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Placenta

[Placentation in Mammals]

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In viviparous mammals, fertilized ovum (egg is small & yolkless) develops into youngones for free existence inside the uterus. They obtain its nourishment from the uterine wall. For this purpose the embryo develops connection with the maternal uterine wall which is known as Placenta. Due to presence of placenta, the mammals are also known as Placentalia.

The Placenta serves as a passage for food and oxygen from the uterine wall or mother into the embryo and liberates excretory products from the embryo to the body of the mother.

The Placenta is therefore, can be defined as an association between the foetal and maternal uterine tissue to serve the purpose of physiological exchange of materials between the foetus and mother.

Different mode of Nutrition in different groups of mammals

1. Prototheria or Monotremata

Prototherians are oviparous mammals laying large yolky and hard-shelled eggs, like those of birds.

These contains plenty of yolk which is sufficient for the developing embryo. Thus Placenta is unknown among prototherian.

The embryo which hatches out of the egg is quite immature and imbecile. It is nourished and protected in abdominal pouch of

2. Metatheria or Marsupialia

Very primitive placenta or starting of formation of placenta occurs in Metatheria. A true allantoic placenta is absent in metatheria and embryo lacks a firm association with the uterine wall.

For example, in Dasyurus, the embryo has a poorly developed allantois but possesses a large yolk sac with no yolk. It completly surrounds the embryo. The wall of yolk sac is in contact with chorion and produces finger like processes.

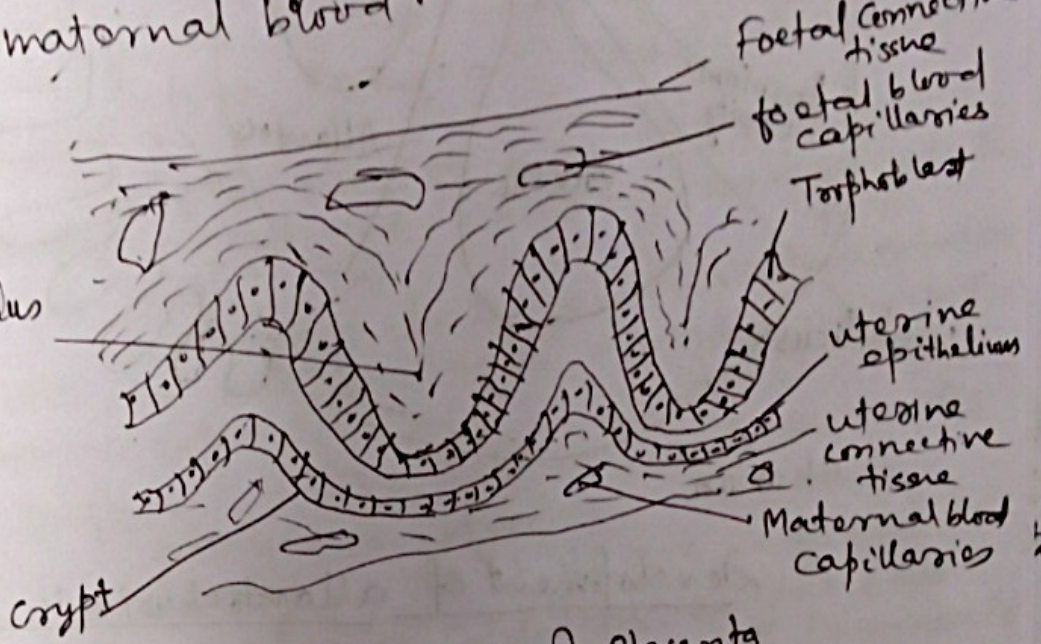
These folds fit into the depressions in the uterine wall. At the time of Parturition, the trophoblastic Villi are withdrawn causing no harm to the uterine wall. To nourish the embryo, the uterine wall secretes a viscid fluid, the uterine milk. It is absorbed by trophoblast and carried to the embryo. This type of placenta is described as yolk sac placenta.

3. Eutheria

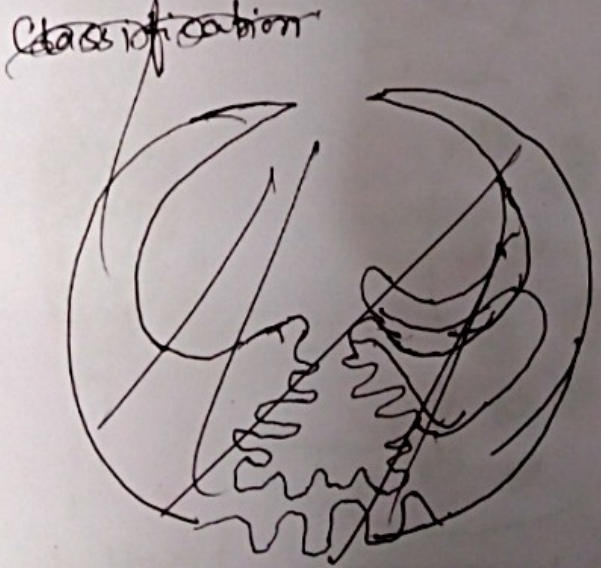
Eutherians are characterised by the possession of a true allantoic placenta, which are formed of allantochorion.

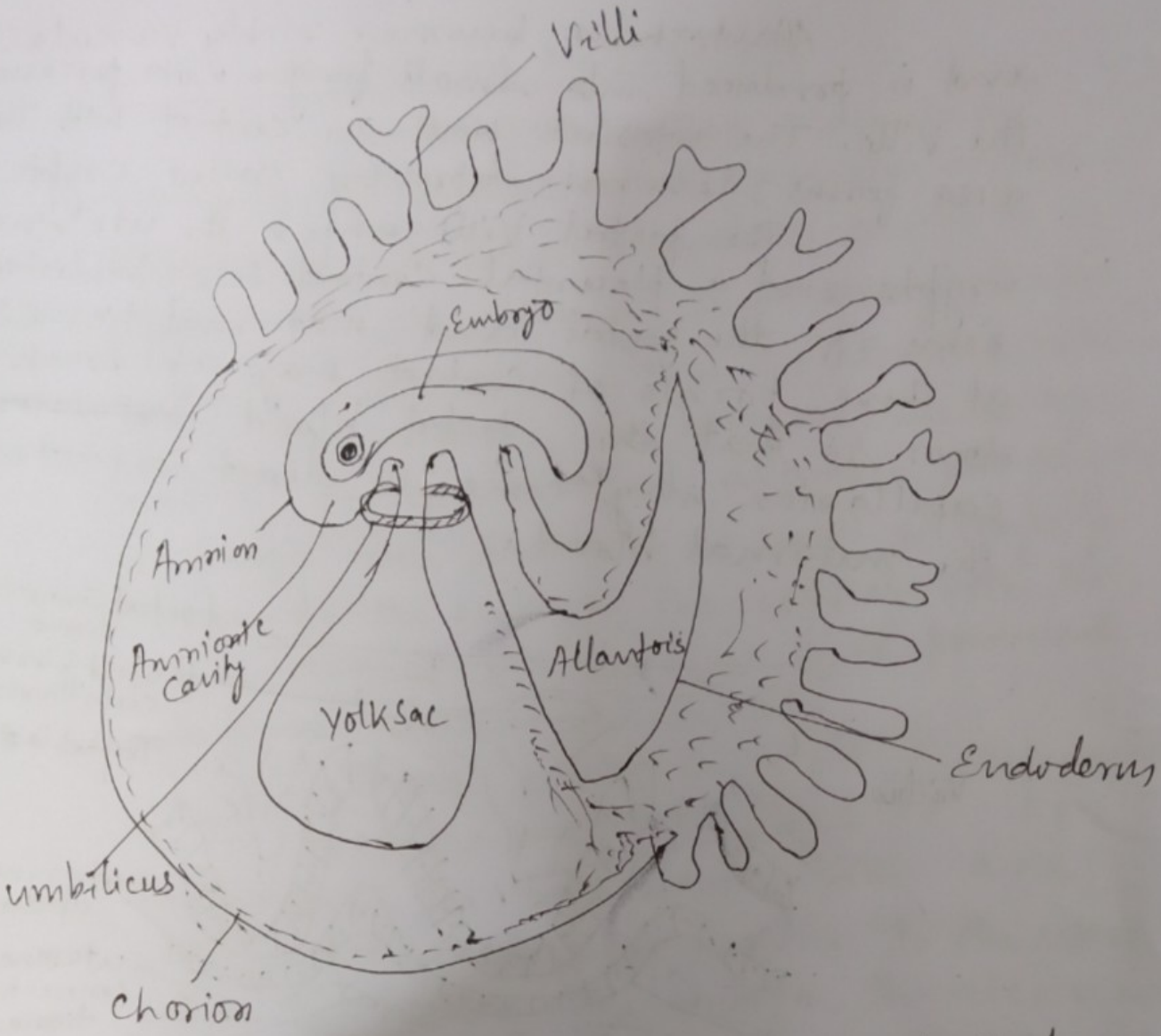
When the chorion is under development the allantois develops as a sac like out-growth from the hinder end of the gut. It grows in size and comes to lie in contact with the chorion. Its mesoderm finally fuses with the mesoderm of the chorion and the layer thus formed is known as allantochorion.

Allantochorion becomes richly vascular and is produced into small finger like processes the villi. The uterine wall in contact with this area forms several depression called crypts. The foetal villi enter the uterine crypts and a placental contact is established Some of the foetal and maternal tissues at these points of contact may also break down so that the foetal blood ~~circulation~~ capillaries may come in direct contact with the maternal blood.



Structure of Placenta





Development of allantochorionic Villi to form placenta

Classification of Placenta

[I] On the basis of behaviour at the time of Birth

[A] Non deciduate [B] Deciduate [C] Contra-deciduate

[A] Non deciduate

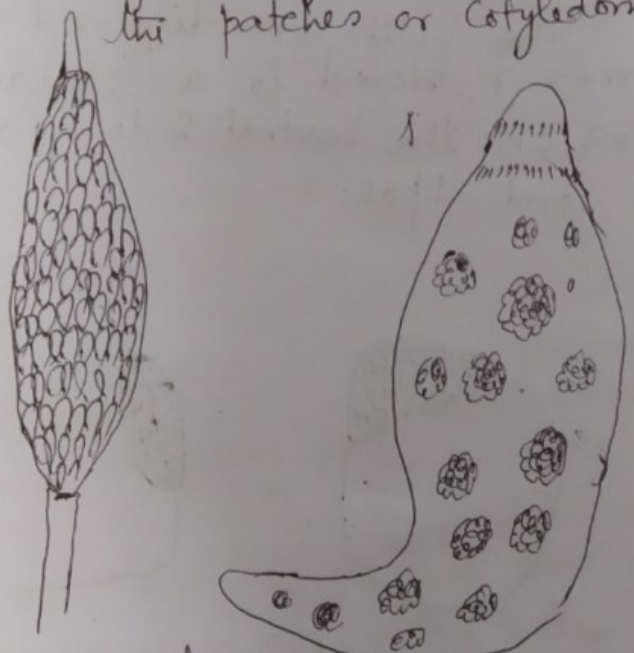
In this type of placenta, the contact between the foetal and uterine wall is not very intimate. The Villi are simple and unbranched and they lie in the Crypts of the uterine wall. Thus, it is also known as Semi-deciduate placenta.

At the time of birth the Villi are completly withdrawn causing no injury to the uterine wall.

According to the manner of distribution of Villi, the non deciduate placenta may be following types -

<i> Diffused — The Villi are restricted to the patches or cotyledons Ex. Horse

<ii> Cotyledonary - The Villi are restricted to the patches or Cotyledons. Ex. Goat & Ruminants



Diffused
(Horse)

Cotyledonary
(Goat & Ruminants

[B] Deciduate

In deciduate Placenta the Villi are branched and deeply embeded in the crypts. These may cause damage to the uterine wall.

At the birth, when the Villi are withdrawn the vascular part of maternal tissue also gets ruptured and comes out accompanied by bleeding.

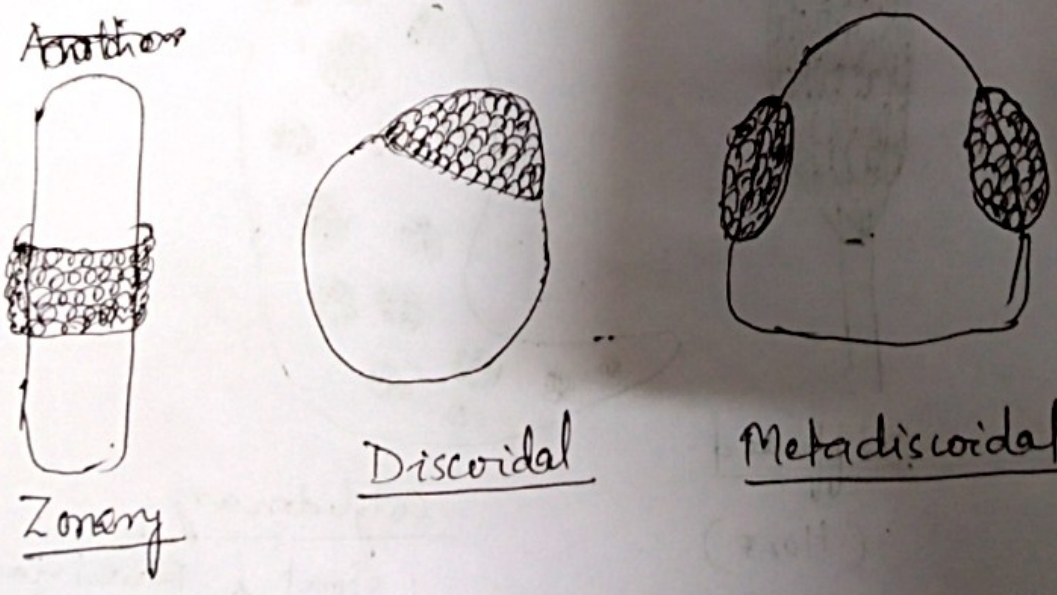
Depending upon the distribution of Villi, the deciduate placenta may be

(a) Zonary – Villi are arranged in a definite band or girdle or zone around the embryo.
Ex- Carnivorous mammals (cats, dogs, lions etc)

(b) Discoidal – The Villi forms a disc like patch on the dorsal surface of the embryo.
Ex- Rodents like Rabbits and Rats.

[C] Metadiscoidal

The Villi are diffused at first but becomes restricted to a small disc like area on the Ventral side of the embryo.
Ex- Man and Apes.



[c] Contra-deciduate

In this type of Placenta, connection between the foetal Villi and uterine Crypts becomes so intimate that ∅ at the time of birth a portion of allantoic placenta is left behind and is absorbed in the uterine wall.
Ex- Bandicoots & moles.

Classification of Deciduate placenta based upon relationship of embryonic Villi with the uterine wall

<I> Epithelio-chorial type

In this type of Placenta the embryonic trophoblast and the uterine epithelium remain in close contact with each other but retain their original layers, that is neither the embryonic nor the maternal tissue is damaged
Ex- Pig.

<II> Syndesmo chorial-

In this type of placenta the uterine epithelium is ruptured and the chorionic epithelium comes in contact with the connective tissue of the uterine wall.
Ex - Sheep & Cow

<III> Endothelio-chorial

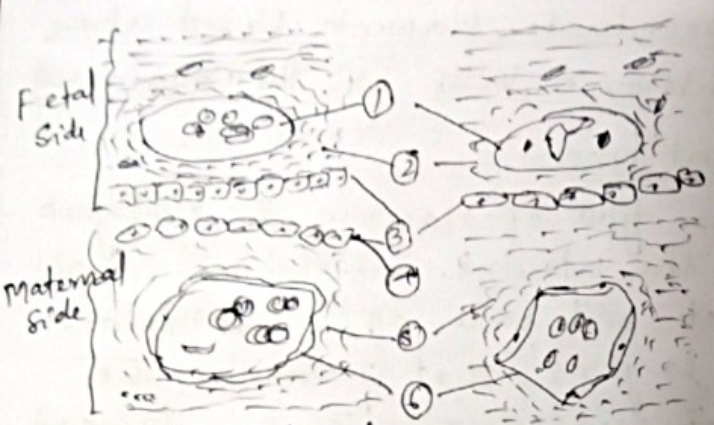
Both uterine epithelium and uterine connective tissue is eroded to some extent, and thus embryonic tissue comes in contact with the endothelium of ~~mater~~ maternal blood vessels.
Ex - Dog, cat & other carnivores.

<IV> Haemo-chorial -

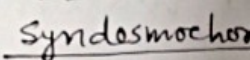
Here uterine epithelium, connective tissue and endothelial wall of maternal blood capillaries are eroded, thus chorionic epithelium comes in ~~contact~~ direct contact with maternal blood which circulates in the lacunae formed in the thickened trophoblast of the Villi Ex- Man

<v> Haemo-endothelial

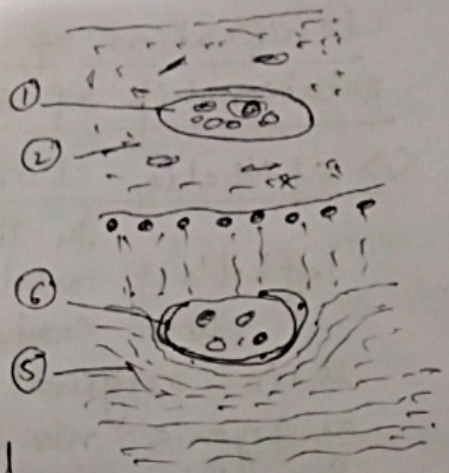
In this type of uterine epithelium, uterine connective tissue, endothelium of maternal capillaries and the trophoblastic epithelium are eroded with the result that the foetal capillaries lie freely in maternal blood. Ex- Rabbit.



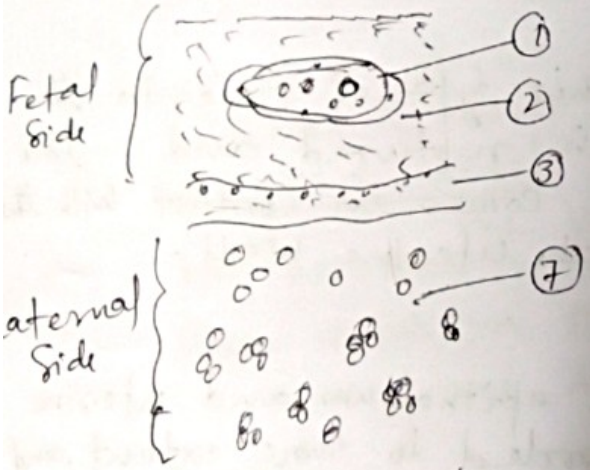
Epitheliochorial



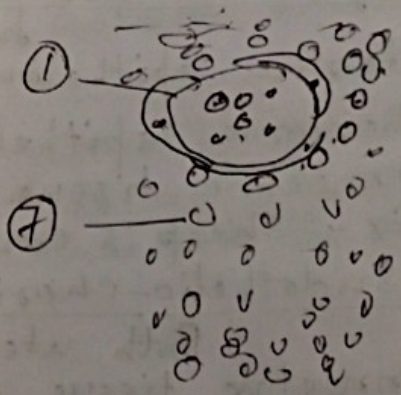
Syndesmochorial



Endotheliochorial



Hemochorial



Haemoendothelial

1. Endothelial lining of foetal blood capillaries
2. Foetal Connective tissue
3. Epithelium of trophoblast
4. Uterine epithelium
5. Uterine connective tissue
6. Endothelial lining of uterine blood capillaries

Function of Placenta

The primary function of Placenta is the interchange of materials present in the blood streams of mother and embryo. All the substances have to pass through the placenta either by simple diffusion, pinocytosis or by active transport etc.

Important Physiological function of Placenta are following -

(a) Placenta help in transportation of nutrients (monosaccharides, disaccharides, proteins and small lipid molecules) from maternal blood stream into the foetus.

(b) Placenta help in the exchange of oxygen and CO_2 between foetus & mother, and thus helps in respiration.

(c) The nitrogenous waste products produced as a result of metabolic activities of embryo diffuse through placenta into maternal blood stream.

(d) The antibodies developed in the blood of mother against certain diseases like diphtheria, measles, small pox, scarlet fever etc. are passed from mother into the foetus

(e) Certain pathogenic organisms like viruses diffuse through placenta.

(f) Some drugs taken by mother during pregnancy cross the placental barrier and may even cause developmental deformities

(g) Placenta stores materials such as fat, glycogen and iron and participate in the metabolism of proteins.

(h) Like endocrine glands, placenta secretes many hormones such as progesterone, estrogen, gonadotrophins placental lactogens etc.