

For Degree - 2 Students of UG
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Placentation in Mammals -

All the mammals are viviparous and the development of their young are in intra-uterine. The size of the egg is very small and they contain very less yolk which does not allow them to grow and develop after certain initial stage, so they get their nourishment from mother's body. This is done by the formation of a connection between mother's body and developing embryo. This connection is called placenta.

The term placenta can be defined as the structure by which the developing egg or embryo of viviparous animals obtain its nourishment from the mother's uterine blood. It is formed by the interlocking of both foetal as well as maternal tissues.

The term placentation can be defined as an intimate relation between a portion of maternal uterine wall and a part of embryo for the purpose of nutrition, respiration and excretion. Placentation involves a series of events followed by implantation of fertilized egg and development of embryo.

Stages of placenta formation -

First step in placenta formation is implantation of the developing embryo to the wall of uterus.

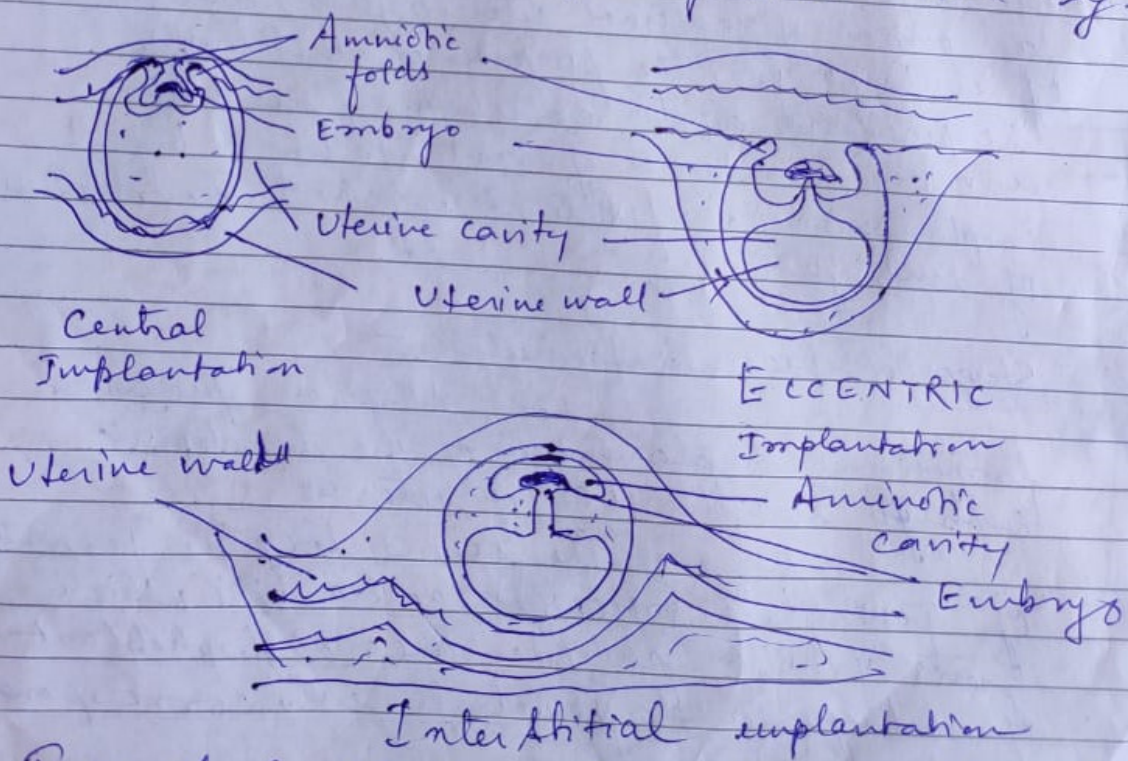
The second step is formation of finger like processes called villi which grow from a particular area of trophoblast of embryo and penetrate into corresponding

crypts in the maternal uterine wall.

Blood vessels, lymphatics, vessels and glands of uterine wall enlarge and their secretions provide nourishment to the embryo, Implantation occurs in three ways -

1. Central implantation - Embryo is attached to the surface of uterine lining and projects freely into uterine cavity
eg - Rabbit, ungulates, lower primates.
2. Concentric implantation - In this case the mucous lining of uterus gives out folds to cover the embryo which is embedded in a pocket of main uterine cavity.
eg - Mouse, Squirrel, Rat, beaver etc.
3. Interstitial Implantation -

The blastocyst of the embryo burrows into the uterine tissue to become completely surrounded by it.



Types of Implantation of embryo in Mammals -

Classification of Placenta - classification of placenta depends upon following three factors

- 1) Nature of extra-embryonic membranes involved.
- 2) Distribution of villi and shape of placenta
- 3) Degree of intimacy between foetal and maternal tissue.

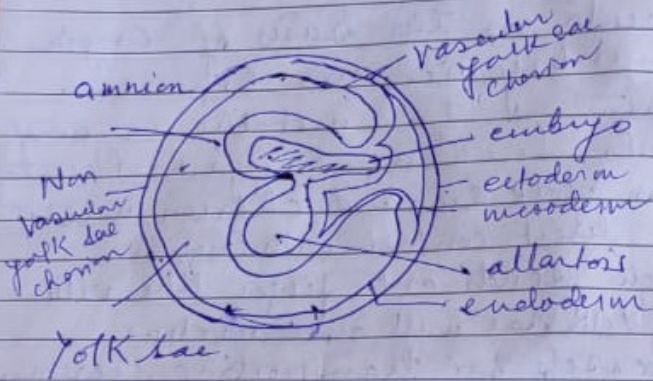
A) Types of placenta on the basis of origin and extra-embryonic membranes -

1) Yolk sac placenta - In metatheria and marsupials, such as Kangaroo, placenta is derived from yolk sac and chorion, wall of yolk sac lies in direct contact with chorion (trophoblast) which sends out finger like villi into uterine wall. Yolk sac wall also develops villous blood vessels for transporting secretions. Uterine milk absorbed from uterus to the developing embryo it is weakly developed so that embryonic nutrition and growth remains limited and young one is born very small and immature, it is transferred to abdominal pouch or marsupium and fed by mother's milk until fully formed. Allantois never comes in contact with chorion.

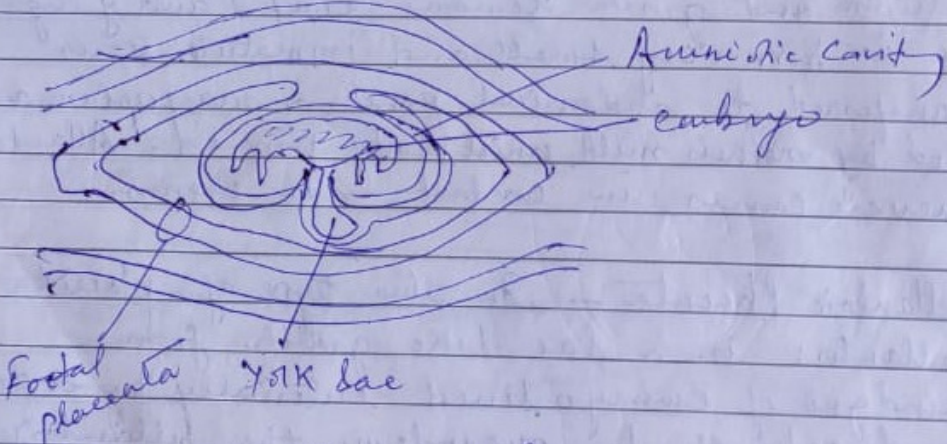
2) Allantoic Placenta - In this type of placenta allantois is a sac like growth from hind gut of embryo lined externally by endoderm and externally by mesoderm, the allantois grows and spreads in the extra-embryonic cavity and the mesoderm fuses with the chorion in a restricted area called allanto chorion. It becomes richly vascular and thrown into small, finger like projections called villi in the corresponding uterine wall depression the crypts. nutrition is absorbed to the foetus by allantoic blood vessel.

Example - Eutheria (majority)

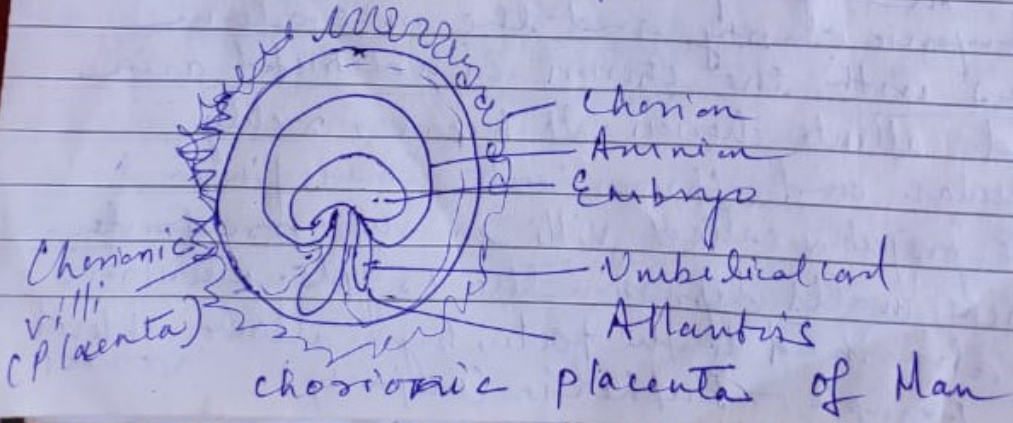
Chorionic Placenta → It is found in human beings and apes and is formed by chorion. Allantoid remains small, burst into ~~body~~ umbilical cord, the mesoderm and blood vessels grow upto chorion while the uterine crypts forming chorionic placenta.



Yolk sac placenta of opossum



Allantoic placenta of Pig



Degree of extent of VLB

Types of placenta on the basis of shape and distribution of villi →

Depending upon the shape of placenta, manner and distribution of villi, degree of connection between foetal and maternal tissues and behavior of placenta at the time of birth there are following types and sub types of placenta -

① Non deciduous placenta -

a) The villi are simple, unbranched without any intimate contact between foetus and uterine wall

b) At the time of birth villi are easily withdrawn from maternal crypts without any tissue damage

c) No uterine tissue is damaged and no bleeding occurs.

It has following sub types -

1) Diffuse - villi remain scattered all over the surface of allanto chorion -
eg - pig, horse, lemur

2) Cotyledonary - villi are arranged in separate tufts or patches called cotyledons eg Goat, sheep, cow, deer etc.

3) Intermediate - Villi are arranged in cotyledons as well as scattered
eg - Camel, Giraffe.

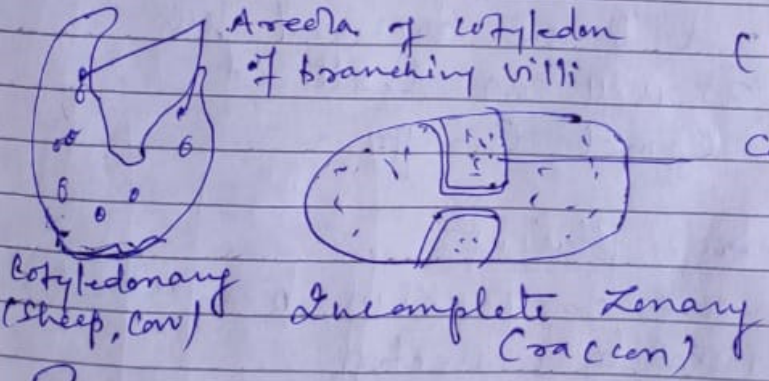
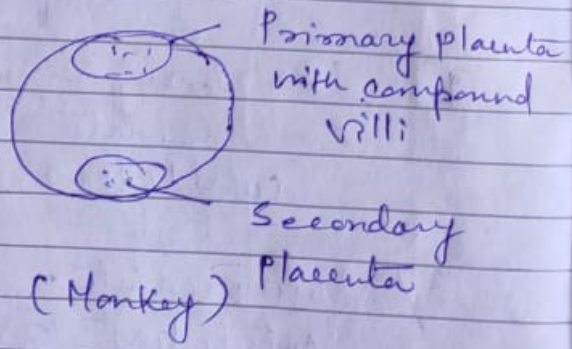
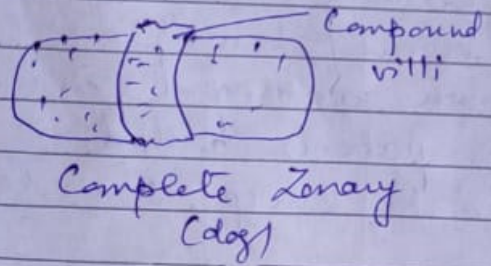
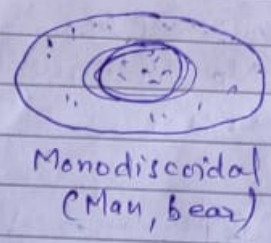
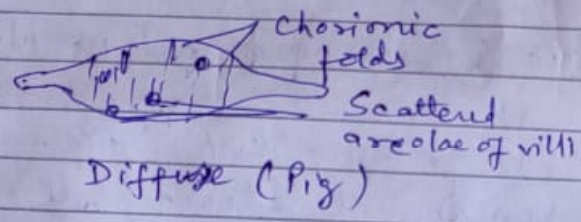
② Deciduous Placenta .

a) Villi are complicated, branched and intimately connected

(b) At birth a variable amount of maternal tissue comes out with bleeding. It is of ~~three~~ types -
three

- i) Zenary - Villi form an incomplete or complete ~~girdle~~ girdle encircling the blastocyst
eg - Cat, dog, Seal and Elephant.
- ii) Discoidal - Villi makes a circular disc or plate on the dorsal surface of blastocyst
eg - bats, rodents, rabbit, bear.
- iii) Metadiscoidal - Villi are initially scattered but later on restricts to ~~one~~ 1-2 discs
monodiscoidal in human and bidiscoidal in monkeys and apes.

(3) Contra deciduans - Highly intimate connection between foetal villi and uterine crypts
eg - Moles and Bandicoot.

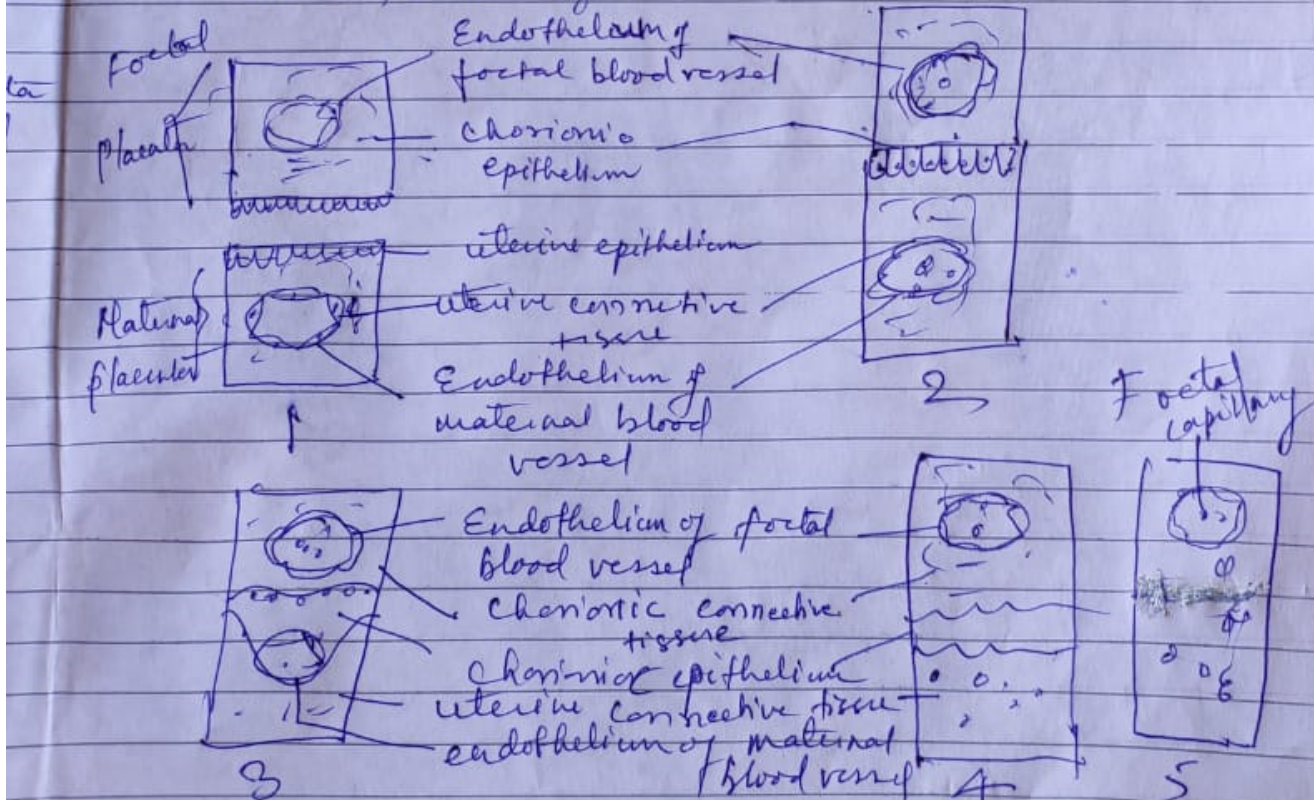


Types of placenta according to villi Diffuse, cotyledonary, Zenary, Discoidal, bidiscoidal.

Types of Placenta on the basis of Histology -

The lining between the foetal and maternal is made up of following types of tissues or membranes and on the basis on those barriers placenta is -

- ① Epithelio chorial - All the six tissue layers are present - eg - Pigs.
- ② Syndesmochorial - uterine epithelium is eroded the chorion comes in contact with uterus eg - Cattle, Sheep
- ③ Endothelio-chorial - only chorionic epithelium comes in contact with endothelium of mother eg - Cat, dog etc.
- ④ Haemochorial - Maternal endothelium is eroded chorionic epithelium directly bathes in maternal blood eg - Man, apes, Monkeys etc.
- ⑤ Haemo-endothelial - Foetal capillaries comes in direct contact with maternal blood - eg Rat Rabbit, Guinea Pig.



Histological types of mammalian placentae.

Functions of Placenta - Placenta is the most important part in the development of embryo into an infant it has following functions -

- ① Exchange of substances - Substances such as nutrients and gases are exchanged between mother and embryo by the process of diffusion.
- ② Ultrafiltration - only selected substances are passed through it.
- ③ Storage - It acts as a liver for the developing embryo for storage of fat, glycogen, minerals etc.
- ④ It helps in metabolism of proteins.
- ⑤ It also acts like an endocrine gland by secretion of Human chorionic and relaxin hormones.
- ⑥ Excretion of wastes - It helps in respiration by exchange of O_2 and CO_2 .