

# PLACENTA

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# PLACENTA

The close association between the maternal and foetal tissue through which physiological exchange of materials take place between the mother and the foetus is known as placenta. Placenta of man looks like a cake, so it is named as placenta and conventionally applied to all such association (Greek: Placenta-flat cake).

# GENERALIZED PLACENTA FORMATION

The embryo of a mammal is transported to uterus in blastocyst stage. This blastocyst is composed of an outer layer of epithelial cells and inner a mass of embryonal cells. This epithelial layer absorbs nutrients from the uterine fluid. As this layer absorbs nutrient so this layer is named as trophoblast (Gk-troph-food blast-cell layer). During the growth of the embryo fingerlike projections develop from the chorion and these are known as chorionic villi. Later connective tissue and blood vessels are extended into it. This will gradually enter into the endometrium of the uterus and draw nutrient from the blood of the mother. The endometrium of the uterus is formed of epithelium, connective tissues, blood vessels and nerves. The close association of endometrium and chorionic villi is the placenta.

# TYPES OF PLACENTA

(Based on the degree of the association of maternal and foetal tissue and foetal tissue)

## Non deciduous placenta

- In the placenta where chorionic villi are loosely associated with the uterine endometrium so that the villi can be withdrawn from the endometrium easily without any blood shedding, is known as non-deciduous placenta.
- Where found. In pigs, cows, buffaloes, goats etc. nondeciduate placenta is found.

## Deciduous placenta

- The placenta in which chorionic villi are deeply embedded in the endometrium of the uterus and during withdrawal of the villi profuse blood shedding of the uterine wall takes place, is known as deciduous placenta.
- Where found : This type of placenta is found in all primate mammals including man.

# TYPES OF PLACENTA

(Based on the degree of the association of maternal and foetal tissue and foetal tissue)

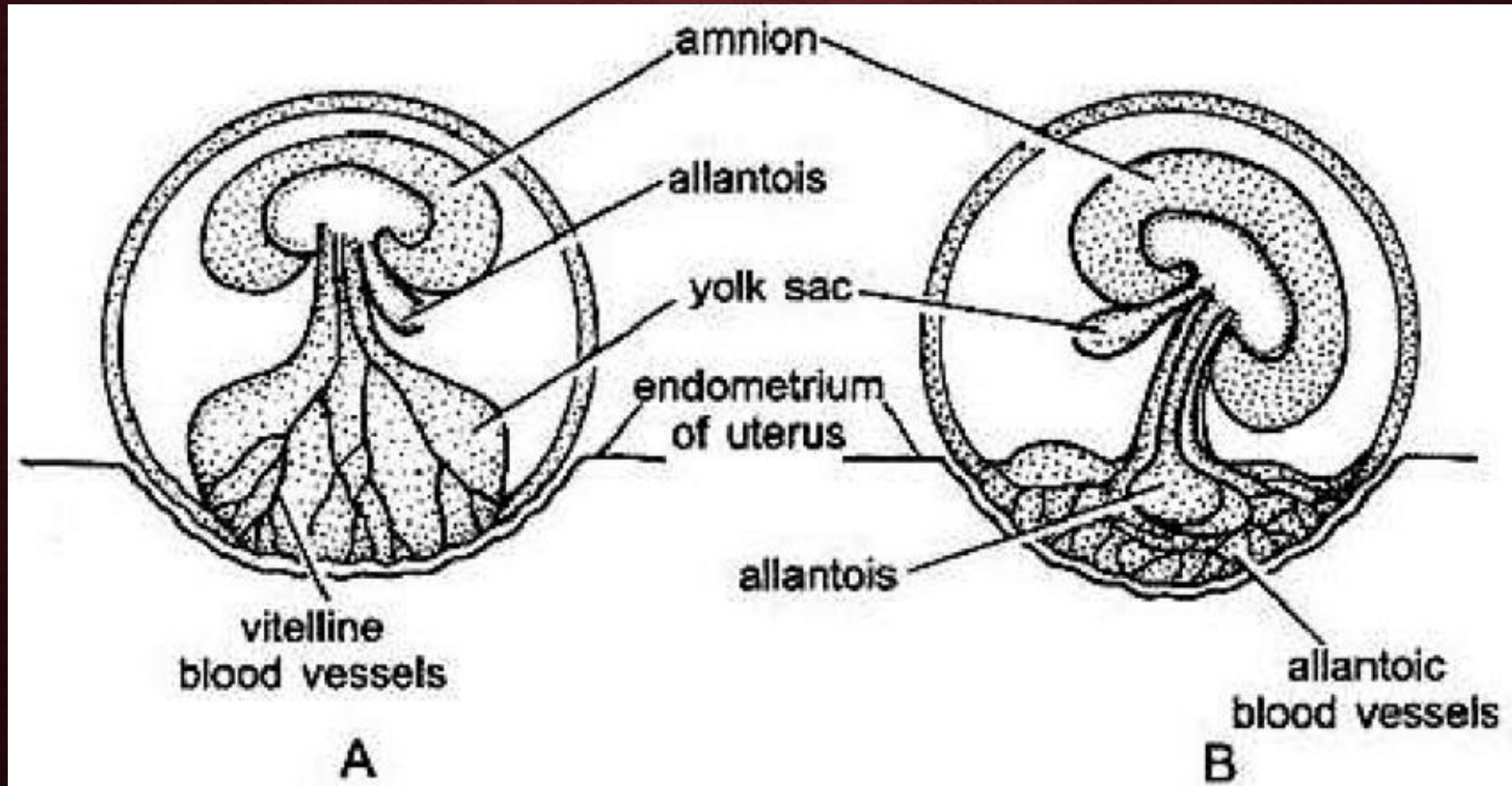
## Chorio-vitelline Placenta

- In this placenta chorion of the embryo, vitelline circulation of yolk sac and epithelium of the uterus together form an association known as choriovitelline Placenta
- Where found- choriovitelline Placenta is found in Marsupials like kangaroo, Macropus, didelphis etc.

## Chorio-allantoic placenta

- The Placenta in which chorion and allantois of the embryo and endometrium of the uterus form a complex organ and through allantoic circulation nutrition and other essential elements from the maternal blood pass on to embryonic circulation is known as chorioallantoic placenta
- Where found- in all eutherian mammals and in some marsupials

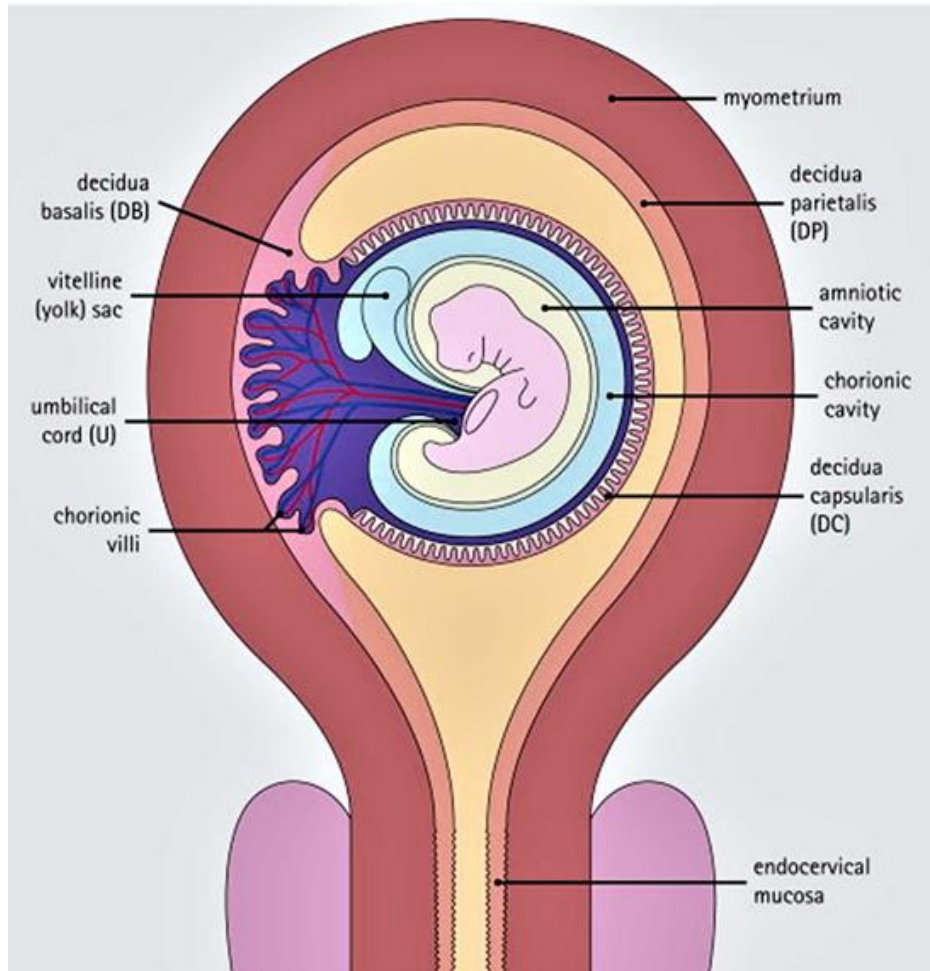
# TYPES OF PLACENTA



A- Chorio-vitelline placenta

B- Chorio-allantoic placenta

# DIVISIONS OF DECIDUA



After implantation of the blastocyst the endometrium of the uterus is divided into three Zones; as-

- Decidua basalis-The uterine area just below the blastocyst is known as decidua basalis.
- Decidua capsularis : The area of the uterus surrounding the chorionic villi.
- Decidua parietalis : The rest part of the uterus is known decidua parietalis.

# TYPES OF PLACENTA

(Based on number of barriers or structures)

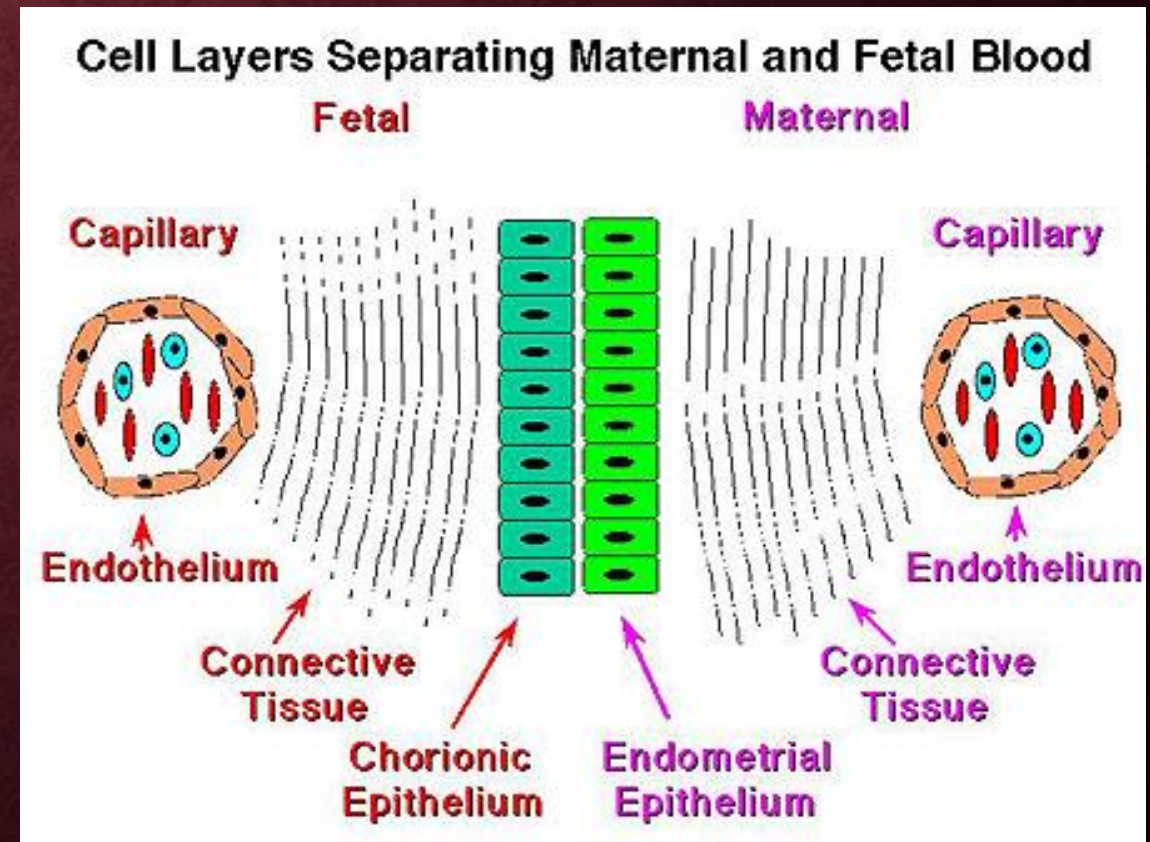
In placenta formation, six tissue or membranes or barriers take participation: They are

## Uterine tissue

- (i) Epithelium
- (ii) Connective tissue outside blood vessels
- (iii) The endothelium of the maternal blood vessels
- (iv) Maternal blood

## Foetal tissue

- (i) Chorionic epithelium
- (ii) Connective tissue
- (iii) Endothelium of chorionic blood vessels
- (iv) Foetal blood



# TYPES OF PLACENTA

(Based on number of barriers or structures)

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On histological basis, five types of mammalian placentae have been recognized:

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The types are

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i. Epitheliochorial

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ii. Syndesmochorial

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iii. Endotheliochorial

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iv. Haemochorial

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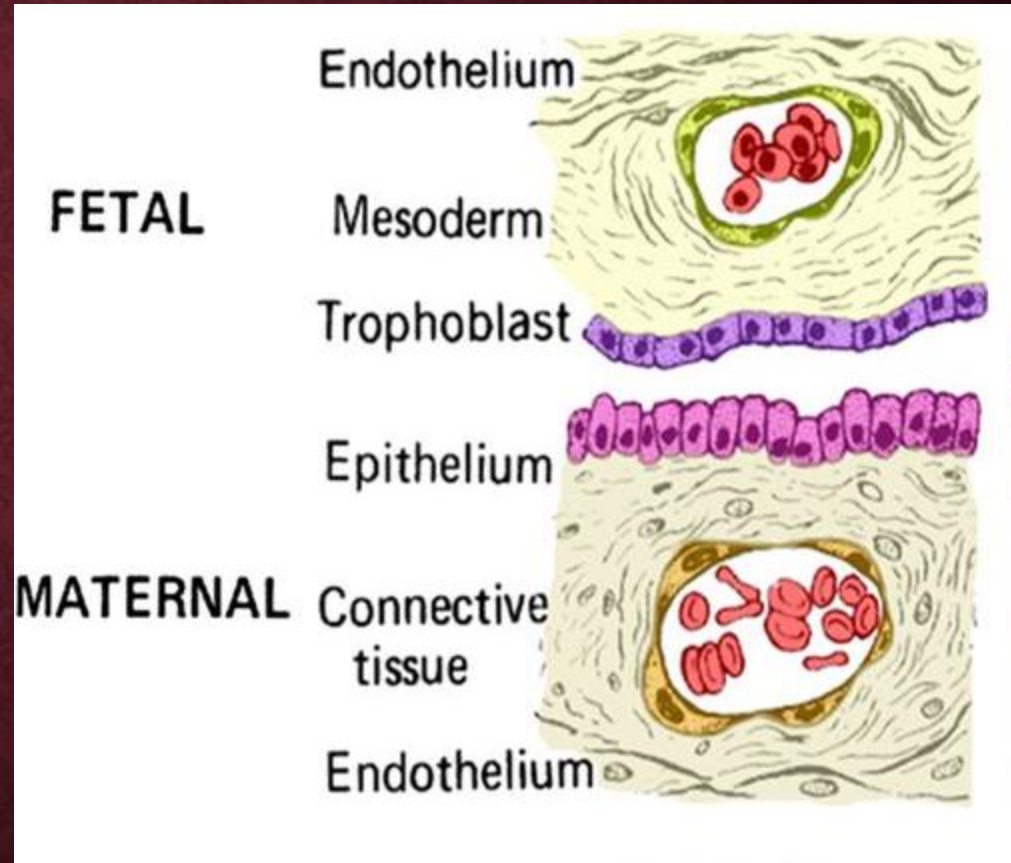
v. Haemo-endothelial

# TISSUES PARTICIPATING IN PLACENTA FORMATION

	UTERINE TISSUE	FOETAL TISSUE
E N D O M E T R I U M	1. Epithelium	1. Chorionic epithelium
	2. Connective tissue outside blood vessels	2. Connective tissue
	3. Endothelium of the blood vessel	3. Endothelium of chorionic blood vessel
	4. Maternal blood	4. Foetal blood

# I. EPITHELIOCHORIAL PLACENTA

E N D O M E T R I U	UTERINE TISSUE	FOETAL TISSUE
	1. Endothelium of the blood vessel	1. Chorionic epithelium
	2. Connective tissue	2. Connective tissue
	3. Uterine epithelium	3. Endothelium of foetal blood vessel



Examples- marsupials, pigs, horses etc.

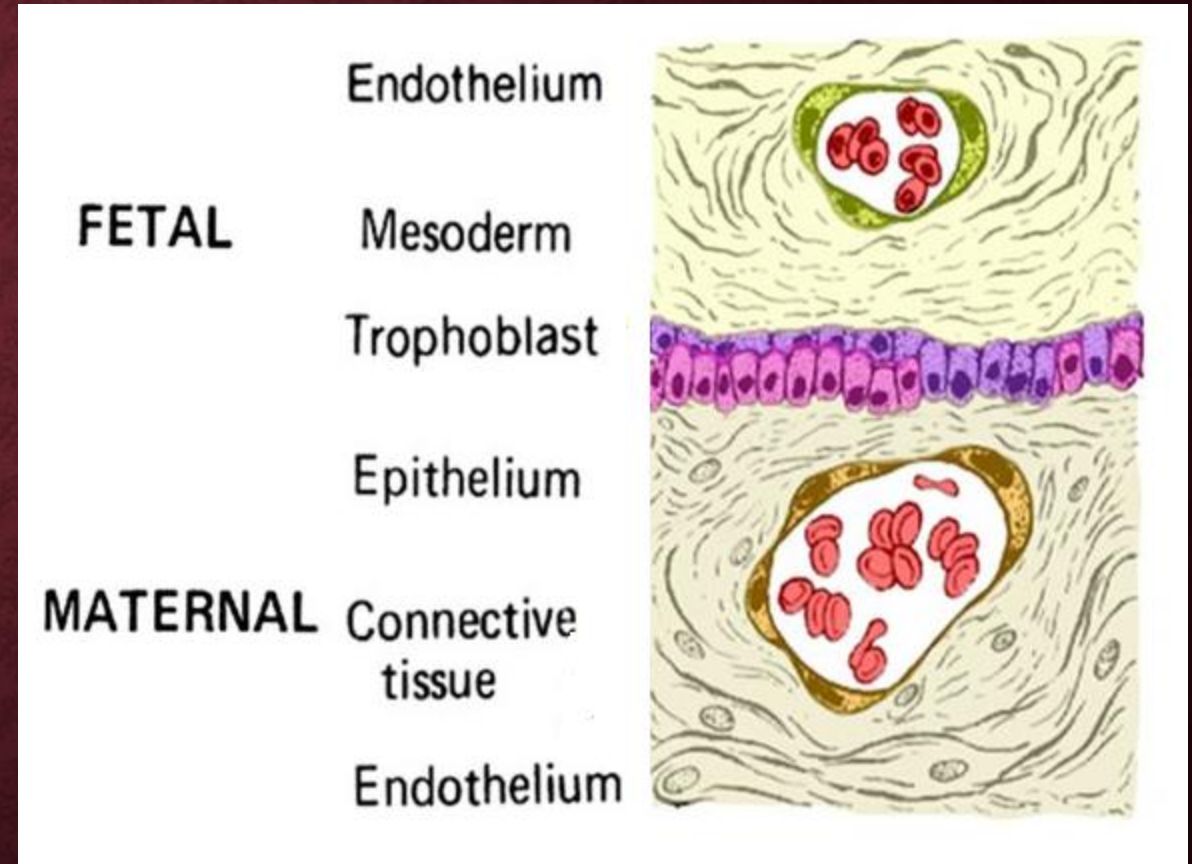
# I. EPITHELIOCHORIAL PLACENTA

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. This is a loose association where the epithelium of the uterus folds to form pockets and within this pocket chorionic villi rest.

If all **the six layers or barriers** are present the placenta is called **epithelio-chorial placenta.**

## 2. SYNDESMOCHORIAL PLACENTA

E N D O M E T R I U	UTERINE TISSUE	FOETAL TISSUE
	1. Endothelium of the blood vessel	1. Chorionic epithelium
	2. Connective tissue	2. Connective tissue
		3. Endothelium of foetal blood vessel



Examples- sheep, giraffe, deer etc.

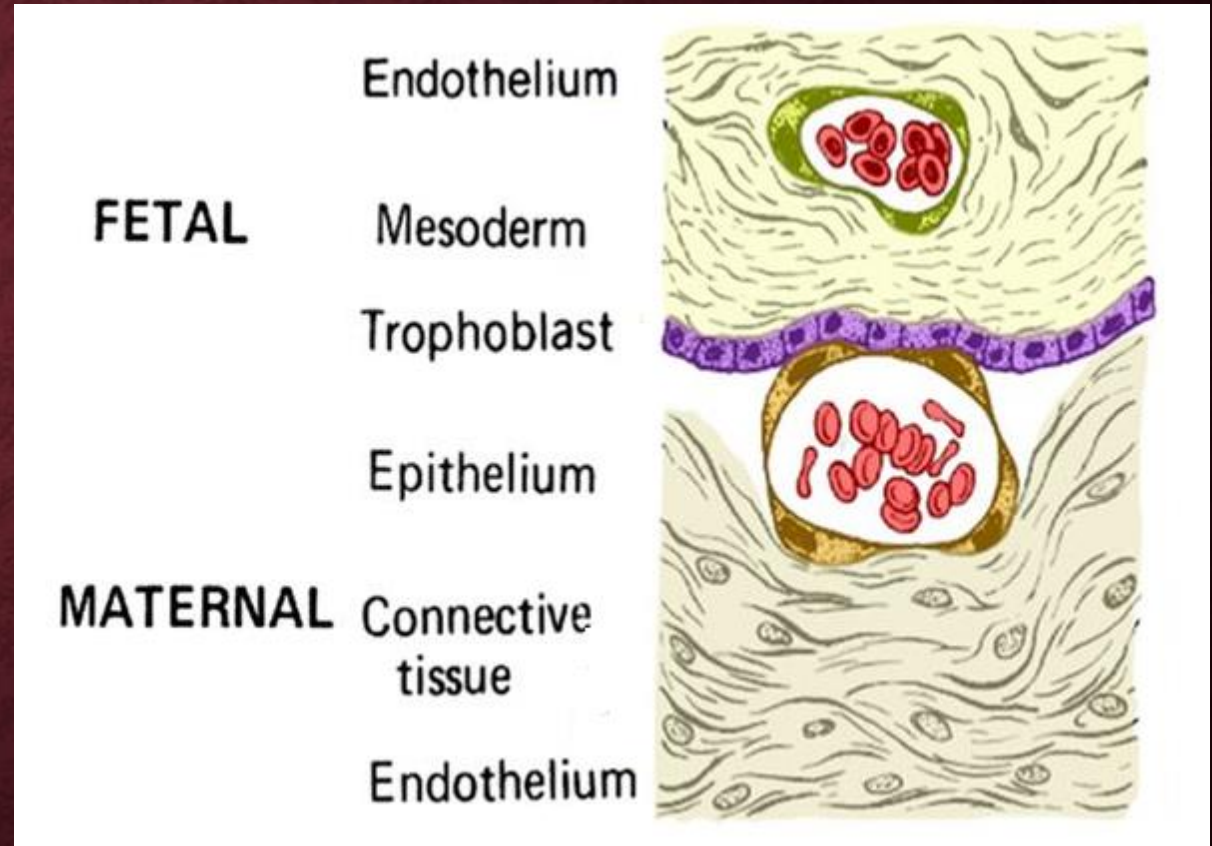
## 2. SYNDESMOCHORIAL PLACENTA

The foetal and maternal components are fused so intimately as to result in a destruction of the uterine epithelium, thus, bringing the chorion into contact with the connective tissue of the uterine mucosa. Thus, epithelium of the uterine wall is lost and chorionic villi reach up to the connective tissue of the uterine wall of the mother. In other words, the allanto-chorionic villi pierces into the uterus of the mother and the chorion comes in contact with syndesmosis of mother's uterus.

**Only five barriers** or tissues lies between the two (viz., foetal and uterine) blood streams. This type of placenta is called syndesmo-chorial placenta. Hence it is called syndesmochorial placenta

### 3. ENDOTHELIO-CHORIAL PLACENTA

UTERINE TISSUE	FOETAL TISSUE
1. Endothelium of the blood vessel	1. Chorionic epithelium
	2. Connective tissue
	3. Endothelium of foetal blood vessel



Examples- dog, cat, fox, jackal etc.

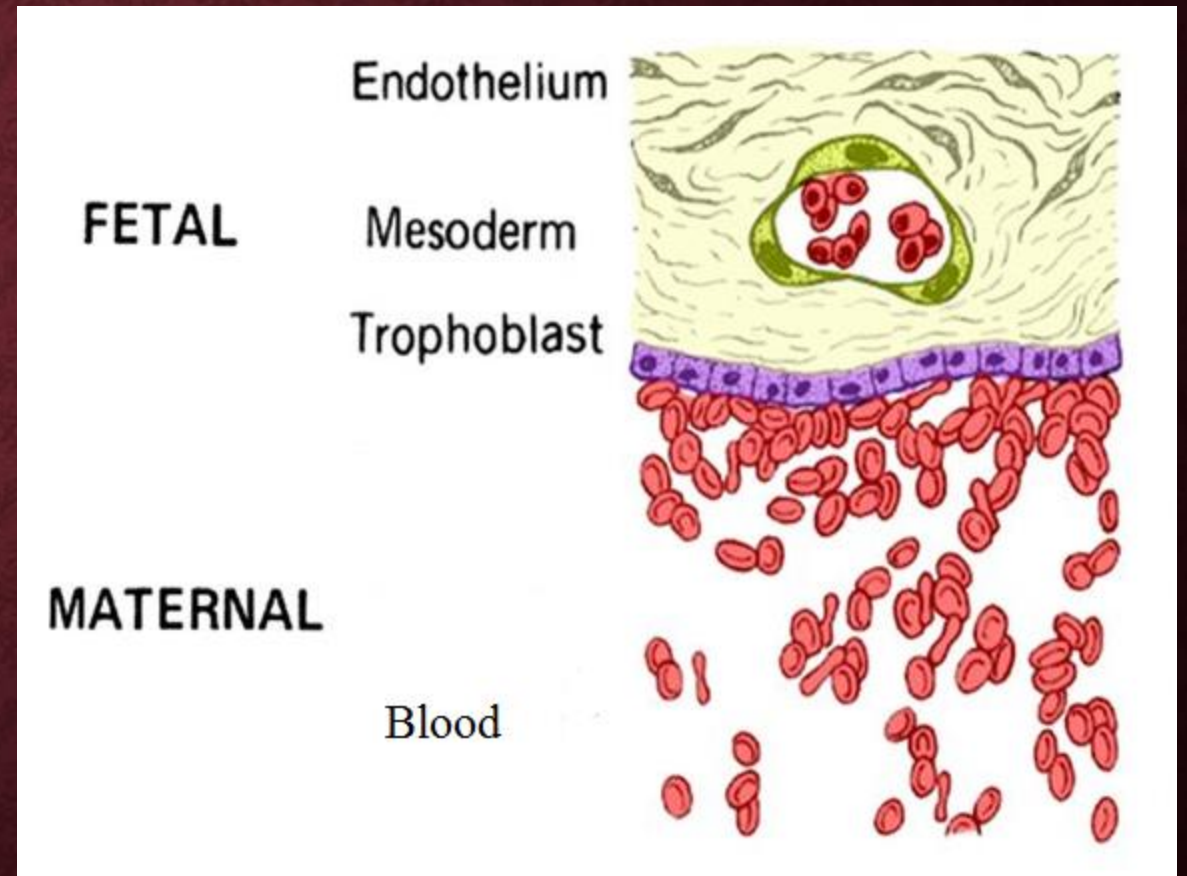
### 3. ENDOTHELIO-CHORIAL PLACENTA

In this type of placenta, the uterine mucosa is also reduced and the chorionic epithelium comes in contact with endothelial walls of the maternal (uterine) blood vessels. The chorion of the foetus will come in contact with the endothelium of mother 's uterus, hence it is called endothelio-chorial placenta.

In such a case, therefore, there **lies only four barriers** between the foetal and maternal blood streams. This type of placenta is called endothelio-chorial placenta.

## 4. HAEMOCHORIAL PLACENTA

E N D O M E T R I U	UTERINE TISSUE	FOETAL TISSUE
	1. Blood lacunae of mother	1. Chorionic epithelium
		2. Connective tissue
		3. Endothelium of foetal blood vessel



Examples- Human being and all other primates

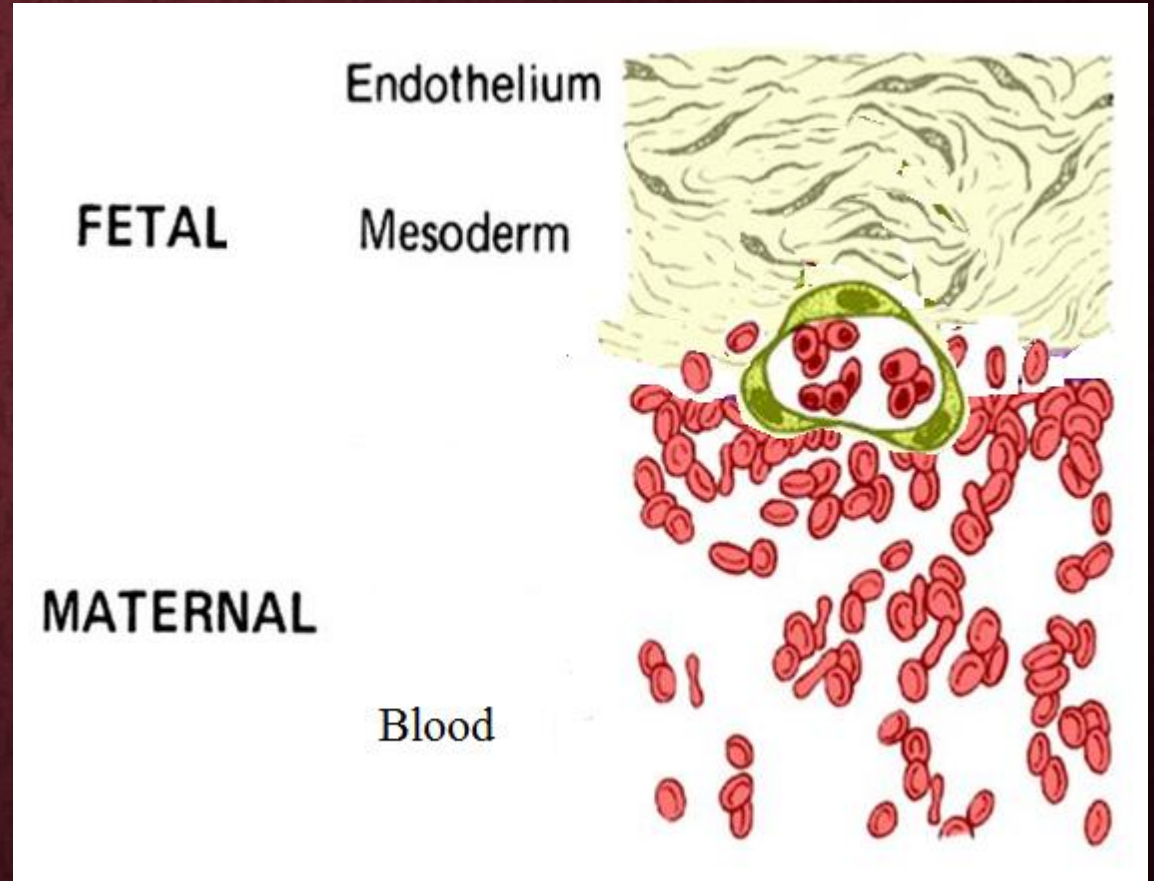
## 4. HAEMOCHORIAL PLACENTA

In this type of placenta, the endothelial walls of maternal (uterine) blood vessels also disappear and the chorionic epithelium is **bathed directly in maternal blood sinuses**. Actually, the chorionic villi are surrounded by spaces (sinuses) devoid of endothelial lining, into which maternal blood enters through the uterine arteries flows out through the uterine veins.

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

# 5. HAEMO-ENDOTHELIAL PLACENTA

E N D O M E T R I U M	UTERINE TISSUE	FOETAL TISSUE
	1. Blood lacunae of mother	1. Endothelium of foetal blood vessel



Examples- Rabbit, rat etc.

## 5. HAEMO-ENDOTHELIAL PLACENTA

The chorionic villi lose their epithelial and connective tissue layers to such a degree that, in most places, the bare endothelial lining of their blood vessels alone separates the foetal blood from the maternal blood sinuses. Foetal blood vessels immerse directly into the blood lacunae of mother.

There is only one layer of tissue barrier.

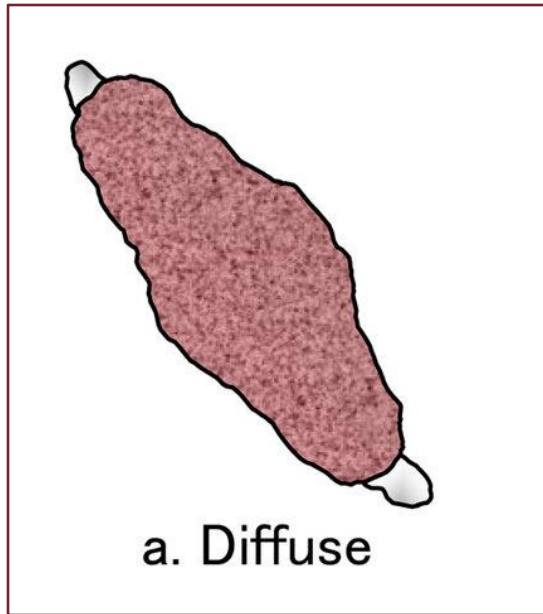
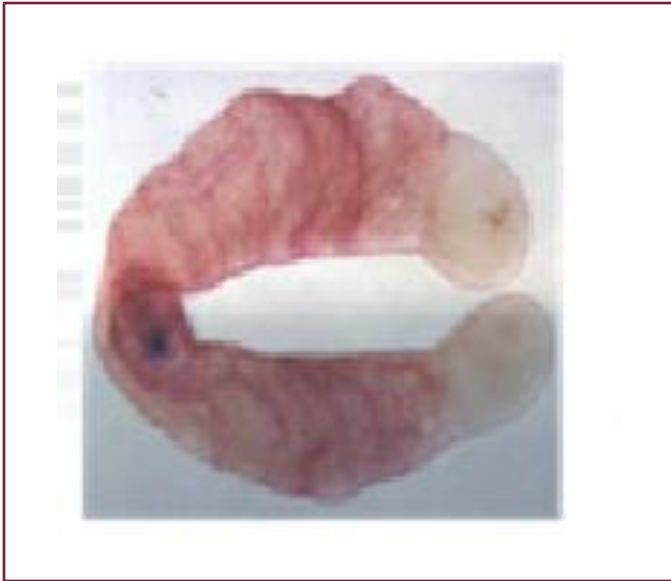
# CHORIONIC VILLI

The chorionic villi are the site where virtually all maternofetal and fetomaternal exchange takes place. Most metabolic and endocrine activities of the placenta are localized there as well. The villi have a dual blood supply from both the fetal and maternal circulations.

## TYPES OF PLACENTA (BASED ON ARRANGEMENT OF CHORIONIC VILLI)

### Diffuse placenta

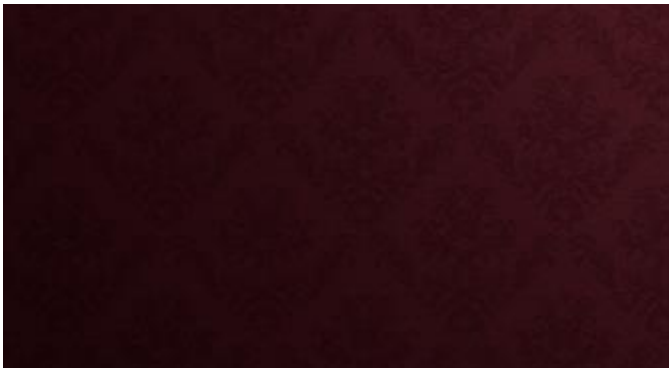
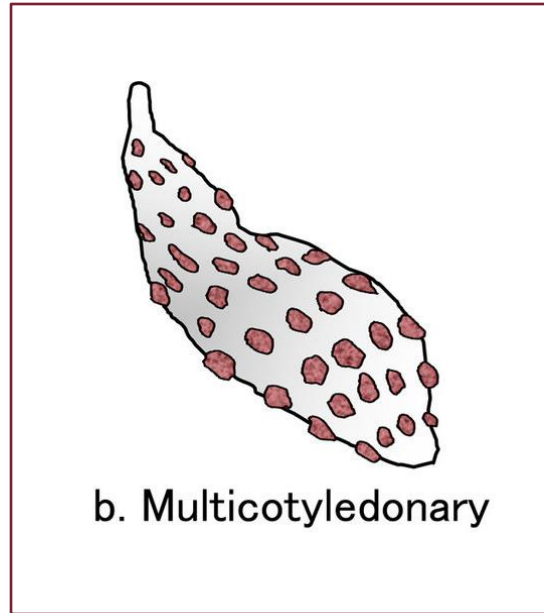
Almost the entire surface of the allantochorion is involved in formation of the placenta. Seen in horses and pigs.



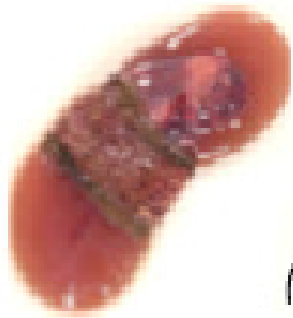
## TYPES OF PLACENTA (BASED ON ARRANGEMENT OF CHORIONIC VILLI)

### Cotyledonary placenta

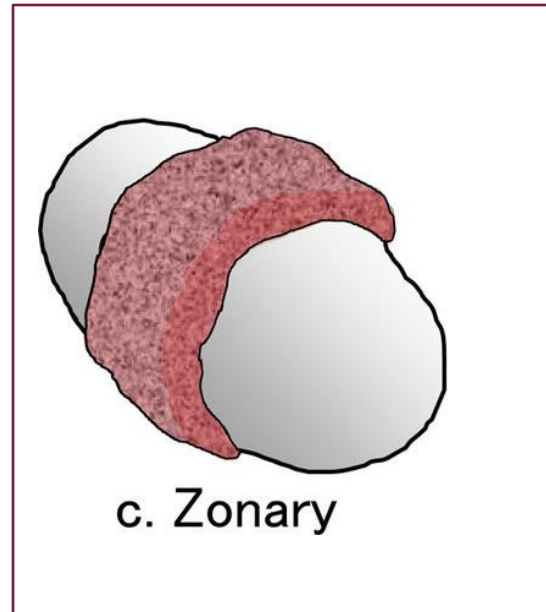
Multiple, discrete areas of attachment called cotyledons are formed by interaction of patches of allantochorion with endometrium. The fetal portions of this type of placenta are called cotyledons, the maternal contact sites (caruncles), and the cotyledon-caruncle complex a placentome. This type of placentation is observed in ruminants.



## TYPES OF PLACENTA (BASED ON ARRANGEMENT OF CHORIONIC VILLI)



(Dog)

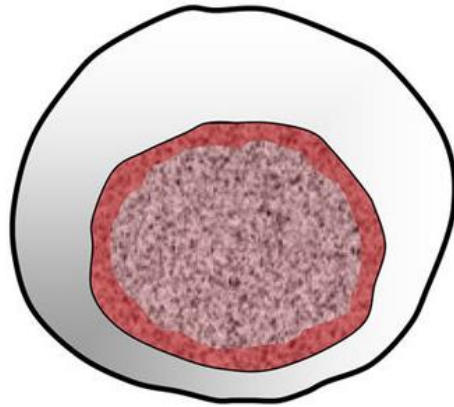


c. Zonary

### Zonary placenta

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

## TYPES OF PLACENTA (BASED ON ARRANGEMENT OF CHORIONIC VILLI)



d. Discoid

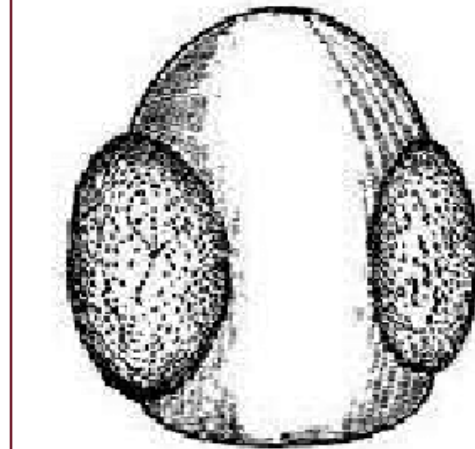


(Mice)

### Discoidal placenta

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

## TYPES OF PLACENTA (BASED ON ARRANGEMENT OF CHORIONIC VILLI)



### **Bidiscoidal placenta**

Chorionic villi are arranged in two discs instead of one.

Example -Monkeys

# WHY MATERNAL AND EMBRYONIC BLOOD DO NOT GET MIXED

- ❖ As the blood pressure of arterial capillaries of mother's blood vessels is very high in compare to tender blood vessels of the foetus and it allowed to flow through foetal blood vessels then they will burst and the foetus will die.
- ❖ There are some protein which a mature individual can tolerate but not the foetal tissue. If such protein is brought to foetal blood via maternal circulation then the foetal tissue will be disintegrated leading to the death of the foetus.
- ❖ Maternal blood carries many hormones and there are hormones which are sex hormones. This sex hormones may influence the foetus and various abnormalities may be found in the foetus.
- ❖ To avoid these difficulties that may disturb the normal development of the foetus the nature has created such tissue barriers in which maternal blood and foetal blood never get mixed.

All the functions of placenta can be divided into two groups as

(i) Positive functions

(ii) Negative functions.

# **FUNCTIONS OF PLACENTA**

# POSITIVE FUNCTIONS OF PLACENTA

Those functions of the placenta which are essential and beneficial to the foetus, are known as positive functions. They are

- (1) Through placenta the embryo is planted on the uterine wall as a result the embryo is protected.
- (2) Water, Oxygen, inorganic salts, ions etc. from maternal blood diffuses into the body of the embryo.
- (3) For the nutrition and growth of the embryo carbohydrate molecules of low molecular weight, amino acid and lipid molecules pass on from the maternal blood via placenta to the body of the embryo by active transport.
- (4) Proteins, hormones and antibody or etc the molecules of high molecular weight pass on to the embryo either by pinocytosis or by diffusion from the mother through placenta.
- (5) As maternal antibody reaches the embryo from the mother, so the embryo is protected from the diseases like measles, pox, diphtheria etc.
- (6) The metabolic products like urea, water, carbon dioxide, non essential ions etc. reach the maternal blood from the embryo and expelled from the mother through definite pathways.

# NEGATIVE FUNCTIONS OF PLACENTA

- ❖ Germs of syphilis, chicken and small pox overcome the placental barrier and may enter the body of embryo and the embryo may be attacked with them.
- ❖ If mother takes medicine like thalidomide then it may cross the placental barrier and may cause great damage to the embryo.

# PLACENTAL HORMONES

Placenta secretes four types of hormone. These hormones are

1. Protein hormones and (2) steroid hormones

(1) Protein hormones

- Lactogen
- Luteotropin - protects the corpus luteum and in early stage corpus luteum secretes oestrogen and progesteron. These hormones help in implantation and penetration of the embryo on the uterine wall.

(2) Steriod hormone

- Progesterone
- Oestrogen- help in parturition

# TABLE SHOWING DIFFERENT TYPES OF PLACENTA

Serial no	Placenta Type (according to tissue)	Uterine tissue			Foetal tissue			Arrangement of villi	Fate of endometrium	Examples
		Endothelium tissue	Connective tissue	Epithelium tissue	Epithelium tissue	Connective tissue	Endothelium tissue			
1	Epithelio-chorial	P	P	P	P	P	P	Diffuse	Non deciduous	Pig, Horse Marsupial
2	Syndesmochorial	P	P	A	P	P	P	Cotyledon	Transitory	Sheep, Cows
3	Endotheliochorial	P	A	A	P	P	P	Zonary	Deciduous	Cat, Dog
4	Haemochorial	A	A	A	P	P	P	Zonary	Deciduous	Man, Apes, Rat
5	Haemoendothelial	A	A	A	A	A	P	Discoidal	Deciduous	Guinepig, Rabbit etc.

P = Present, A = Absent

# REFERENCE BOOKS

- ❖ 'Modern approach to a textbook of Zoology' by Dr Asim Kr. Chatterjee and Dr. Chandrasekhar Chakrabarti
- ❖ "An introduction to embryology" by Balinsky and Fabian



**THANK YOU**