

DEPARTMENT OF ZOOLOGY
B.N. COLLEGE BHAGALPUR
T.M. BHAGALPUR UNIVERSITY,
BHAGALPUR- 812007



Dr. Rajesh Kumar
Assistant Professor

Phone- 7677189610 (M)
7004072016 (R)
Email id- raju.km1987@gmail.com

B.Sc. Zoology Part II

EMBRYOLOGY: DEVELOPMENT OF PLACENTA AND TYPES OF PLACENTA

INTRODUCTION

- The placenta is a Greek word and it means a 'flat cake'.
- This name is received from the human placenta which is flat, rounded mass, shaped more or less like a pan cake.
- The term placenta in its broadest sense refers to any region in a viviparous organism where maternal and embryonic tissues of any kind are closely opposed and which serves as a site of physiological exchanges between parent and embryo.

DIFINITION

“The placenta can be defined as a temporary organ which is formed jointly by the extra-embryonic membranes of the foetus and maternal tissues and by which the developing embryo or foetus of viviparous mammals obtains its nourishment from the maternal uterine tissue.”

- The true placenta of the eutherian mammals serving as a provisional lung, intestine, kidney and endocrine glands for the embryo, it allows the maternal and foetal blood to come in proximity for the mutual exchange of substances.
- The placenta permits the entry of foodstuffs, vitamins, oxygen, hormones and antibodies and the exit of CO₂ and nitrogenous metabolic wastes.
- The mode of formation and fusion of the placenta to the uterine wall is called **placentation**.
- The phenomenon of placentation is invariably related with the **viviparity** of the organism.
- In all viviparous animals, the development of the young one takes place inside the uterus of the mother because the amount of stored yolk of egg does not remain sufficient for the development of an embryo which can lead an

independent mode of existence, therefore the developing embryo has to depend on the mother in lesser or greater degree for nourishment oxygen supply and other physiological assignment.

- The placenta are not found exclusively in mammals but also appear in animals belonging to various groups of the animals kingdom such as in *Peripetus* (Onychophora), *Salpa* (Tunicata), *Mustelus laevis* (Elasmobranchia) and certain Lizards (Reptilia).

CLASSIFICATION OF PLACENTA

- In the embryos of various mammals placenta are formed by different **extra-embryonic membranes**.
- These differ also in the pattern of villi on the surface of chorion.
- Further these differ in mode of attachment and behavior at the time of birth.
- On the basis of all these above mentioned differences, placenta are classified into various types:-

A. Classification of placenta on the basis of extra-embryonic membrane involved in the formation:-

- Extra-embryonic membranes are four in number namely amnion, chorion, yolk sac and allantois.
- Out of these the first one does not reach to the outer most boundary formed by chorion.
- Hence any possibility of its participation in the formation of placenta is ruled out.
- The second one i.e. chorion forms the outermost boundary which is touched on its inner surface by remaining two i.e. yolk sac and allantois.
- This leads to the formation of two types of combination i.e. a combination of chorion and yolk sac as well as chorion and allantois.
- The former combination is known as chorion vitelline whereas the latter combination is named allanto chorion.
- Depending upon the type of combination i.e. chorion vitelline and allanto chorion involved in the formation of placenta, the latter is classified into following two types:-

(i) Chorio-vitelline placenta or yolk sac placenta:-

- In metatherian mammals except *perameles* and a few others, the allantois remains comparatively small in size and never touches chorion whereas the yolk sac is so enlarged that the major portion of embryo remains surrounded by it.
- The wall of yolk sac fuses with chorion. The latter receive vascular supply from the vitelline blood vessels of the yolk sac.
- The chorion forms rough wrinkles on its outer face to contact the uterine wall.
- So only a weak connection occurs in the case of **yolk sac placenta**.

- Due to this the embryonic nutrition and growth remain limited when the embryo is in immature condition.
- This type of placenta is found in marsupials like *Didelphys*, *Macropus*, *Dasyurus* etc.

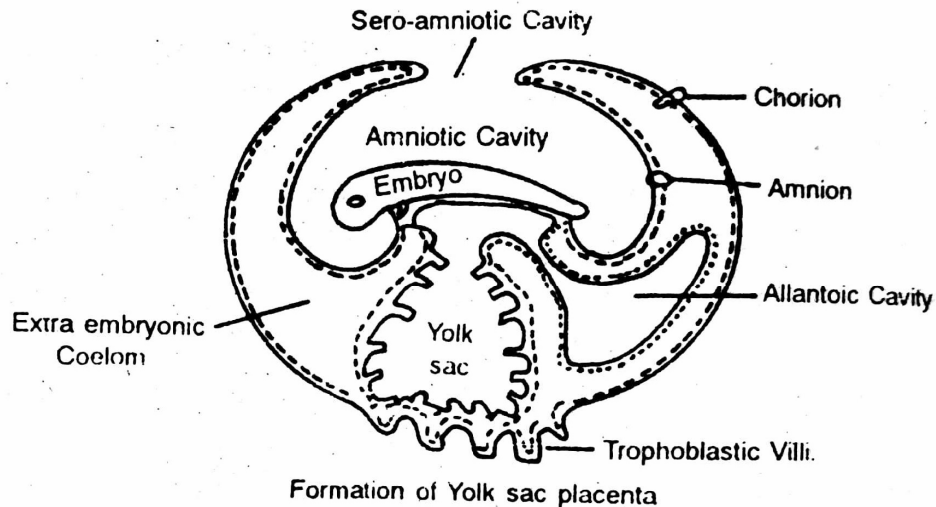


Fig. 10.30 Formation of yolk sac placenta.

(ii) Chorio-allantoic placenta or allantoic placenta:-

- In the majority of eutherian mammals as well as in *Perameles* (Metatheria) the allantois is very large whereas the yolk sac is small.
- The allantois develops as a bag like outgrowth from the hindgut of the embryo.
- It grows rapidly and acquires entire extra-embryonic coelom.
- It is splanchnopleuric in nature i.e. its wall is composed of an outer layer of splanchnic mesoderm and an inner layer of endoderm.
- When it touches chorion the mesoderm layers of two i.e. splanchnic mesoderm of allantois and somatic mesoderm of chorion fuse together which leads to the formation of three layered structure- outer ectoderm, middle mesoderm and inner endoderm.
- This structure is known as allanto-chorion.
- This structure is highly vascular as mesoderm develops blood vessels.
- The allanto-chorion gives rise to a number of projections which are known as villi.
- These villi burrow into the crypts of maternal uterine wall establishing an intimate connections between the embryo and the uterus of mother.
- Some of the maternal and foetal tissues breakdown so that the foetal capillaries of the villi come in contact with maternal blood in crypts.
- The villi and crypts in this way bring the foetus and mother in close contact.
- Though this connection foetus derive food and oxygen from the maternal blood and also fulfil its requirements concerning respiration and excretion.

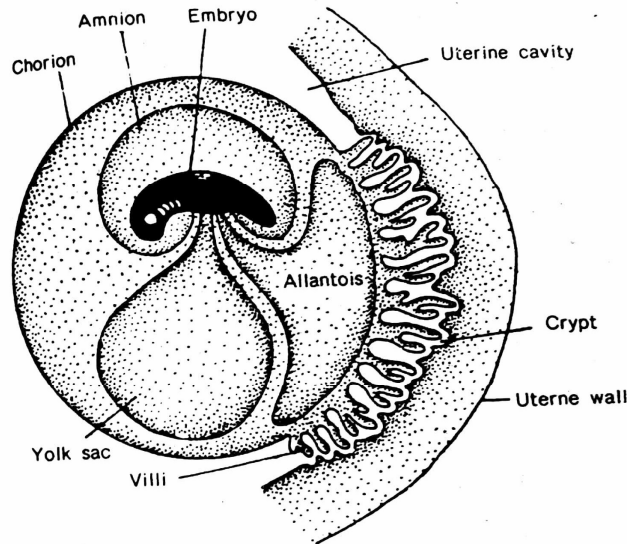


Fig.10.3] Formation of Allanto-chorion placenta.

B. Classification of placenta on the basis of its behavior at the time of birth:-

Depending upon the behavior shown at the time of birth placenta is classified into following 3 types:-

(i) Non-diciduate placenta:-

- When the two layers participate in placenta i.e. foetal villi and uterine crypts maintain their intactness and distinctness but both are in intimate connection in such a way that at the time of birth the former i.e. foetal villi are withdrawn from the latter i.e. crypts of uterine wall completely in a fashion of withdrawal of fingers from gloves without causing any damage to uterine wall, then placenta is designated as **non-diciduate**.
- This type of placenta is found in pig, horse, goat, cattle and some other mammals.

(ii) Diciduate placenta:-

- When foetal villi are branched and uterine wall is dissolved leading to formation of such an intimate connection between two that at the time of birth when villi are pulled out the vascular wall of the uterine wall also ruptures and comes out followed by occurrence of bleeding, then placenta is designated as **diciduate placenta**.
- This out coming portion of the uterus is called **diciduate**.
- This type of placenta is found in man, primates, carnivores, insectivores etc.

(iii) Contradeciduate placenta:-

- When the connection between the foetal villi and uterine crypts becomes so intimate that some portion of allantoic placenta is left behind at the time of birth and absorbed in the uterine wall, then placenta is designated as **contradeciduate**.
- This type of placenta is found in bandicoots and moles.

C. Classification of placenta on the basis of pattern of distribution of villi:-

The chorio-allantoic placenta is classified into following five types on the basis of pattern of distribution of villi on the surface of chorion:-

(i) Diffuse placenta:-

- When the villi remain uniformly distributed all over the surface of chorio-allantoic membrane, then placenta is designated as **diffuse placenta**.
- This type of placenta is present in horse, pig etc.



Fig. 10.32 Diffuse placenta

(ii) Cotyledonary placenta:-

- When the villi remain restricted to the patches on the surface of the chorio-allantoic membrane and inter-patches spaces are smooth then patches of villi are termed cotyledons and placenta is known as **cotyledonary placenta**.
- The latter type of placenta is found in sheep, goat, deer, cow etc.

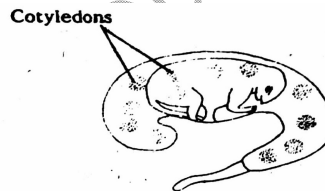


Fig-10. 33 Cotyledonary placenta.

(iii) Zonary placenta:-

- When the villi form a regular band around the embryo then placenta is termed **zonary placenta**.
- This type of placenta is found in carnivores such as dog, cat, fox etc.



Fig. 10.34 Zonary placenta.

(iv) Discoidal placenta:-

- When villi form a small disc like patch on the dorsal surface of the foetus then it is termed **discoidal placenta**.
- This type of placenta is found in bat, mouse, rat, rabbit etc.

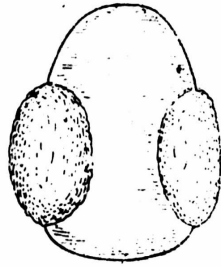


Fig. 10.35 Discoidal placenta

(v) Metadiscoidal placenta:-

- When the villi are diffused in the beginning but become restricted to one or more small disc like areas on the ventral surface of foetus then placenta is termed **metadiscoidal**.
- This type of placenta is found in man and apes.

FUNCTIONS OF PLACENTA

1. Placenta acts as device through which maternal blood supplies food and oxygen to the foetus by diffusion as well as the foetal blood gives out waste products like urea and carbon dioxide into maternal circulation by diffusion.
2. All substances are not allowed to pass into foetal circulation by placenta but the latter exercises a selection influence on the food of the foetus. It breaks down the macromolecules into micro molecules before entry and from these micro molecules, macromolecules are resynthesized by foetus. Thus it acts as a physiological barrier to substances which may be harmful to the foetus. It permits only useful nourishment to pass through i.e. it forms a semipermeable membrane between the mother and foetus.
3. Placenta serves as a protective device for the delicate foetal tissue by preventing the direct entry of maternal blood which is under high pressure into foetal circulation.
4. Placenta stores glycogen for the foetus before its layer is formed. It also manufactures fructose from glucose. It selectively absorbs ascorbic acid.
5. The antibodies to some diseases like diphtheria, small pox, measles, tetanus etc. developed in the blood of mother pass through placenta and keep the embryo immune even after sometime of birth.
6. Certain pathogenic organisms and viruses can pass through placenta if the blood of mother becomes infected by these. The latter include viruses and pathogenic organisms causing small pox, chicken pox, measles, syphilis, rubella etc.
7. Placenta also acts as an endocrine gland whose secretions control proper development of the foetus as well as stimulate ovaries to secrete such hormones which are helpful in maintaining pregnancy. The hormones secreted by placenta include oestrogen, progesterone, chorionic gonadotropin, lactogen etc. In some mammals such as rabbit it produces relaxin.
