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PLACENTAL CLASSIFICATION

The term placenta was derived from Greek word it means flat cake. Placenta is not common to all mammals. It is developed well in Eutheria (the embryo develops in the uterus of mother). The term placenta applies to any type of organ developed from the maternal and foetal tissues jointly and which serves for the transport of nutrients from the mother to embryo. Placenta is a special connective tissue, which contains the uterus of mother and foetal membranes of foetus.

Based on the point of origin of placenta, there are two parts: **foetal placenta** furnished by the extraembryonic membranes and **maternal placenta** developed from the endometrium.

Fetal membranes

Classification of placenta based on the type of foetal membranes involved

- **Chorio-vitelline placenta or yolk-sac palcenta**
- **Chorio-allantoic placenta**
- **Chorio-vitelline placenta or yolk-sac palcenta**

In some marsupials, the allantois remains relatively small and never makes contact with the chorionic sac, whereas the yolk sac becomes very large and gets fused with chorion. The chorionic blood vessels are connected with the vitelline blood vessels of the yolk sac. Hence, the yolk sac contributes the major share in the formation of placenta. Eg. Didelphys, dasyurus

- **Chorio-allantoic placenta**

In some marsupials and all eutherian mammals, the yolk sac remains rudimentary and the allantois becomes well developed and vascularised to fuse with chorion. The chorio-allantoic villi constitute the placenta. In these animals yolk sac placenta is not seen. This type of placenta is called as chorio-vitelline placenta. The chorio-allantoic villi grow out and get attached with the uterine wall. Eg. Peramoles and eutherian mammals.

Functions of placenta:

- 1) Placenta will form a physiological barrier between mother and foetus. It will possess foetal and maternal blood mixing.
- 2) Placenta allows the diffusion of monosaccharides, amino acids, hormones, vitamins, oxygen, carbon dioxide, water and other waste materials, because of this it supplies food, oxygen to foetus.
- 3) It works as an excretory organ of foetus. It releases the nitrogenous waste materials into mother blood.
- 4) It works as an endocrine gland. It will secretes lactogen, progesterone, etc. hormones.
- 5) The placenta will manufacture fructose from glucose.

Placenta in Eutheria:

In Eutherian mammals true allantoic placenta is seen. Allantoic becomes big and comes in contact

with chorion. This part will show close association with uterine wall. This connection is called placental connection. The structure of placenta will vary in different orders of Eutheria.

Classification of placenta based on the Nature of contact

It is three types, non-deciduate, deciduate and contra-deciduate placenta

Non-deciduate type placenta

Here the implantation is superficial type. The chorionic villi are simple projections, they lie in contact with uterus. The villi are initially formed by the trophoblast but later on the blood vessels and connective tissues are extended to them. They have a loose contact. There is no fusion. At the time of birth of embryo uterus is not damaged. No bleeding occurs at the time of parturition. Ex. Ungulate, Cetaceans, Sirenians. Lemurs

Deciduate type Placenta: Here the degree of intimacy between the maternal and foetal tissues is great. The allanto-chorionic villi penetrate into uterine villi. They are intimately fused. Hence at the time of birth, the uterus is damaged. Bleeding occurs, the uterine wall enters into formation of placenta is called deciduas. Ex: Primates, Rodentia, Insectivora, chiroptera

Contra-deciduate placenta

This is a modified type of deciduate placenata. In this placenta there is a loss of maternal tissues and foetal portion of the placenta, both of them are absorbed **in situ** by maternal leucocytes.

Classification of placenta according to the mode of implantation

Implantation is the first stage in development of the placenta. In most cases, implantation is preceded by a close interaction of embryonic trophoblast and endometrial epithelial cells that is known as **adhesion** or **attachment**.

- **Superficial:** Here, the chorionic sac remains in the central uterine cavity. The foetus is found facing towards main cavity of uterus. Eg. carnivores, ruminants, horses, and pigs.
- **Eccentric:** In this type the chorionic sac lies in the fold or pocket of uterus and remains away from the main cavity. Eg. rats and mice.
- **Interstitial:** Here the chorionic sac penetrates deep into the substances of the uterine wall and develops embedded in it. Eg. include primates, including humans, and guinea pigs.

Classification of placenta according to the distribution of villi there are five types of placenta are found.

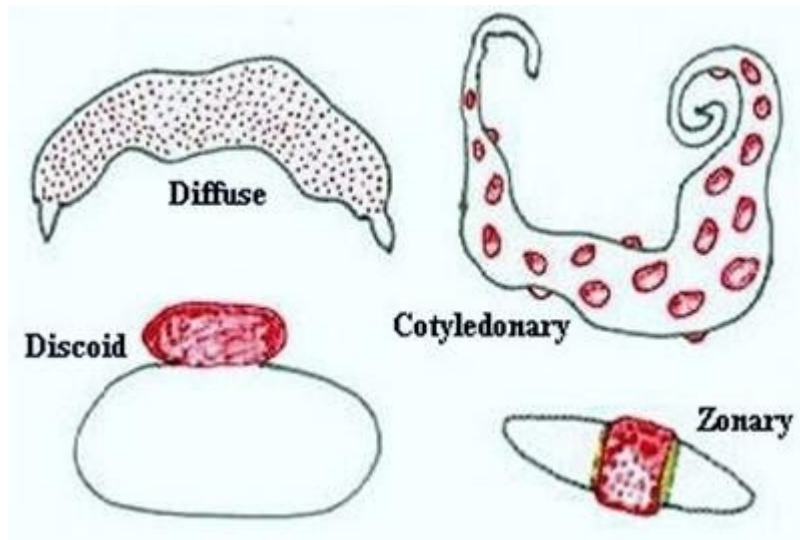
1. **Diffused type placenta:** Ex Horse, pig,
The villi are uniformly distributed on the surface of blastocyst, except at the extreme ends.
2. **Cotyledonary placenta** Ex Sheep, Cow, Deer.
The villi are arranged in groups. Each group is called cotyledon. Each cotyledon fits into caruncla of uterus.
3. **Intermediate type Placenta** Ex : Giraffe.
It is a rare type, it shows free villi on cotyledons. Hence it is called intermediate type placenta In these three types of placenta during parturition the foetus will not damage uterus.

4. **Zonary placenta: Ex Cat, Dog, Carnivores.**

The villi are in the form of transverse zones. In dog a single girdle of vhf will be present. In fox two girdles of villi are present. The villi penetrate into uterine wall. Hence during parturition uterine wall is damaged.

5. **Discoidal Placenta: ex Rat, Bat, Rabbit.**

On the entire surface of blastocyst the villi are in the form of discs. When the embryo is growing It moves away from uterus hence the look like a disc. These villi are intimately connected with uterus. Hence during parturition much uterine tissue is damaged.



Classification of placenta according histological intimacy of foetal and maternal tissues

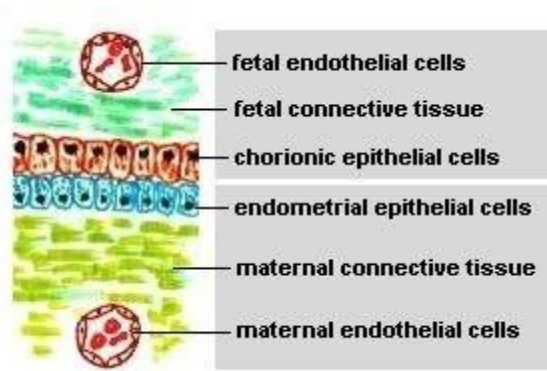
Just prior to formation of the placenta, there are a total of six layers of tissue separating maternal and fetal blood. There are three layers of fetal extraembryonic membranes in the chorio-allantoic placenta of all mammals, all of which are components of the mature placenta:

1. Endothelium lining allantoic capillaries
2. Connective tissue in the form of chorioallantoic mesoderm
3. Chorionic epithelium, the outermost layer of fetal membranes derived from trophoblast

There are also three layers on the maternal side, but the number of these layers which are retained - that is, not destroyed in the process of placentation - varies greatly among species. The three potential maternal layers in a placenta are:

1. Endothelium lining endometrial blood vessels
2. Connective tissue of the endometrium
3. Endometrial epithelial cells

According to number of layers of cells present between foetus and uterus blood supply the placenta is classified into five types.



a) **Epithelio chorial placenta** : Ex Pig, Horse, (Ungulates Lemmures)

The foetal chorion is in contact with epithelium of the uterus hence it is called epithelio-chorial placenta. In between foetal, maternal parts six layers are present. If all the six layers are present the placenta is called epithelio-chorial placenta.

b) **Syndeumose chorial placenta**: Ex Sheep, Cow.

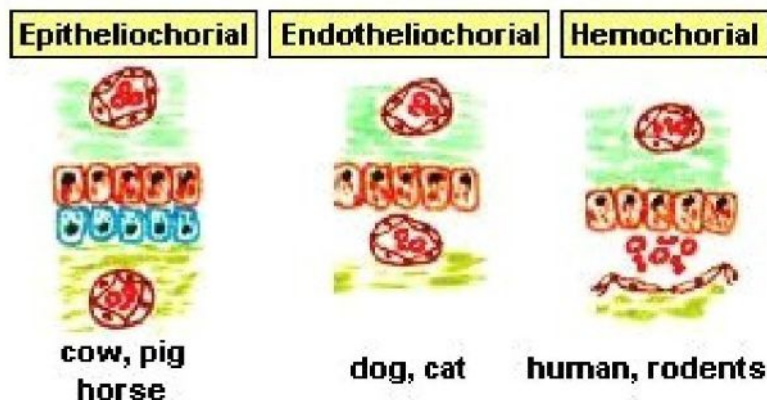
The allanto-chorionic vith will pierce into the uterus of the mother, the chorion will come in contact with syndesmosse of mother's uterus. Hence it is called syndesmosse chorial.

c) **Endothelio chorial placenta** : Ex Dog, Carnivores. The chorion of the foetus will come in contact with the endothelium of mother's uterus, hence it is called endothelio-chorial placenta.

d) **Hemochorial placenta**: Ex: Bat, Man, Primates, Insectivores.

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.

e) **Hemo endothelial placenta** Ex: Rat, Rabbit, Hence guinea-pig will float in mother's blood. Hence it called hemo endothelial placenta.



Summary of Species Differences in Placental Architecture

The placental mammals have evolved a variety of placental types which can be broadly classified using the nomenclature described above. Not all combinations of those classification schemes are seen or are likely to ever be seen - for instance, no mammal is known to have a diffuse, endotheliochorial, or a hemoendothelial placenta. Placental types for "familiar" mammals are summarized below:

Objective point of view

Type of Placenta	Common Examples
Diffuse, epitheliochorial	Horses and pigs
Cotyledonary, epitheliochorial	Ruminants (cattle, sheep, goats, deer)
Zonary, endotheliochorial	Carnivores (dog, cat, ferret)
Discoid, hemochorial	Humans, apes, monkeys and rodents

