

# *The placenta*

*Dr . Rana Khalaf*

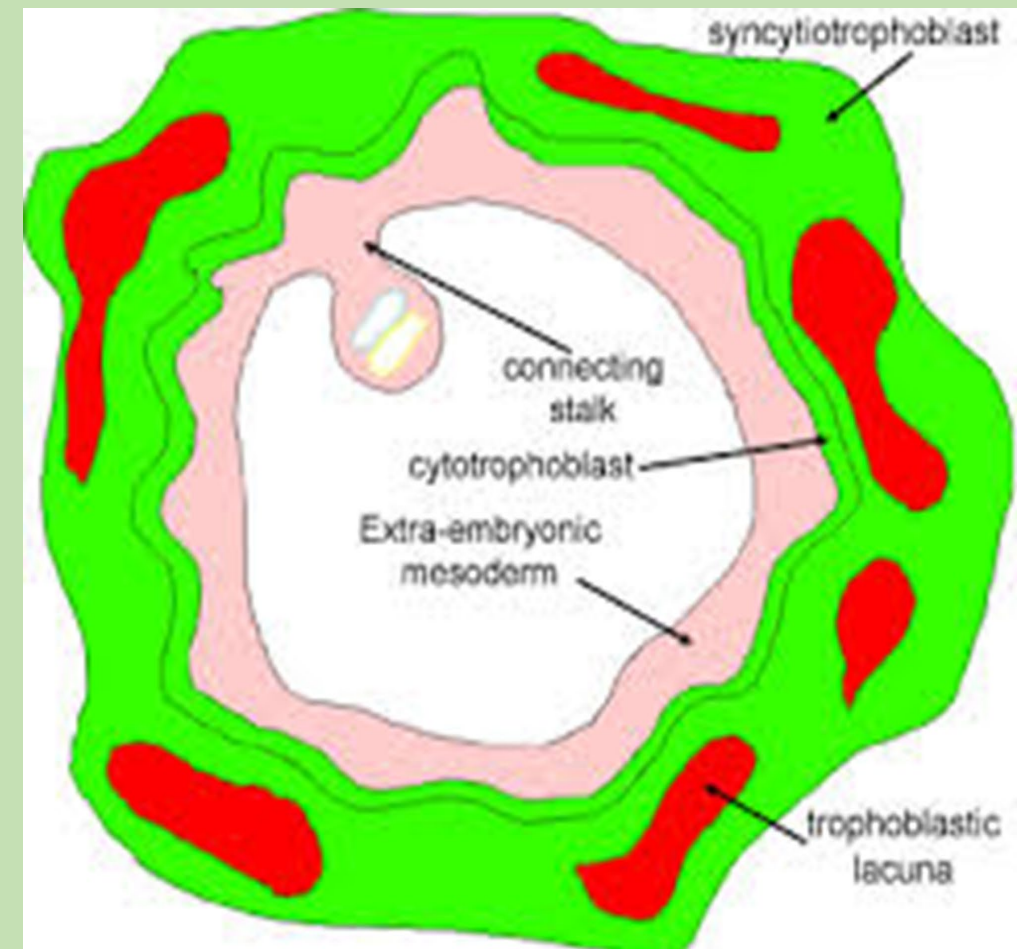
- **The placenta** is a vital connecting organ between the maternal uterus and the fetus.
- It supports the developing fetus, in utero, by supplying nutrients, eliminating waste products of the fetus and enabling gas exchange via the maternal blood supply.

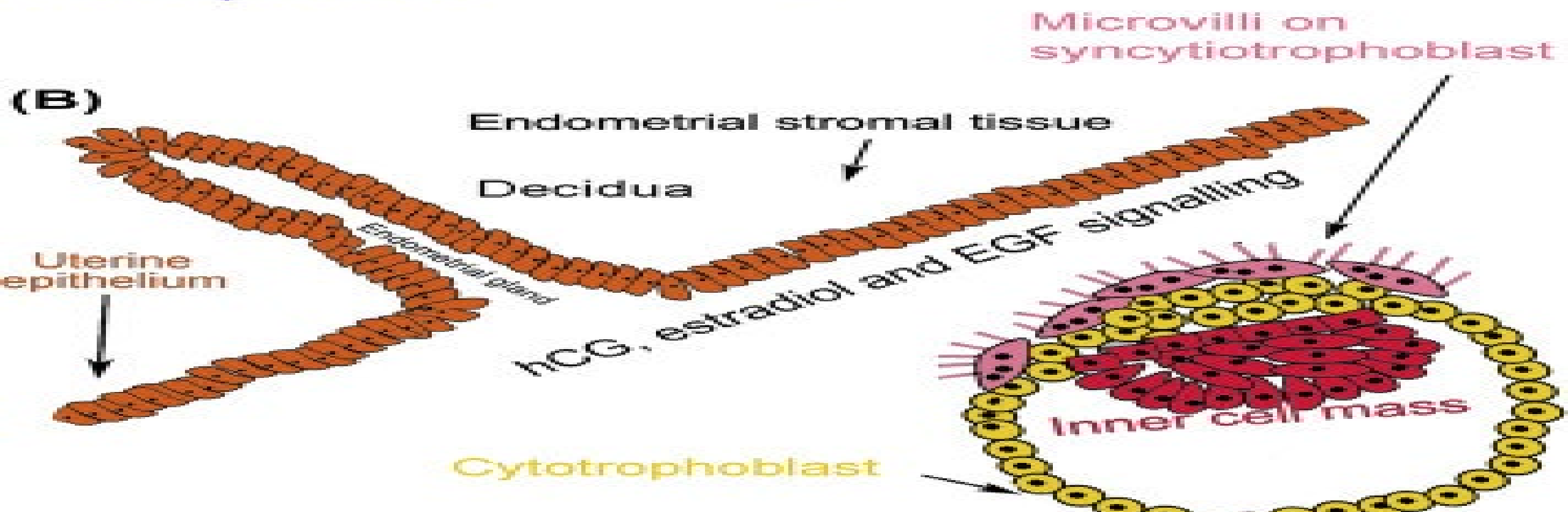
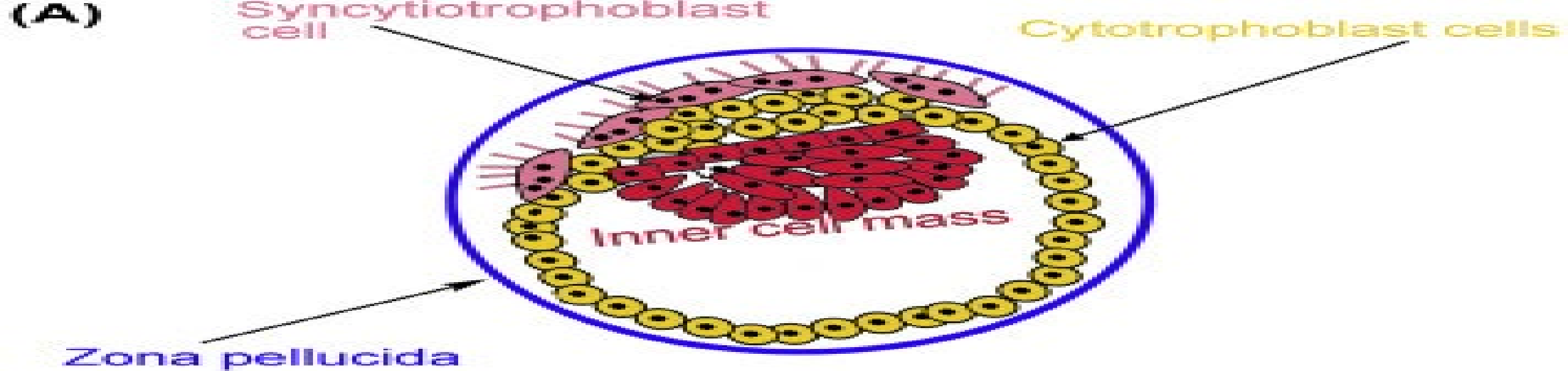
## • Pre-Implantation

- The development of the placenta begins during implantation of the blastocyst.
- The 32-64 cell blastocyst contains two distinct differentiated embryonic cell types: the outer trophoblast cells and the inner cell mass. The trophoblast cells form the placenta. The inner cell mass forms the fetus and fetal membranes.

The trophoblast cells differentiate into the outer multinucleated syncytiotrophoblast, which erodes maternal tissues by sending out projections, and the inner mononucleated cytotrophoblast, which is actively proliferating.

The syncytiotrophoblast is responsible for producing hormones.

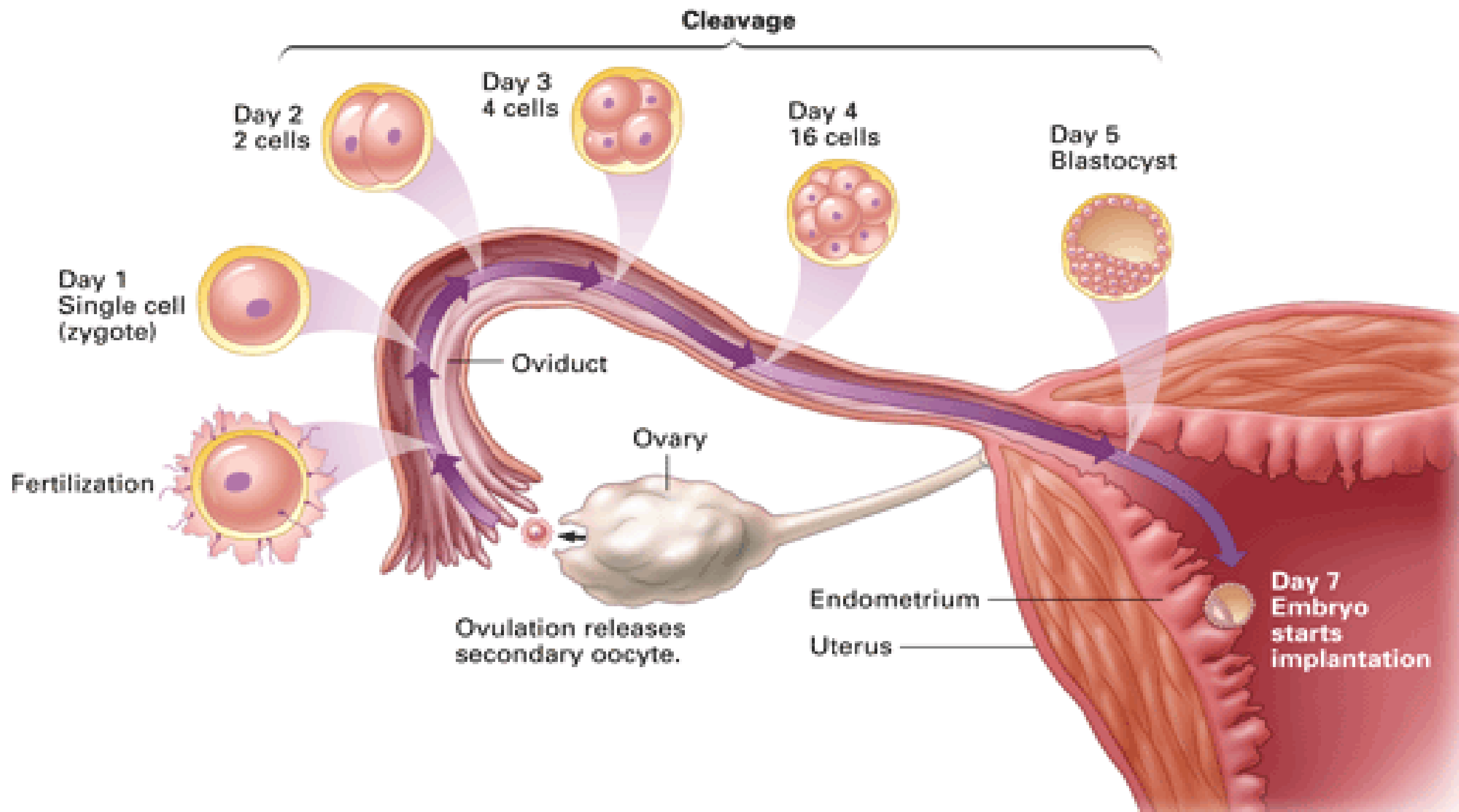




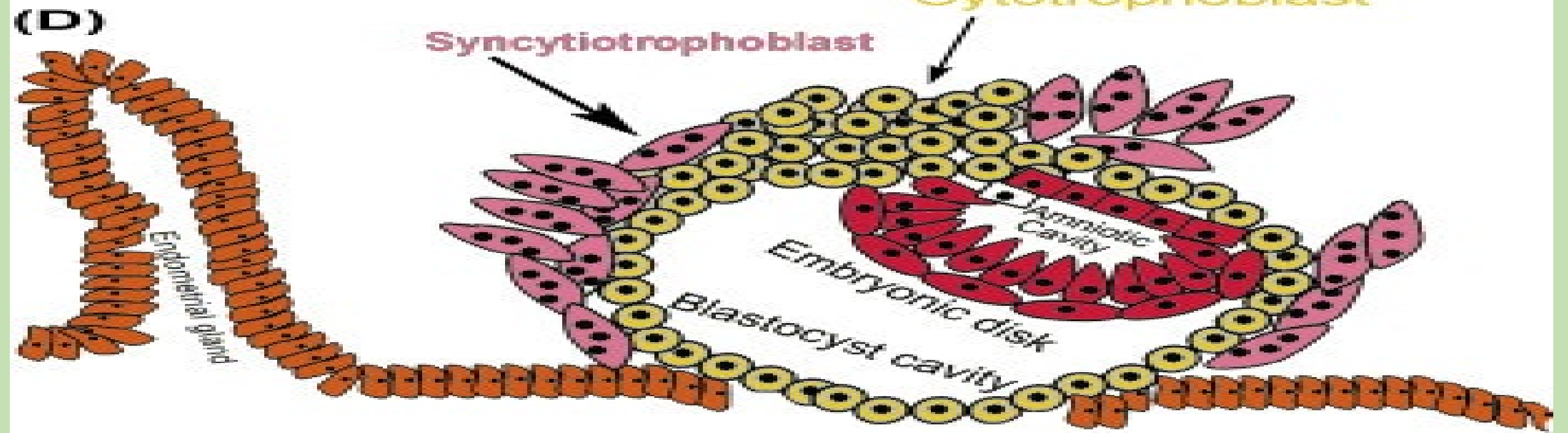
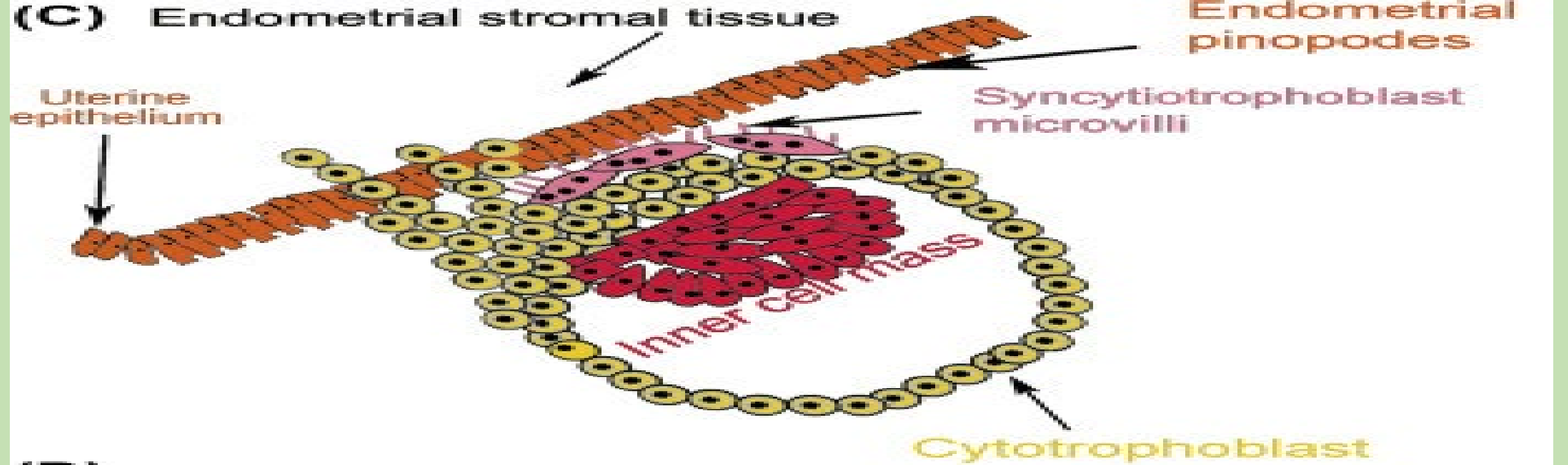
# • Implantation

- Syncytiotrophoblast cells on a blastocyst develop microvilli. The blastocyst hatches. With hatching, the syncytiotrophoblast cells produce hCG, estradiol, and EGF which signal to the uterine epithelium that a blastocyst is about to implant
- The trophoblast cells interact with the endometrial decidual epithelia to enable the invasion into the maternal uterine cells.
- The trophoblast cells interact with the endometrial decidual epithelia to enable the invasion into the maternal uterine cells.

- The embryo then secretes proteases to allow deep invasion into the uterine stroma. Implantation is interstitial. Normal implantation occurs on the anterior or posterior wall of the body of the uterus. The most common ectopic implantation site is in the ampulla of the Fallopian tube.





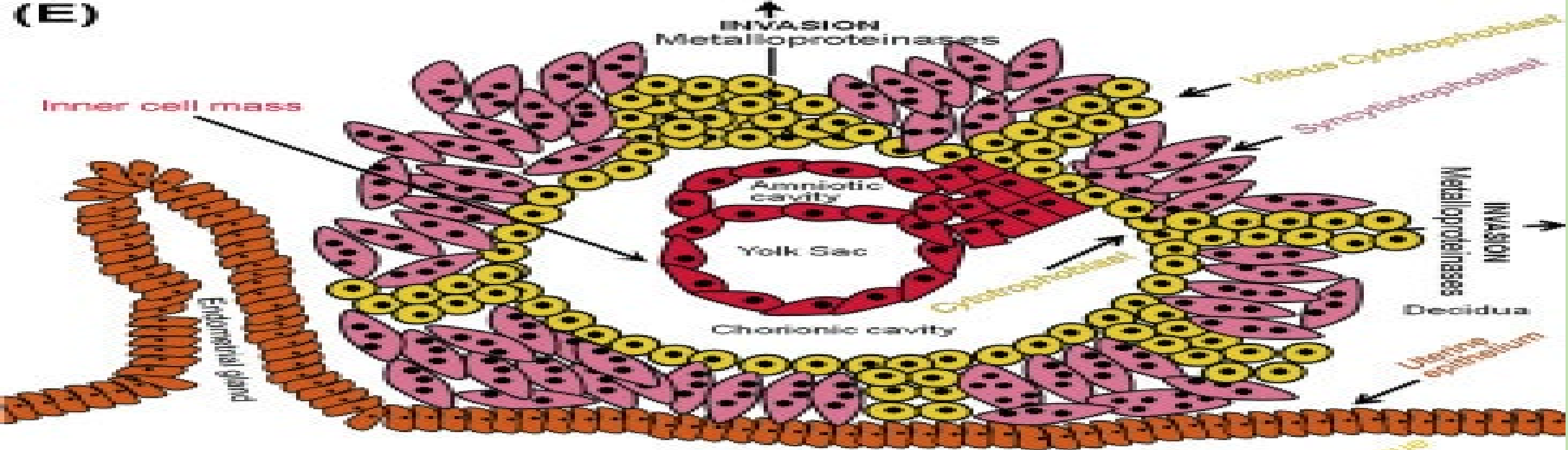


- Post-Implantation

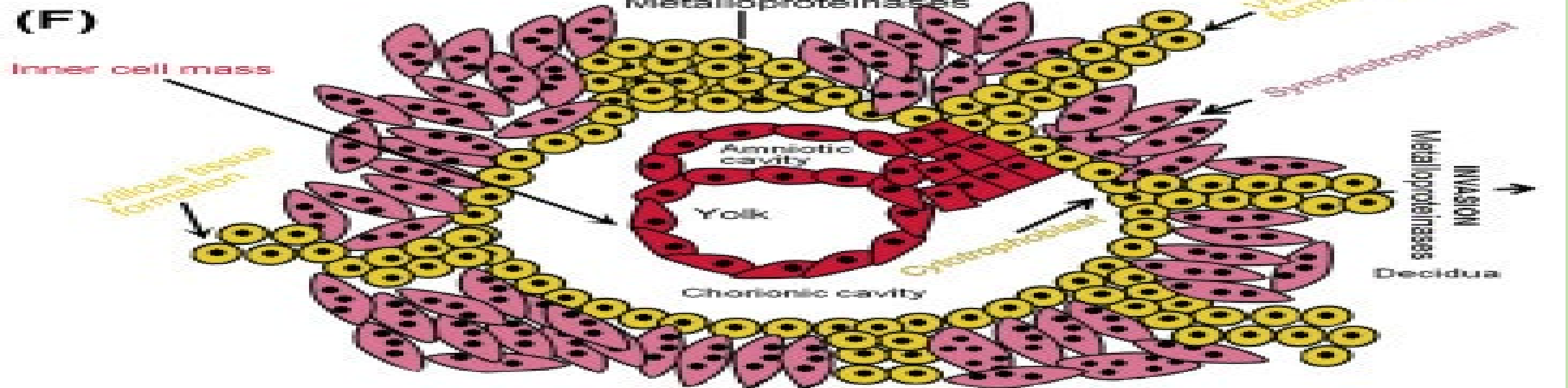
- lacunae or spaces form within the syncytiotrophoblast.

The syncytiotrophoblast also erodes maternal tissues allowing maternal blood from uterine spiral arteries to enter the lacunar network. Thus early uteroplacental circulation is established.

(E)



(F)



- Meanwhile, the cytotrophoblast begins to form primary chorionic villi (finger-like projections) which penetrate and expand into the surrounding syncytiotrophoblast, the extra-embryonic mesoderm grows into these villi called secondary chorionic villi.
- By the end , embryonic vessels begin to form in the embryonic mesoderm of the secondary chorionic villi, making them tertiary chorionic villi

- The placenta is composed of two different surfaces:
- The maternal surface, facing towards
- the outside. Derived from the endometrium.
  
- The fetal surface, facing towards the
- inside, or the fetus. Derived from the chorionic sac.

On the fetal surface, we can observe the umbilical cord, the link between the placenta and the fetus. Placenta and umbilical cord form a transport system for substances between mother and fetus



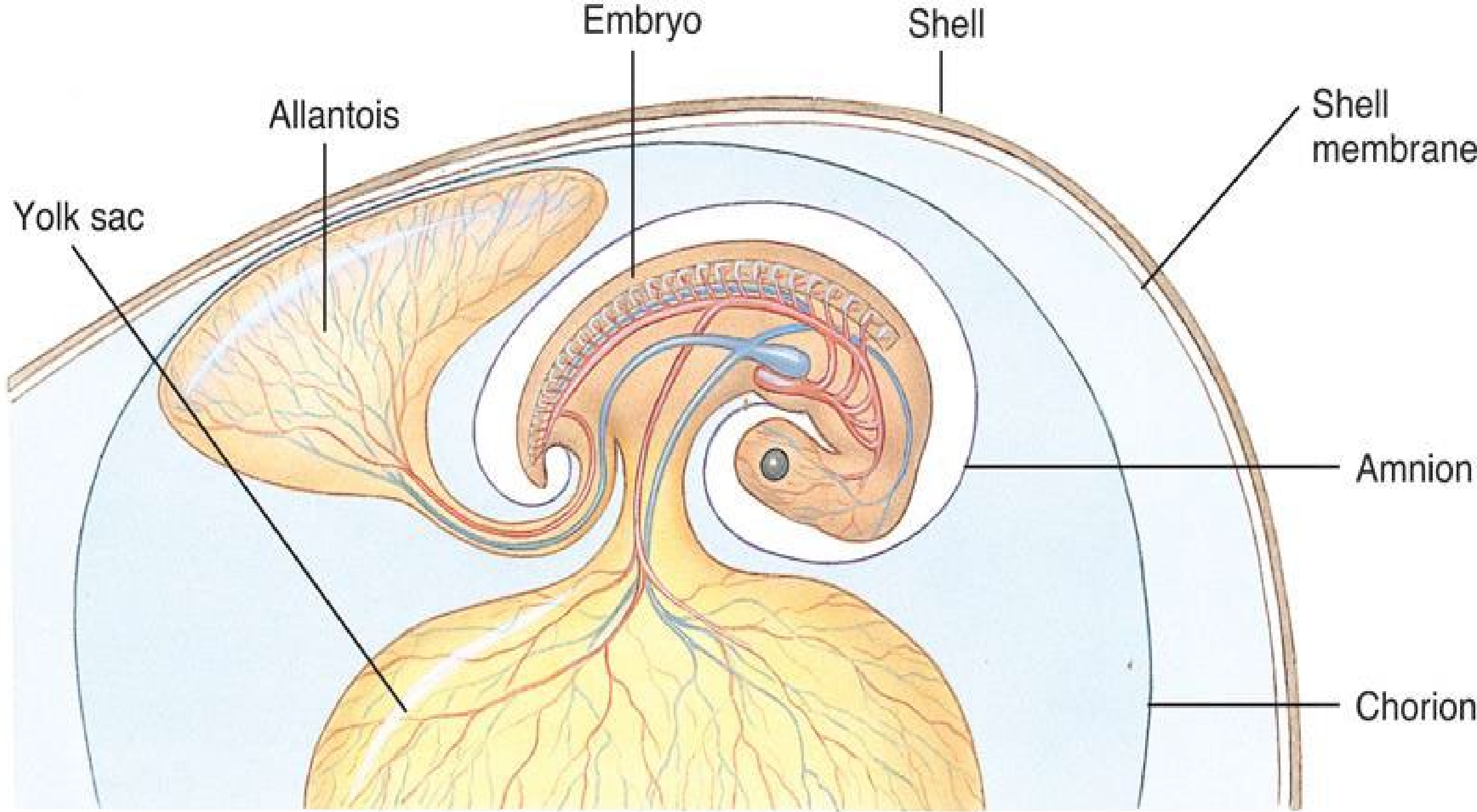
- In the mammalian organisms, the three germ layers give
- rise to the four extraembryonic membranes that
- surround the developing embryo
- **Amnion** – fluid filled membranous sac that encloses the embryo.  
Protects embryo from shock.
- **Yolk sac** –on Source of stem cells that give rise to blood and lymphoid cells. Stem cells migrate to into the developing
- embryo

- **Chorion** - lies beneath the eggshell and encloses the embryo and other extraembryonic membrane.

- **Allantois** - storage of metabolic wastes during development.

Contributes to the formation of the umbilical cord





- Placental functions

- During pregnancy, the placenta has

- 6 main roles to maintain good health and a good environment for the growing fetus:

- 1- Respiration

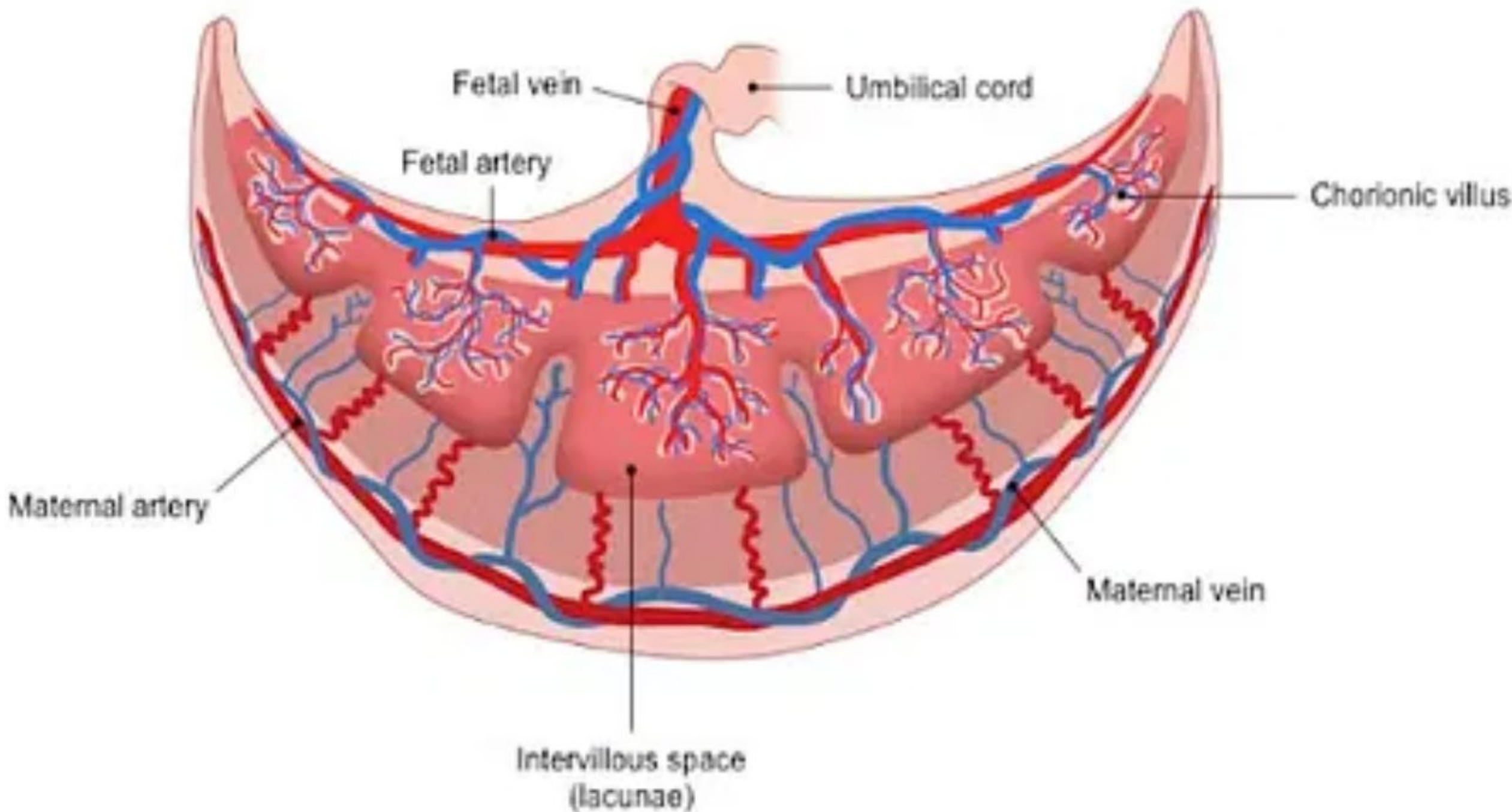
- 2- Nutrition

- 3 -Excretion

- 4- Protection

- 5 -Endocrine

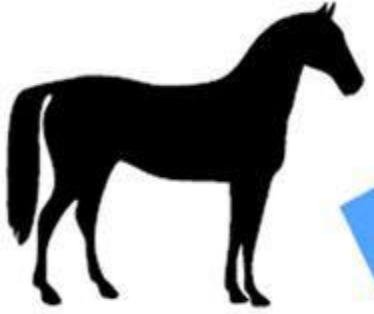
- 6 -Immunity



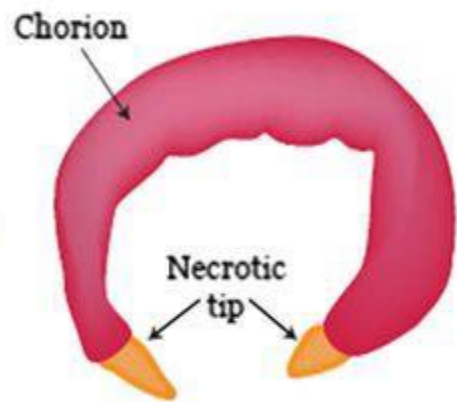
## classification of placental

- The placentas was classification according to structural and functional features, but there are differences among species
- in gross and microscopic structure of the placenta.

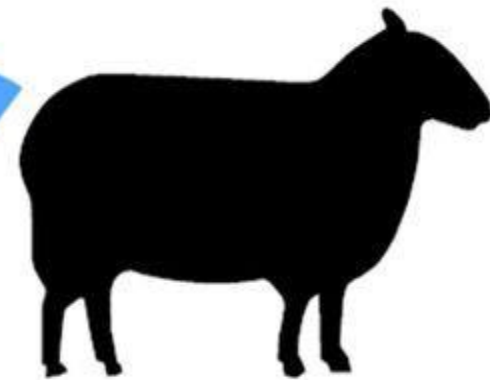
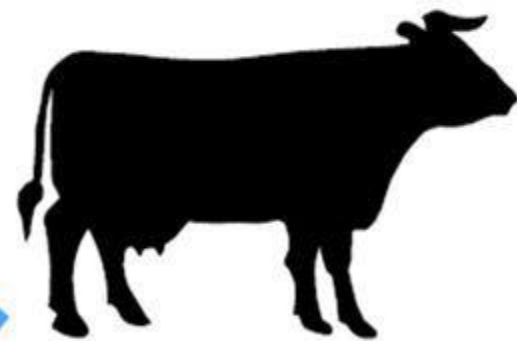
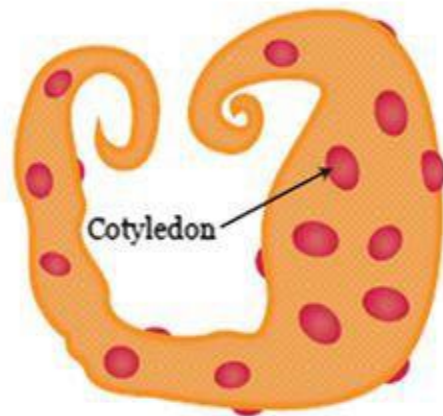
- **classification of placental types:** according to
- The gross shape of the placenta
- The distribution of contact sites between fetal membranes and endometrium.
- The number of layers of tissue between maternal and fetal vascular systems.
- Types of Implantation fetal on uterine wall



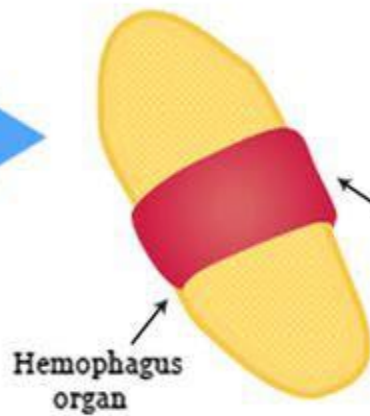
DIFFUSE



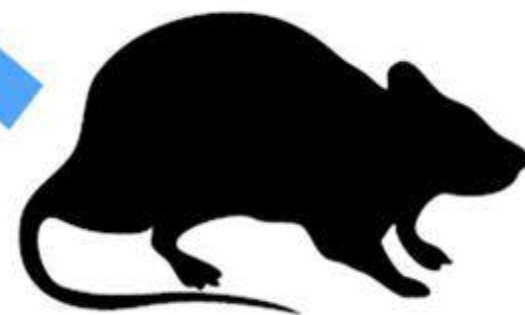
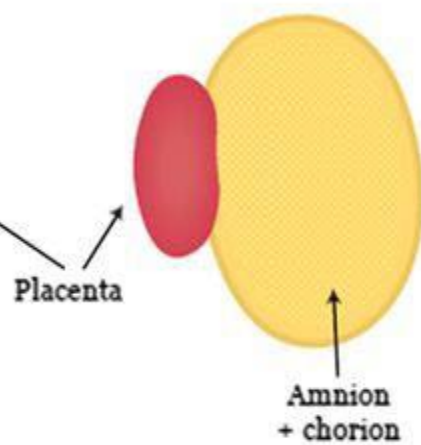
COTYLEDONARY



ZONARY

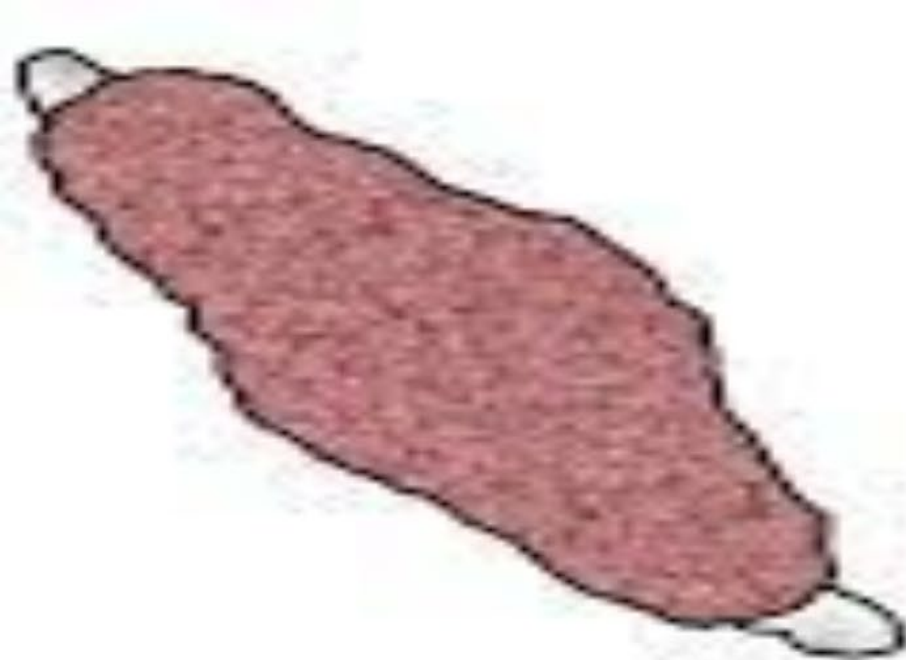


DISCOID

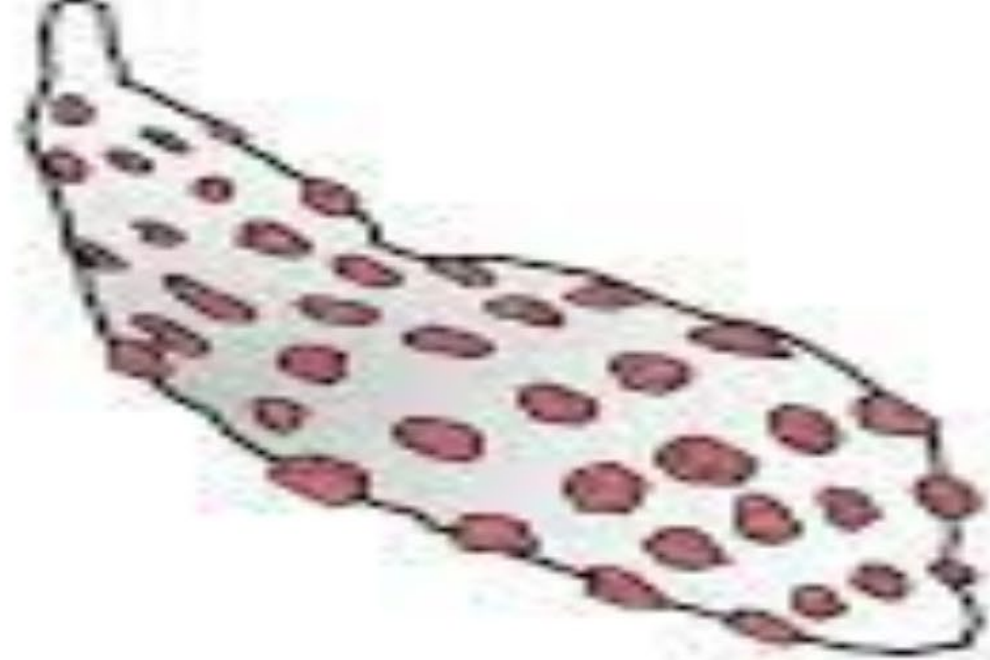


# A-CLASSIFICATION BASED ON DISTRIBUTION OF VILLI OR CHORION

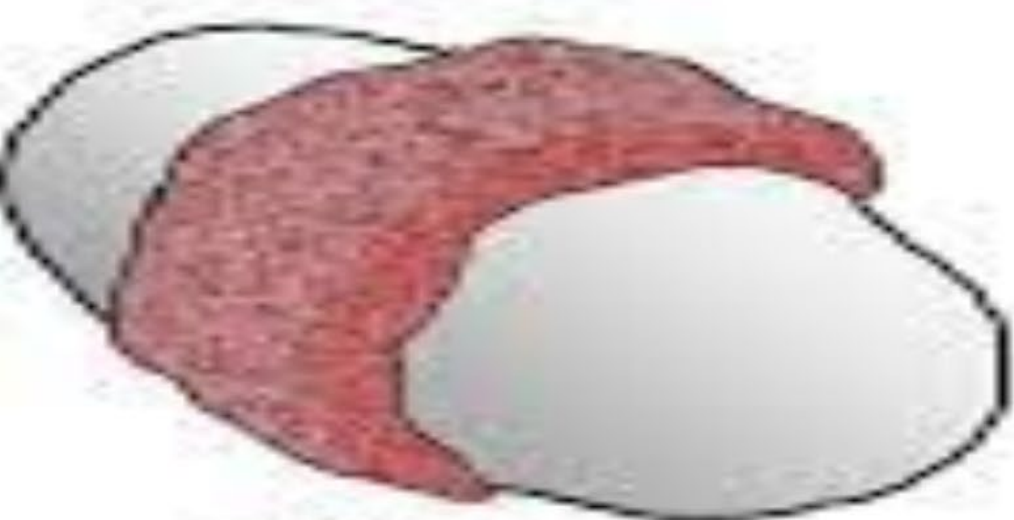
- 1-Diffused –Villi scattered all over the surface of blastocyst eg. Mare and Pig
2. Cotyledonary –Villi distributed in isolated patches Goat and Ruminants like Deer, Sheep, Cattle .
3. Zonary –Villi arranged in definite band or girdle encircling the middle of blastocyst eg. Carnivores, Cats, Dogs .
4. Discoidal –Villi located in one or two discoidal areas or patches eg. Mouse, Rat, Rabbit, Monkey and human



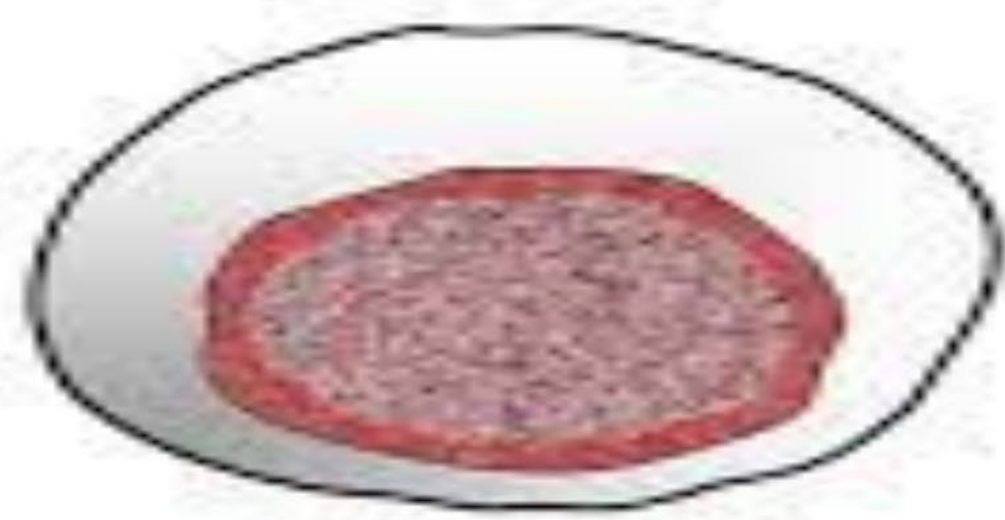
a. Diffuse



b. Multicotyledonary



c. Zonary



d. Discoid



# B-BASED ON THE DEGREE OF ASSOCIATION BETWEEN FETAL AND MATERNAL TISSUE ( MAMMALS

1-Non-deciduate (non-deciduos) placenta –Implantation superficial; foetal chorionic epithelium lies in contact with the uterine epithelium and at the time of birth the fetal villi are drawn out completely without tearing or causing injury to the uterine wall and no bleeding occurs eg. Pigs, Cattles, Horse & other Ruminates

2-Deciduate (Deciduos) placenta –Implantation is more intimate; the wall of the uterus become eroded so that the fetal chorionic epithelium may come to lie either in the connective tissue or into the maternal blood and at the time of parturation when fetal part separate from the uterine part of the placenta there is more or less extensive bleeding or haemorrhageand tearingof tissue from the uterine wall eg. Human, Rabbit, Dog, Cat

3-Contra-Deciduate placenta –implantation or association is intimate but both fetal and maternal tissue are absorbed insitu by maternal leucocytes eg. Talpa(mole)

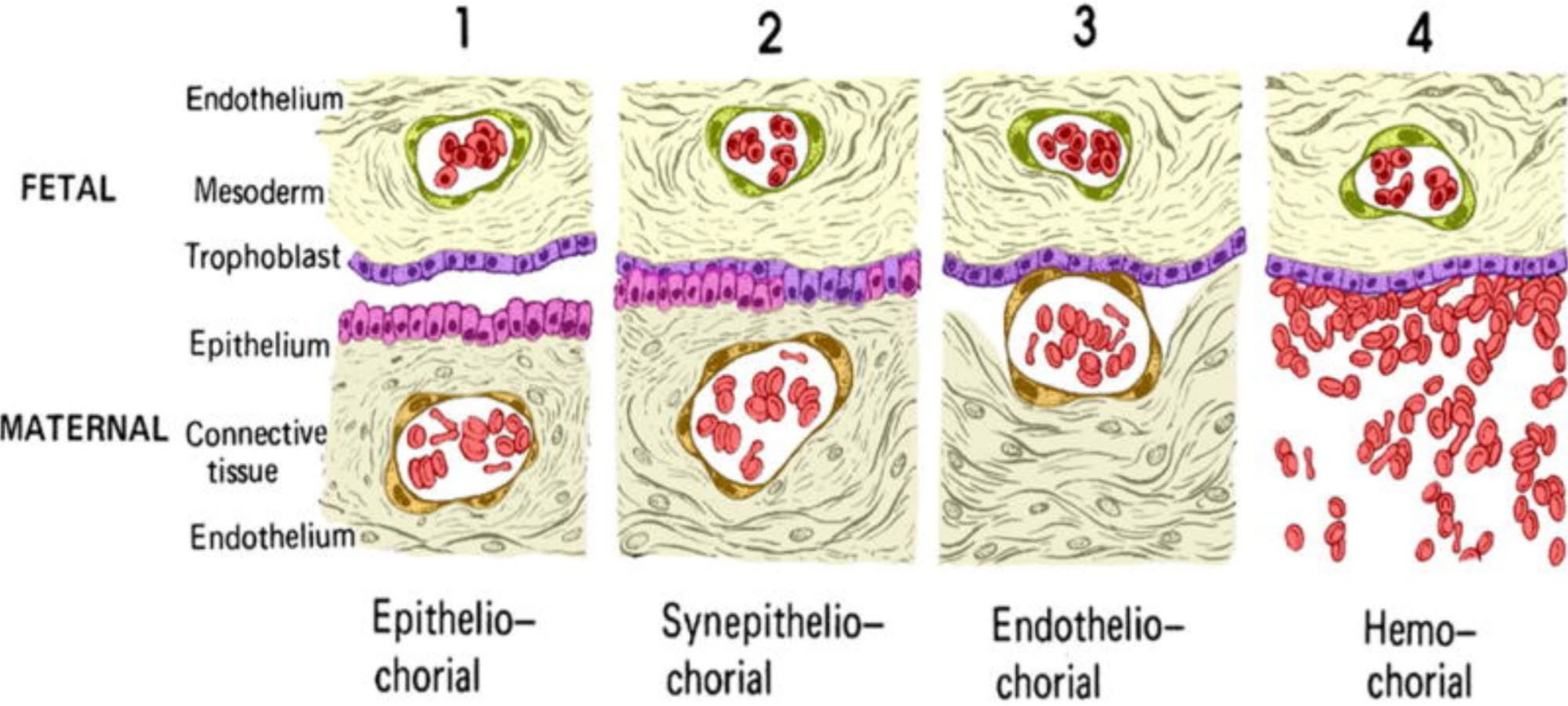
## C-HISTOLOGICAL CLASSIFICATION OF PLACENTA Based on the histological relationship of embryonic villi with the uterine wall and degree of erosion

1. **Epithelio-chorial** –The trophoblast or chorionic epithelium and uterine epithelium remain in close contact but both retain their original layer eg .pig & horses
2. **Syndesmo-chorial–Chorionic** villi erode the uterine wall , so that the uterine epithelium is ruptured and the chorionic villi comes in contact with the connective tissue of the uterine wall eg. Sheep & Cow (ruminants)

3. **Endothelio-chorial** –Both uterine epithelium and connective tissue is eroded so that the chorionic villi comes in contact with endothelium of maternal blood vessel  
eg. Dogs ,Cats

4. **Haemo-chorial–Uterine** epithelium , connective tissue and endothelium all are eroded and the chorionic villi baths in the maternal blood eg. HUMEN

5. **Haemo-endothelial**–Foetal capillaries lie freely in maternal blood eg. Rabbit



Type of Placenta	Maternal Layers Retained			Examples
	Endometrial Epithelium	Connective Tissue	Uterine Endothelium	
Epitheliochorial	+	+	+	<u>Horses</u> , <u>swine</u> , <u>ruminants</u>
Endotheliochorial	-	-	+	<u>Dogs</u> , <u>cats</u>
Hemochorial	-	-	-	<u>Humans</u> , <u>rodents</u>

## D- Classification Based on the Types of Implantation

- The term in case of placental mammals is referred to the process by which the embryo remains associated intimately with the uterine wall.
- Generally three types of implantation are seen which are as follows:

## 1. Central or Superficial Implantation:

The chorionic sac of the embryo grows and makes superficial attachment with the uterine mucosa. This type of implantation is called central or superficial implantation and the embryo remains within the lumen of the uterus e.g in monkey. .

## 2-Eccentric Implantation:

In mouse, rat., the blastocyst in its early stage comes to lie between the uterine epithelial folds , this type of implantation is called eccentric implantation. The epithelial folds at a later stage, encloses the blastocyst almost completely.



### 3. Interstitial Implantation:

- In interstitial implantation the embryo burrows into the uterine mucosa below the epithelium and becomes surrounded completely by the endometrial tissue of the uterus .This type of implantation is seen in pig, chimpanzee, human.

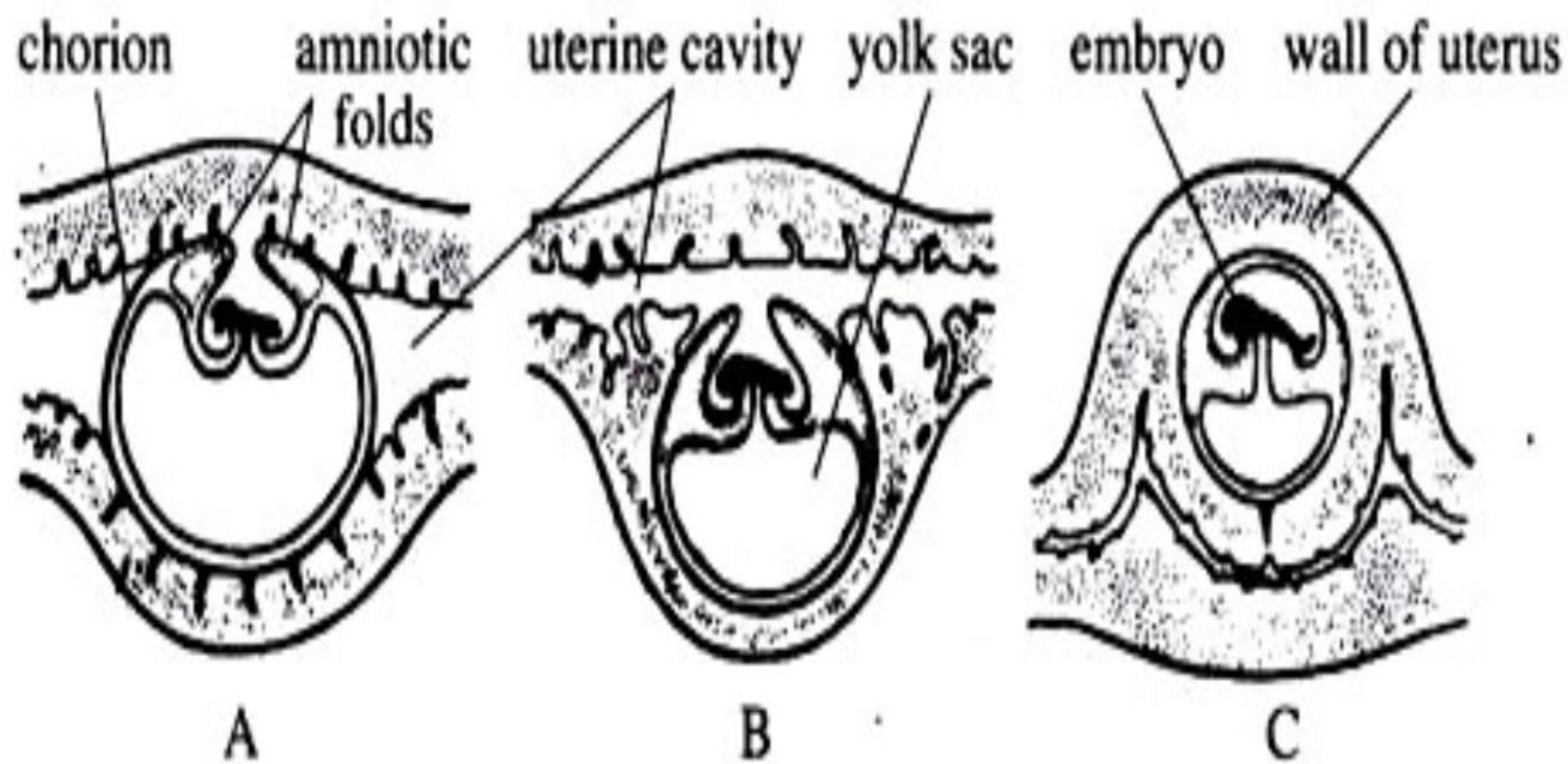


Fig. 5.53 : Classification based on the depth of implantation among mammals. A. Superficial (dog), B. Eccentric (ground squirrel), C. Interstitial (hedgehog).