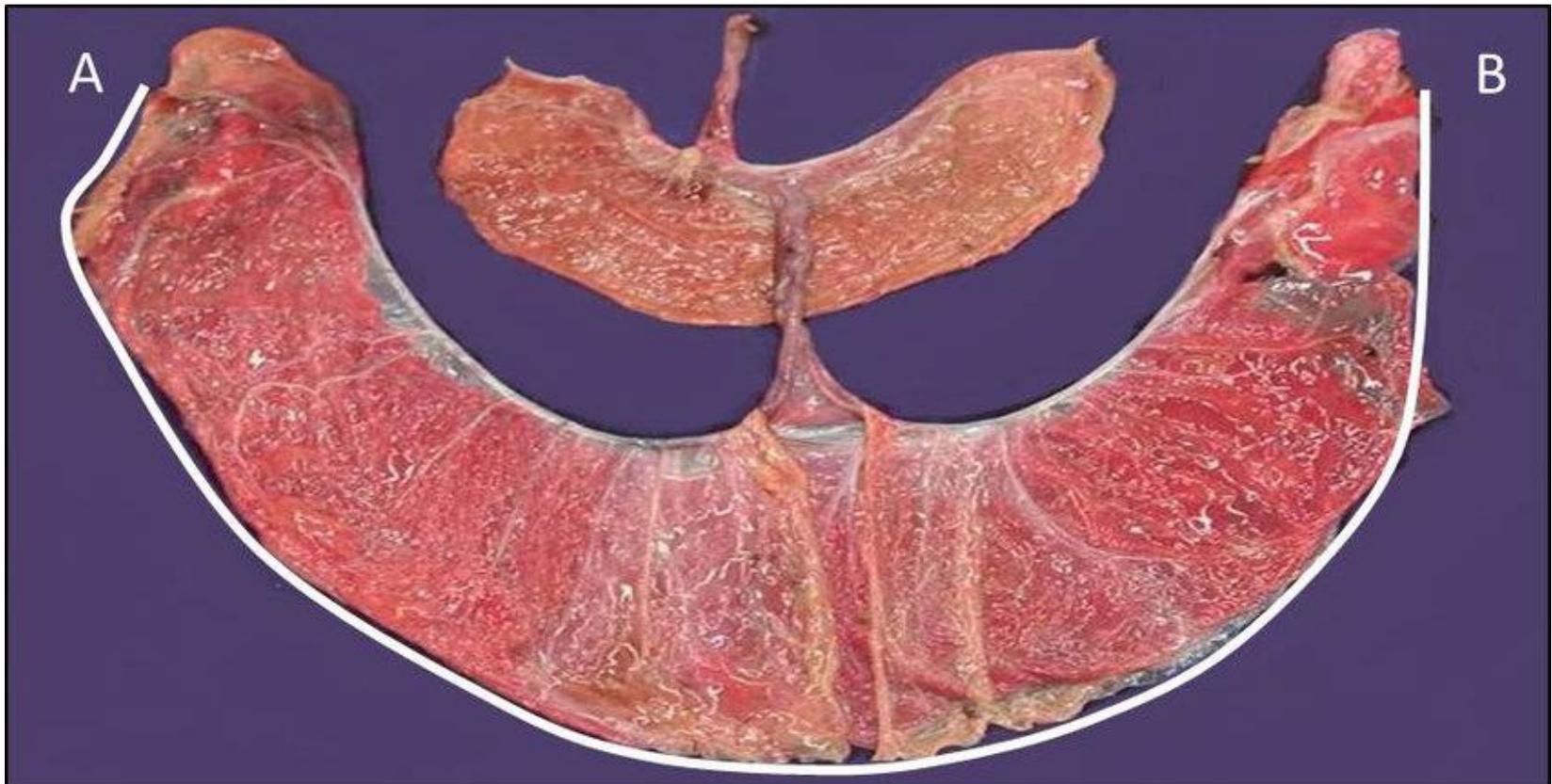
c. Zonary



d. Discoid

1. Diffuse:

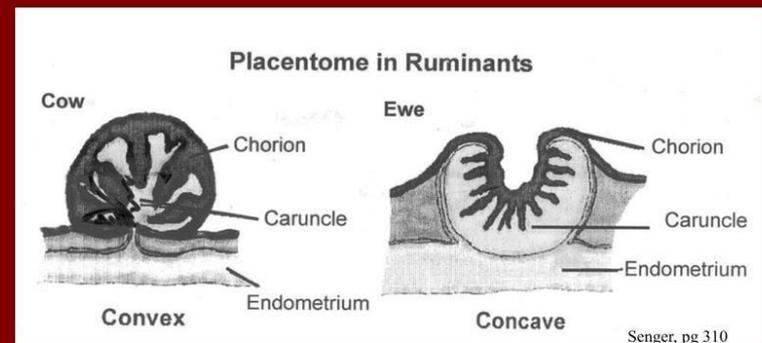
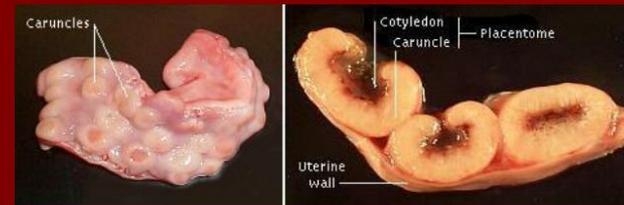
- Almost the entire surface of the allanto-chorion is involved in formation of the placenta.
- Present in horses and pigs.



2. Cotyledonary:

- Multiple, discrete areas of attachment called cotyledons are formed by interaction of patches of allantochorion with endometrium.
- Fetal portions are called **cotyledons**, the maternal contact sites (**caruncles**), and the cotyledon-caruncle complex a **placentome**.
- Present in ruminants.

Cotyledonary Placenta



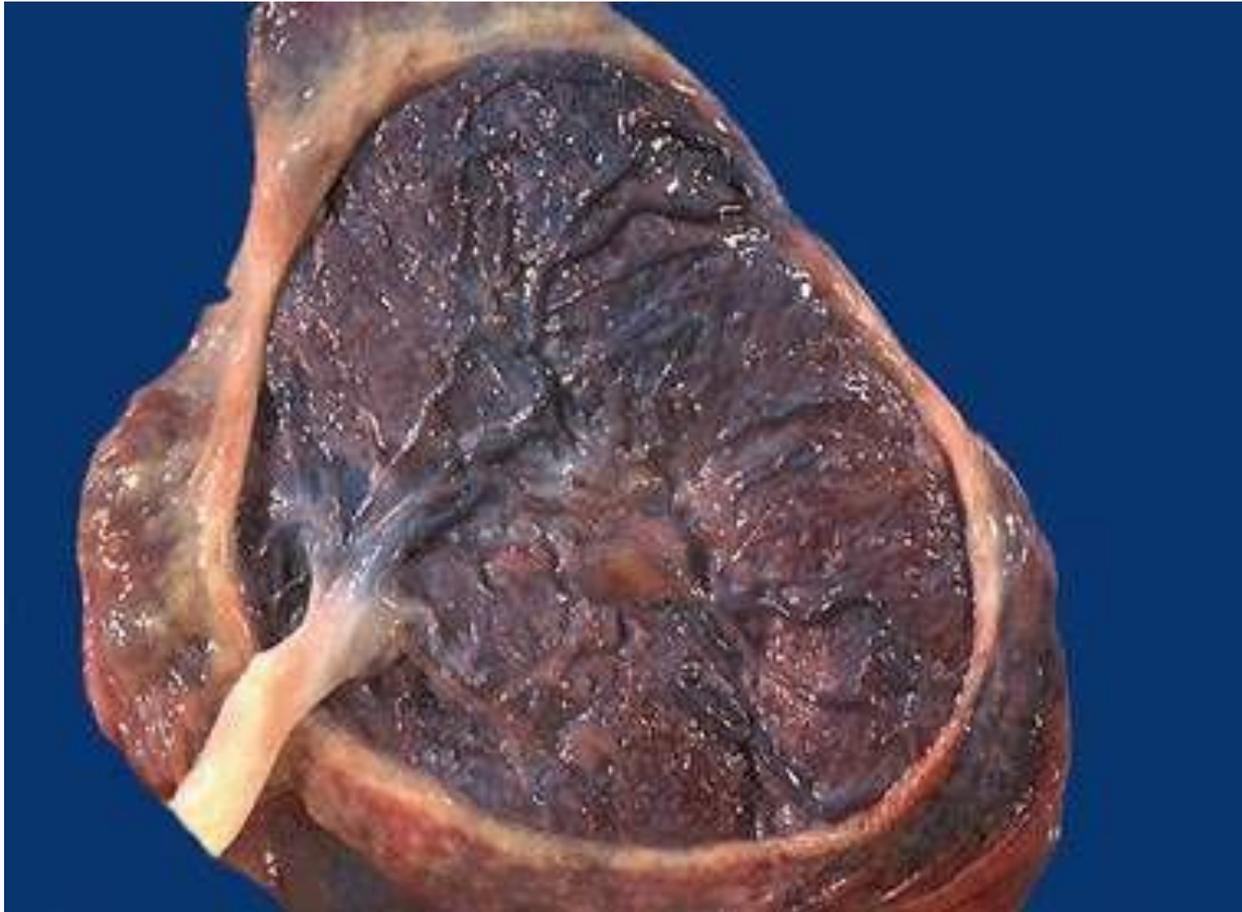
3. Zonary:

- The placenta takes the form of a complete or incomplete band of tissue surrounding the fetus.
- Present in dogs and cats, seals, bears, and elephants.



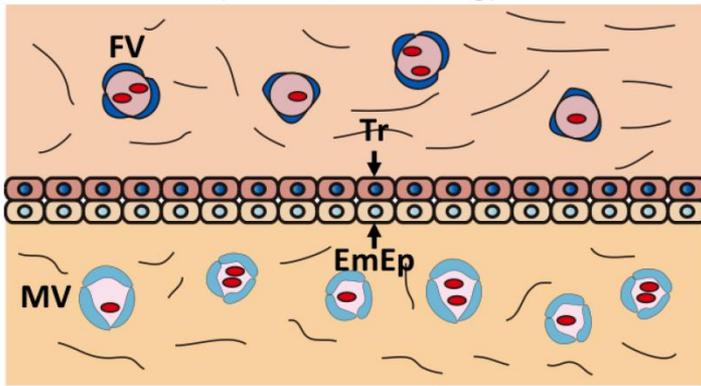
4. Discoid:

- A single placenta is formed and is discoid in shape.
- Present in primates and rodents.



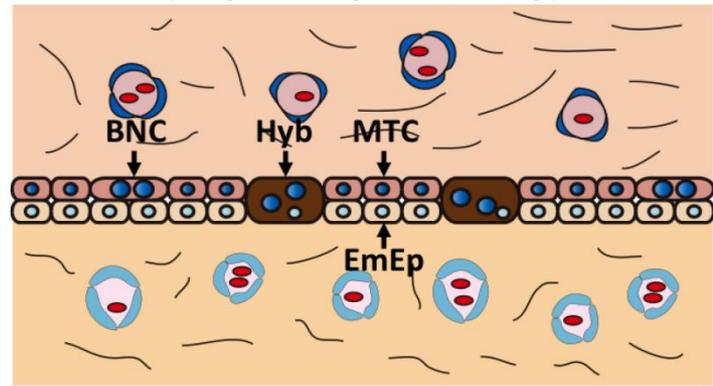
Epitheliochorial

(Diffuse; Horse, Pig)



Synepitheliochorial

(Cotyledonary; Cow, Sheep)

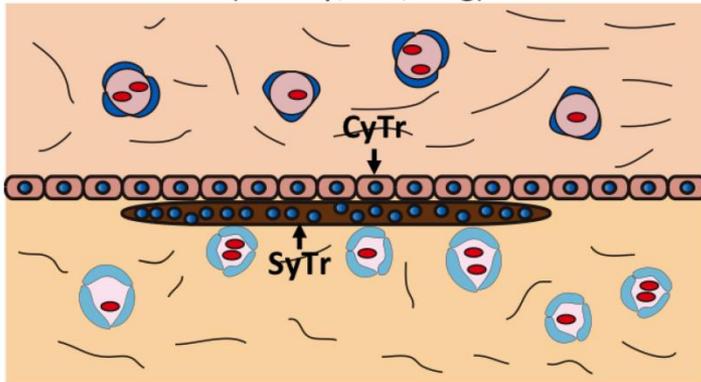


Villus

EM

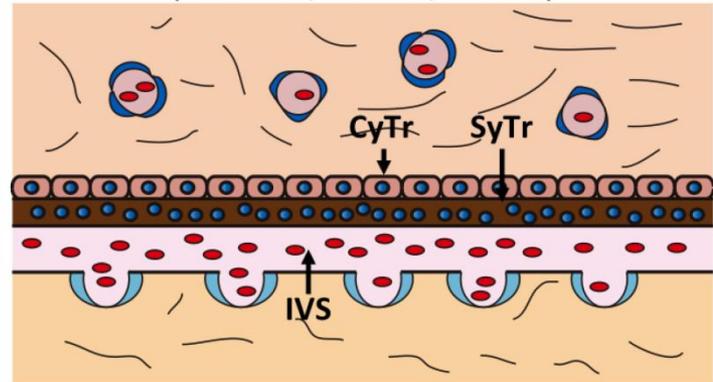
Endotheliochorial

(Zonary; Cat, Dog)



Hemochorial

(Discoidal; Human, Mouse)



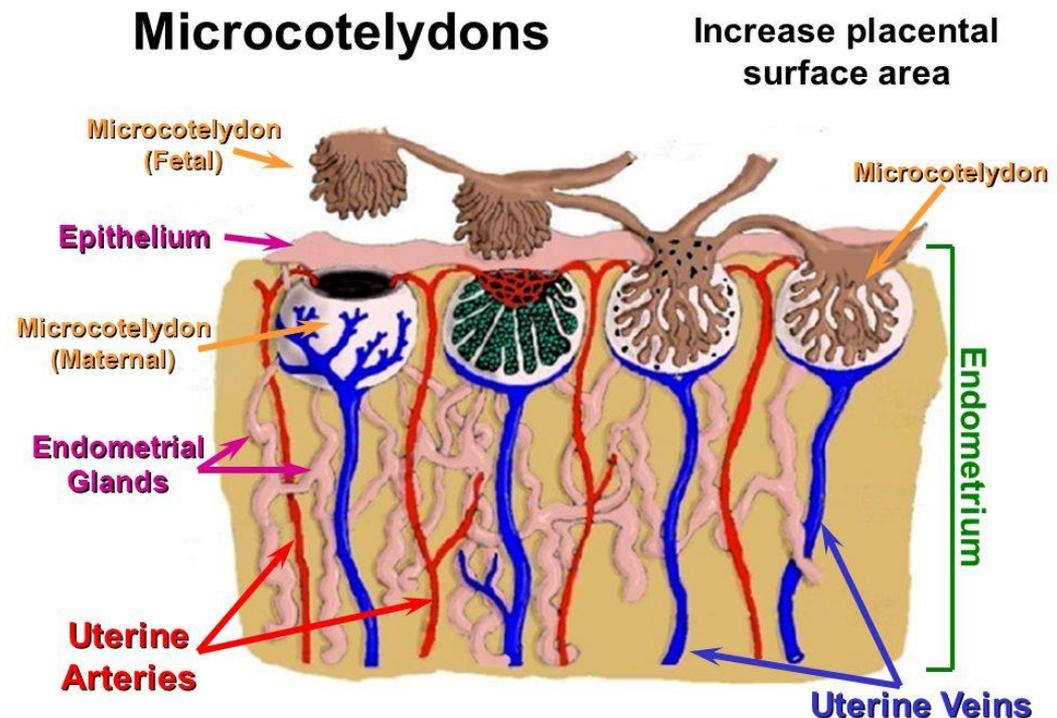
Villus

EM

Different types of placenta based on tissue layers involved

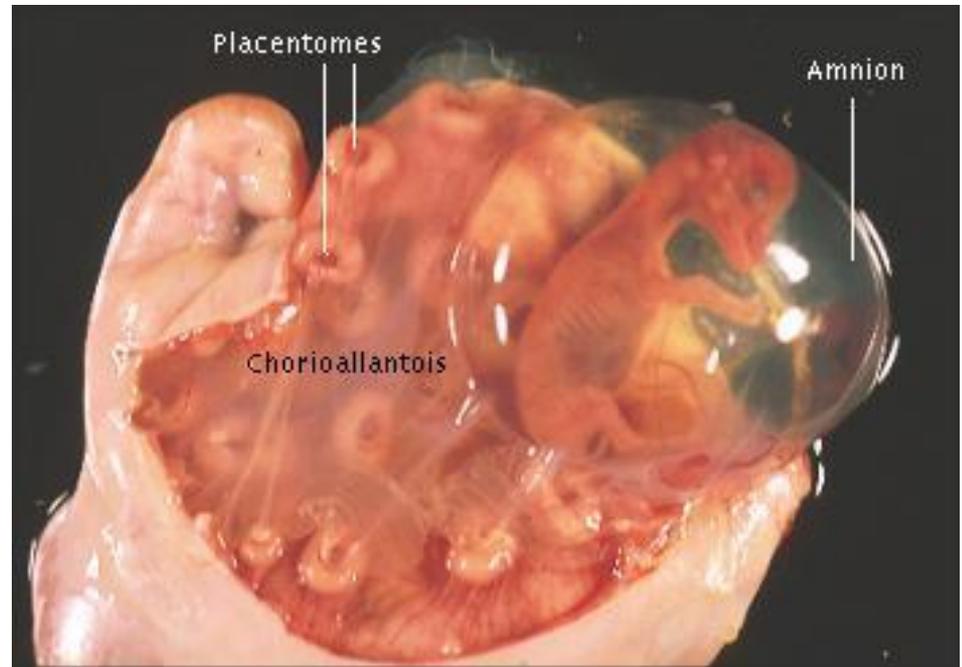
1. Epitheliochorial placenta

- ❖ Has all six layers.
- ❖ Present in **mare**.
- ❖ Characterized by development of endometrial cups.
- ❖ Cups are formed in semi circular area of uterus between the 6-20th week of gestation.



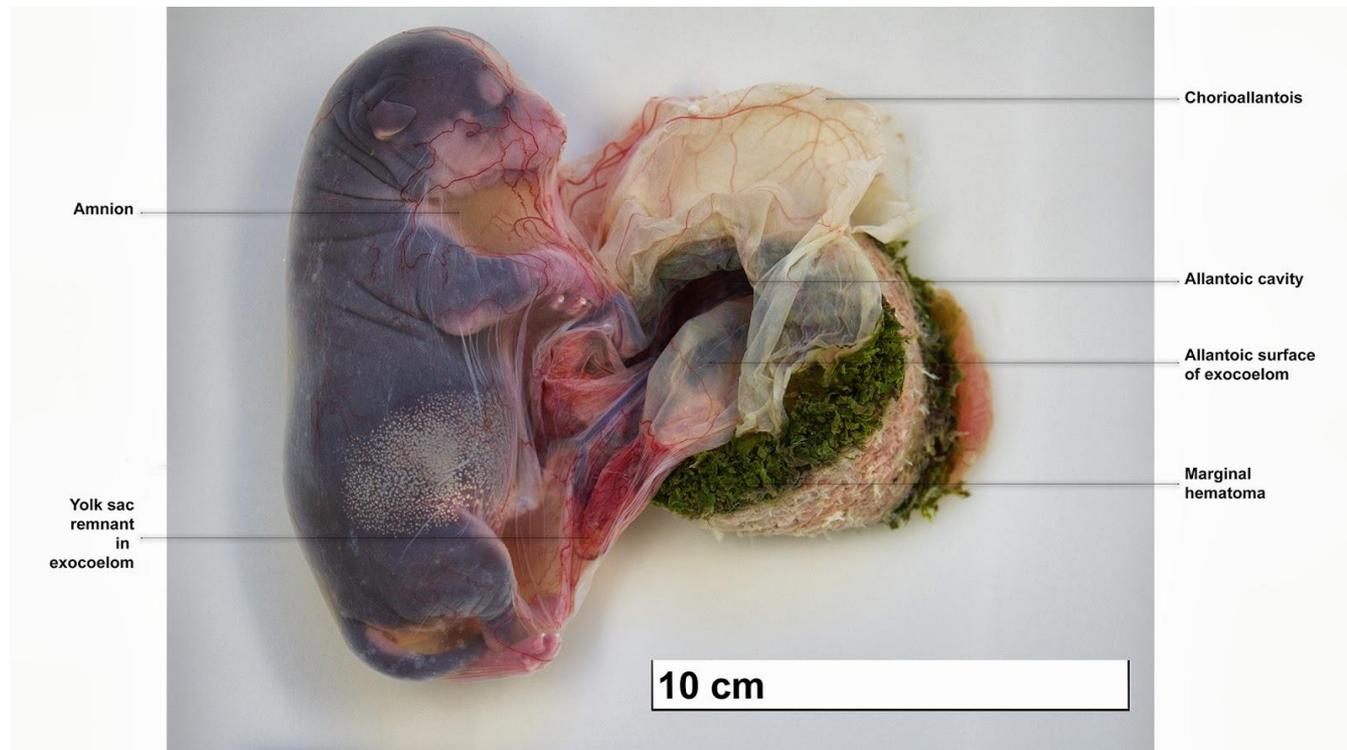
2. Syndesmochorial placenta

- The uterine epithelium disappears in restricted area due to invasive action of trophoblast.
- Only 5 tissue layers separate fetal and maternal blood, hence referred as syndesmochorial type of placenta.
- Feto-maternal structures so formed are called as **placentomes**.
- Present in **ewe & doe** (goat).



3. Endotheliochorial placenta:

- Maternal connective tissue is lost and allanto-chorionic epithelium is in apposition to the endothelium of the maternal vessels.
- Gross shape of placenta is zonary or discord, present in **dog, cat, ferret.**

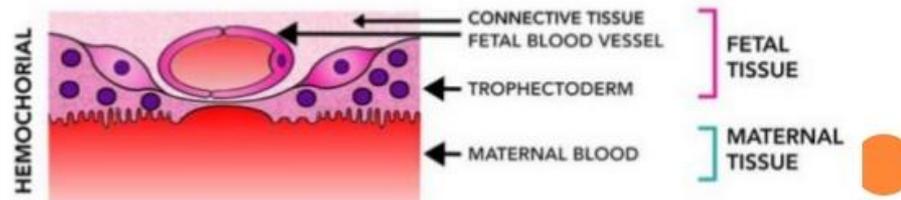


4. Hemochorial type:

- Formed in **primates**.
- results due to additional loss of maternal endothelium.
- It is most advanced & evolutionary type of placenta as the transfer of nutrients is more rapid.

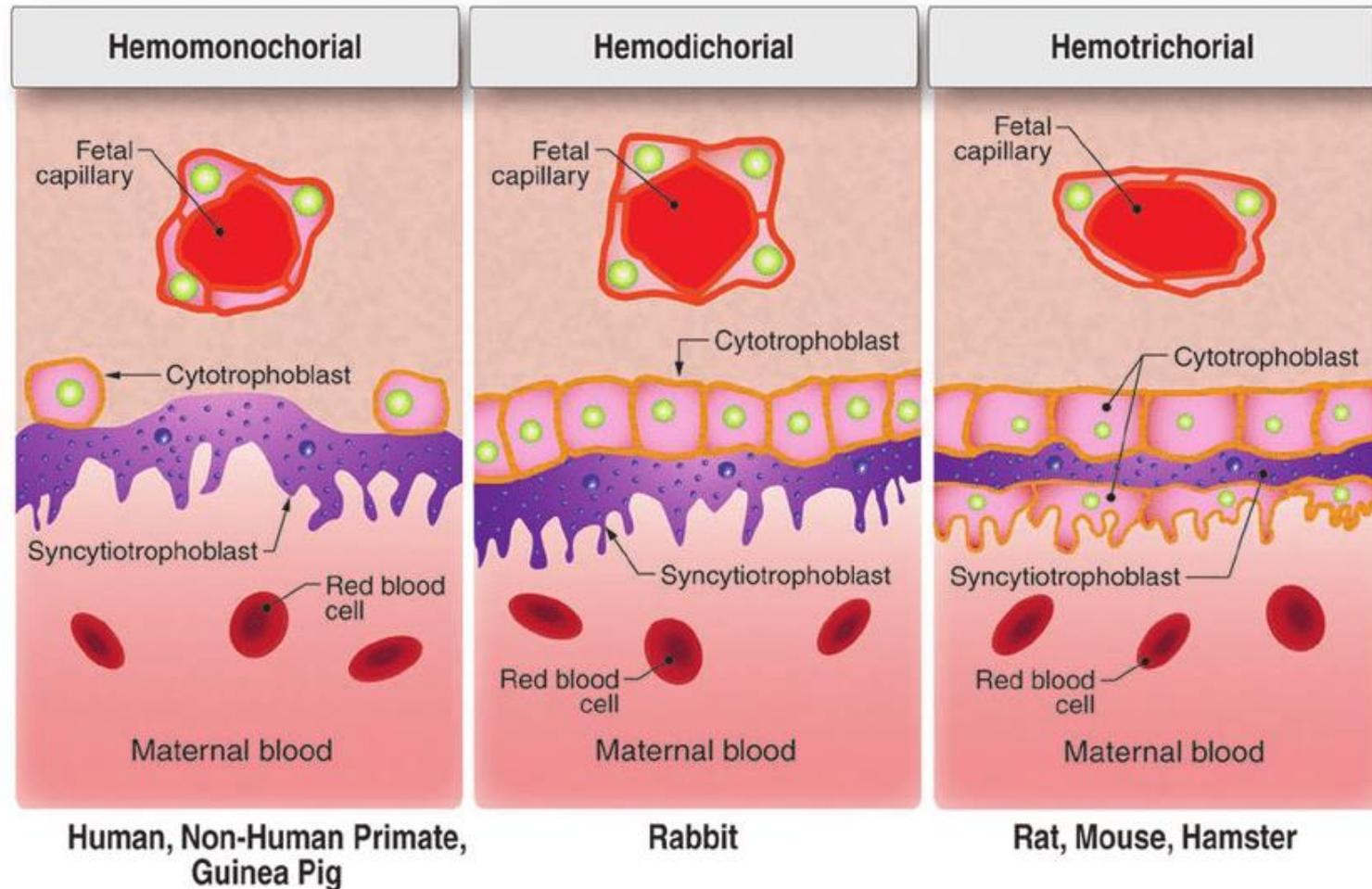
The placental connections are more intimate. The chorion of foetus will float in the blood pools of mother's uterus. Hence it is called haemochorial placenta

al Hemochorial

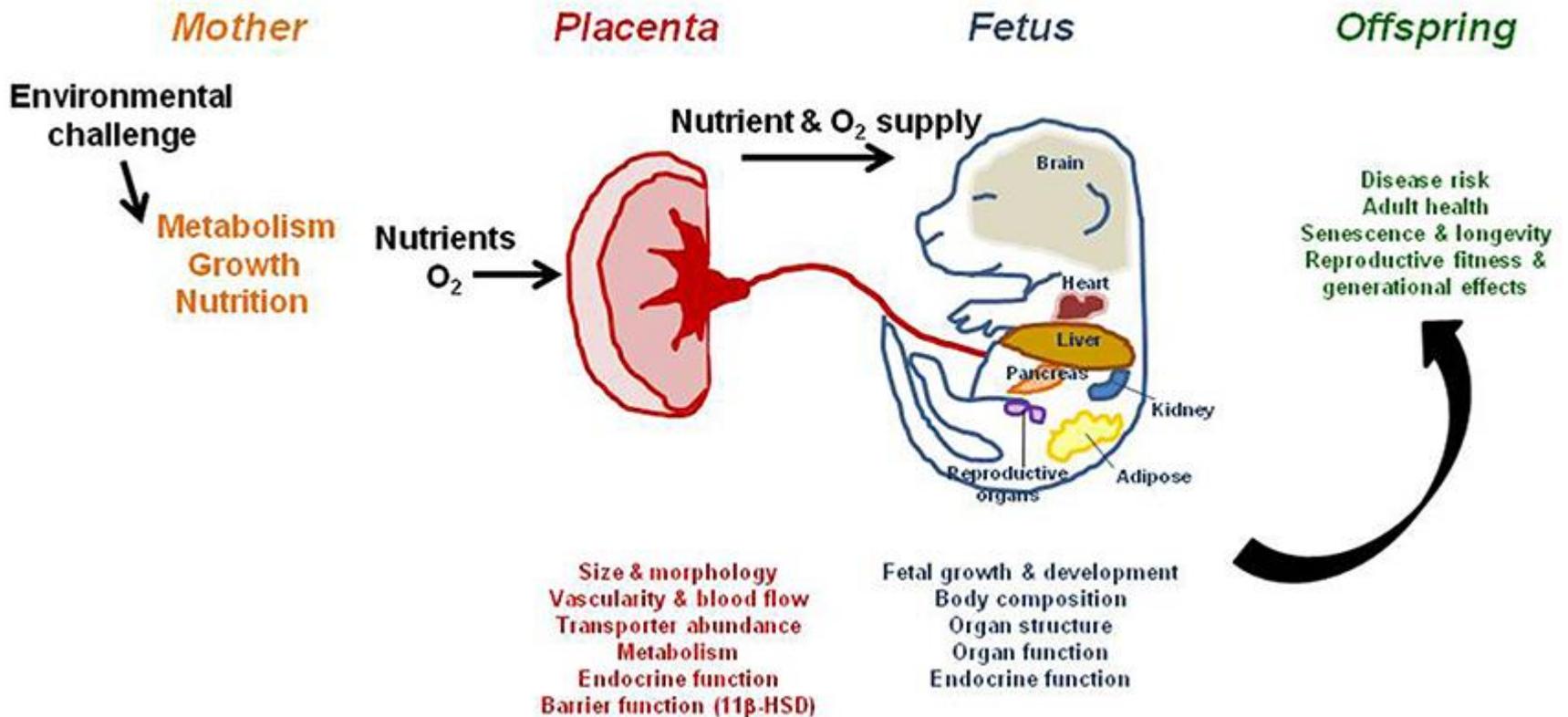


5. Hemoendothelial:

- Comprises of fetal endothelium of blood vessel only.
- Present in **rat, rabbit, guinea pig**.



Functions of Placenta



- Placenta performs many functions and substitutes for the fetal gastrointestinal tract, lung, kidney, liver and endocrine glands.
- Placenta separates the maternal and fetal organisms, thus ensuring the separate development of fetus.
- Blood of the fetus and dam never come into direct contact, yet the two circulation are close enough at the junctions of the chorion and endometrium for oxygen and nutrients to pass from maternal to fetal blood and waste products in opposite direction.

Exchange of Gases

- Many similarities exist between the gas exchange across placenta and that across lungs.
- Major difference - placenta has fluid-to-fluid exchange system, while lungs have gas to fluid system.
- Umbilical arteries carry unoxygenated blood from the fetus to the placenta, while the umbilical veins carry oxygenated blood in the reverse direction.
- Fetal blood has lower affinity for CO_2 from fetal to maternal blood.

Transport of Nutrients

- Sugars, amino acids, vitamins and minerals are transported to the fetus as substrate for fetal growth.
- Transport of nutrients is based on net flux from either dam to fetus or in opposite direction due to concentration difference or unidirectional carrier-mediated transport.
- Glucose, amino acids, electrolytes & vitamins are transported by carrier systems located in the trophoblast.
- Placenta contains large amounts of glycogen synthesized mainly from maternal glucose.

- Fructose comprises about 70 to 80 % of the sugar in fetal blood.
- Proteins as such are not transferred.
- Amino acids cross readily against a concentration gradient and are found in higher concentration in fetal than in mammalian plasma.
- Immunoglobulins are transferred in human and some animals but not in farm animals due to structural differences in placental type.