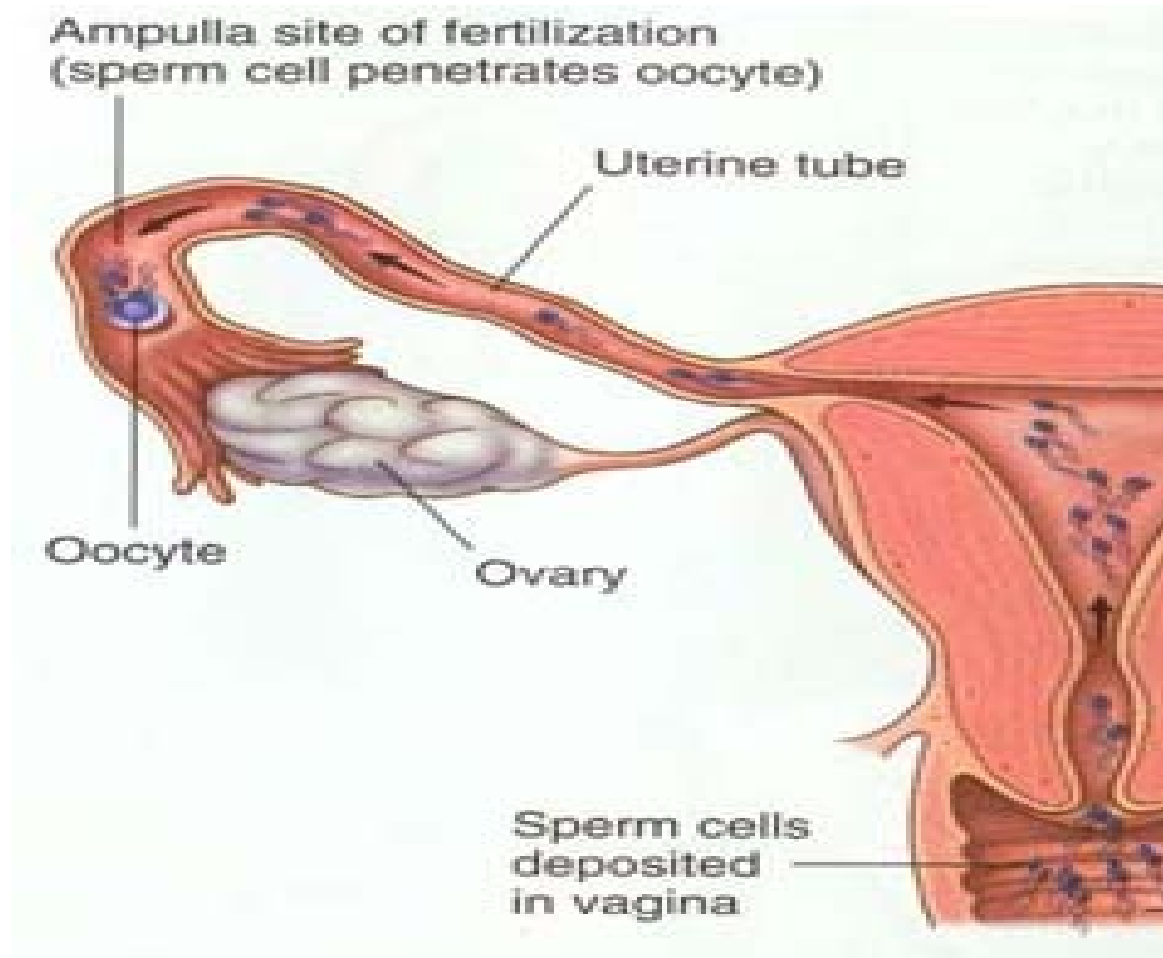


1ST week of development

- **Fertilization**
- **Cleavage**
- **Blastocyst Formation**
- **Beginning of implantation**

- **Fertilization:** The process in which the spermatozoon penetrates into the ovum to form fertilized ovum.
In the ampulla of oviduct



Phases of Fertilization

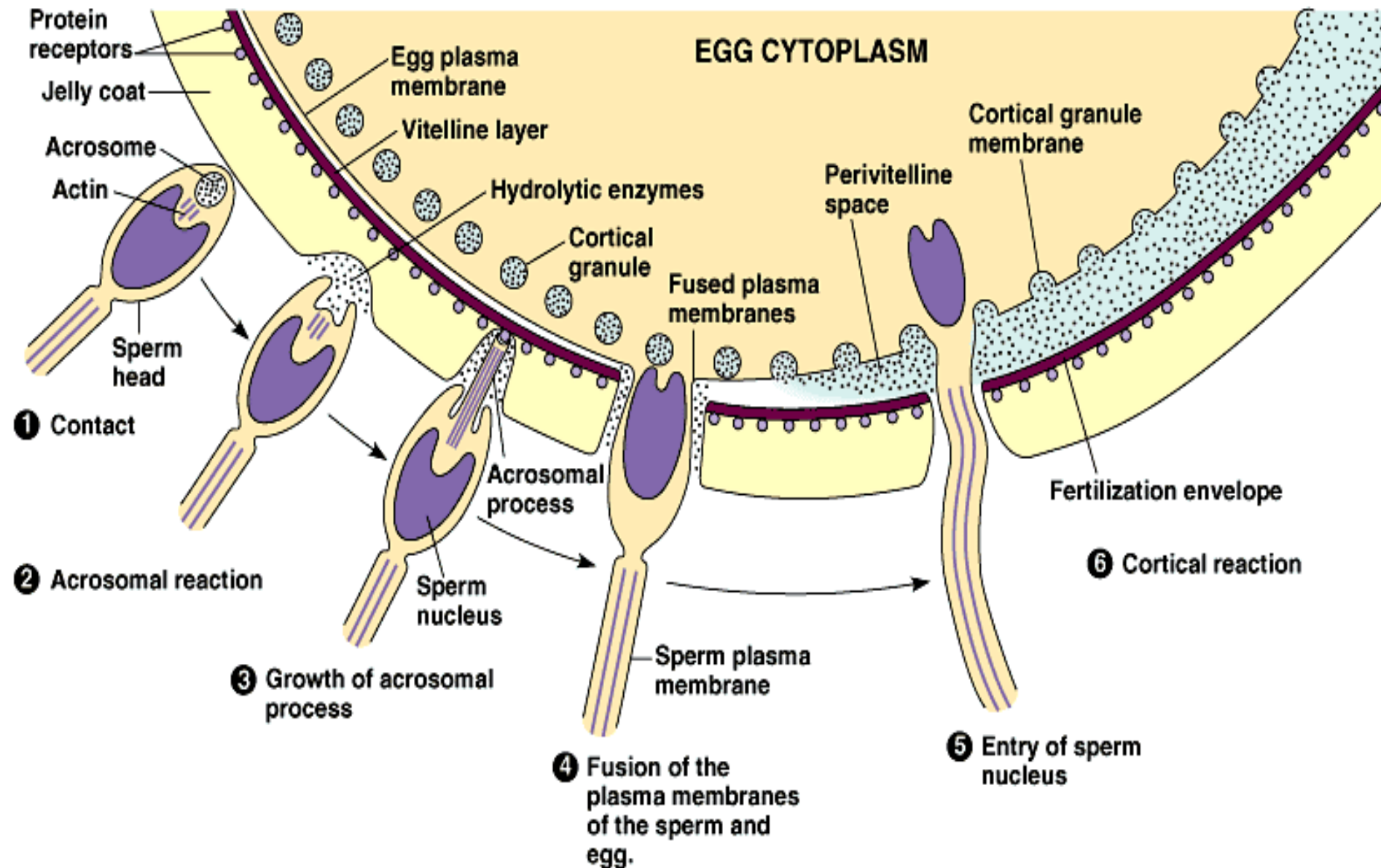
- **Phase-1 - penetration of the corona radiata**
 - 300-500 spermatozoa reach the site of fertilization, only one of these fertilizes the egg.
 - It is thought that the others aid the fertilizing sperm in penetrating the barriers protecting the female gametes.
 - Capacitated sperm pass freely through corona cells.
 - Capacitation:- during which time a glycoprotein coat and seminal plasma proteins are removed from the spermatozoon head.
- **Phase-2 - penetration of the zona pellucida**
 - The zona is a glycoprotein shell surround the egg that facilitates and maintains sperm binding and induces the acrosome reaction.
 - Both binding and the acrosome reaction are mediated by the zona protein.

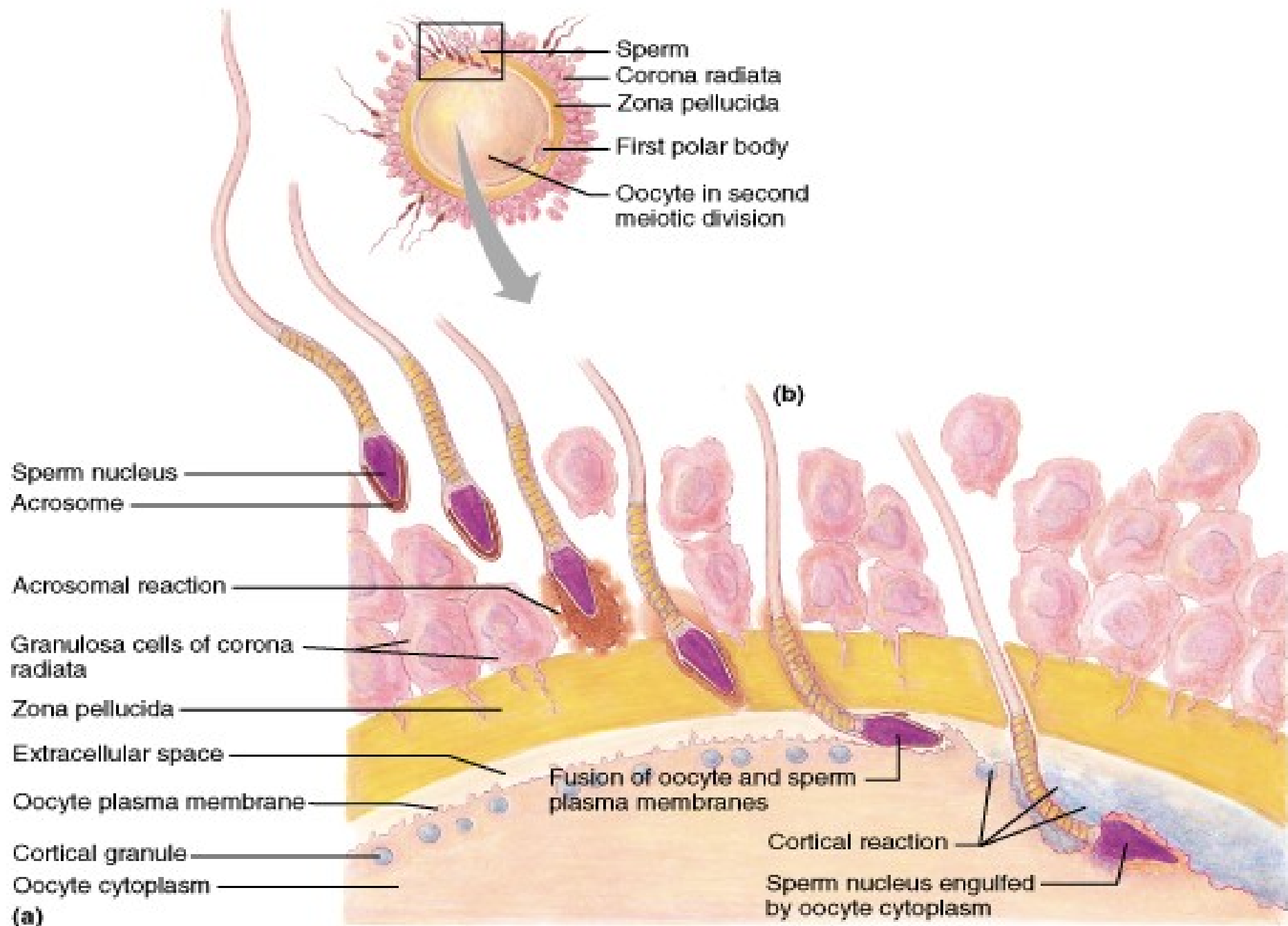
- **Phase-2 cont'd**

Only one sperm is able to penetrate the oocyte.

- **Phase-3: Fusion of the oocyte and sperm cell membrane**
 - The initial adhesion of sperm to the oocyte is mediated in part by the interaction of **integrins** on the oocyte and **disintegrin** on sperm.
 - After adhesion, the plasma membrane of the sperm and egg fuse.
 - Both the head and tail of the spermatozoon enter the cytoplasm of the oocyte, but the plasma membrane left behind.

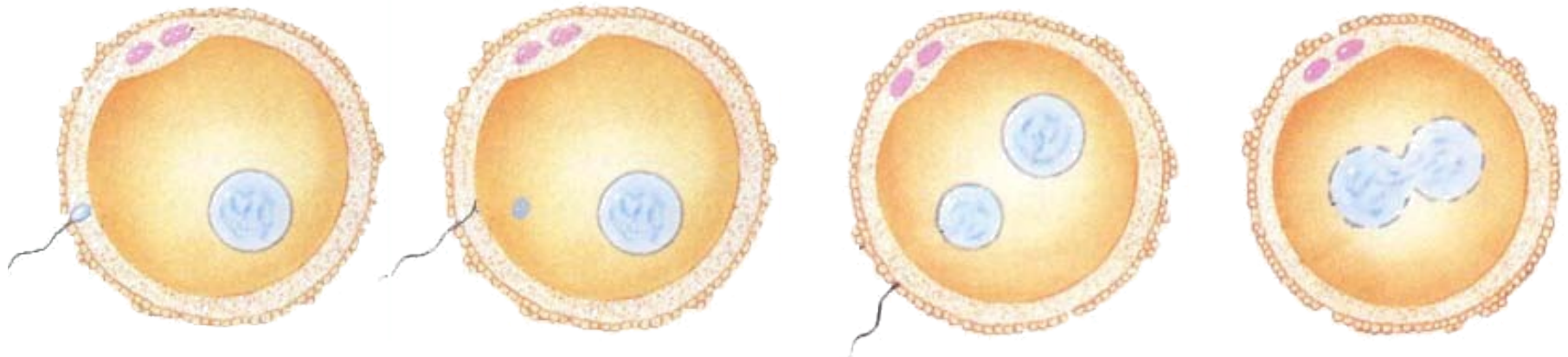
Acrosomal, Cortical Reactions





- As soon as the spermatocyte has entered the oocyte.
 - ❖ The oocyte finishes its second meiotic division and forms the female pronucleus.
 - ❖ The zona pellucida becomes impenetrable to other spermatozoa(zonal reaction).
 - ❖ The head of the sperm separates from the tail, swells, and forms the male pronucleus.

Process of fertilization



① Fusion of the membrane of sperm and ovum

② The nucleus of sperm penetrate into ovum

③ Formation of pronuclei

④ Fusion of pronuclei

Alteration of ovum

24 h

-The main results of fertilization are:

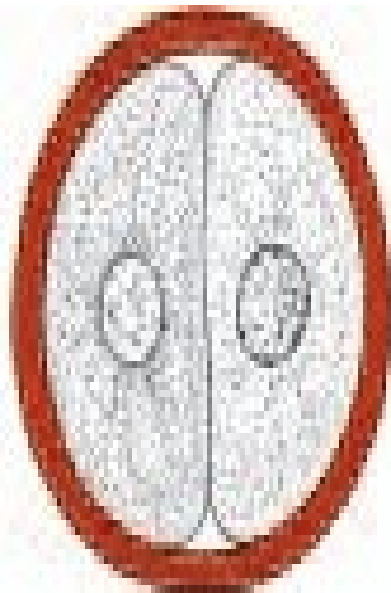
1. Restoration of the diploid number of chromosome
2. Determination of sex.
3. Metabolic activation of ootid & initiation of cleavage.
4. stimulates the penetrated oocyte to complete the 2nd meiotic division.
5. intermingling of maternal & paternal chromosomes.
--- specious variation.

Condition of fertilization

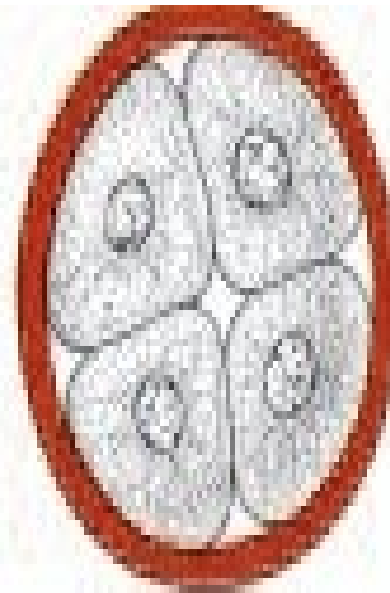
- ① Normal ovum
- ② Normal sperm
sufficient numbers
- ③ Certain time
12-24h
- ④ Free reproductive tract

❑ Cleavage

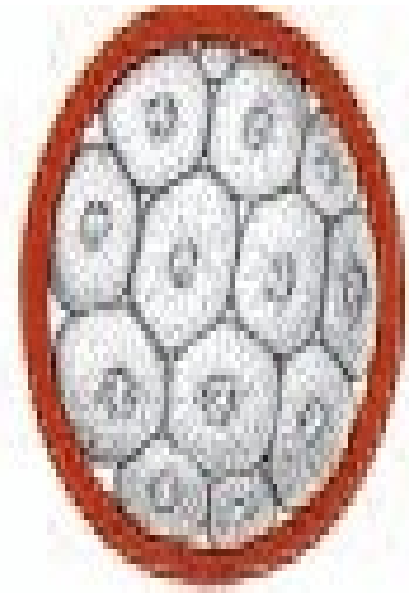
- ❑ Cleavage is the rapid succession of mitotic cell divisions , resulting in an increase in the number of cells, **blastomeres** which become smaller with each division
- ❑ Cleavage is thus a fractionating process rather than a process of growth



Two-cell stage

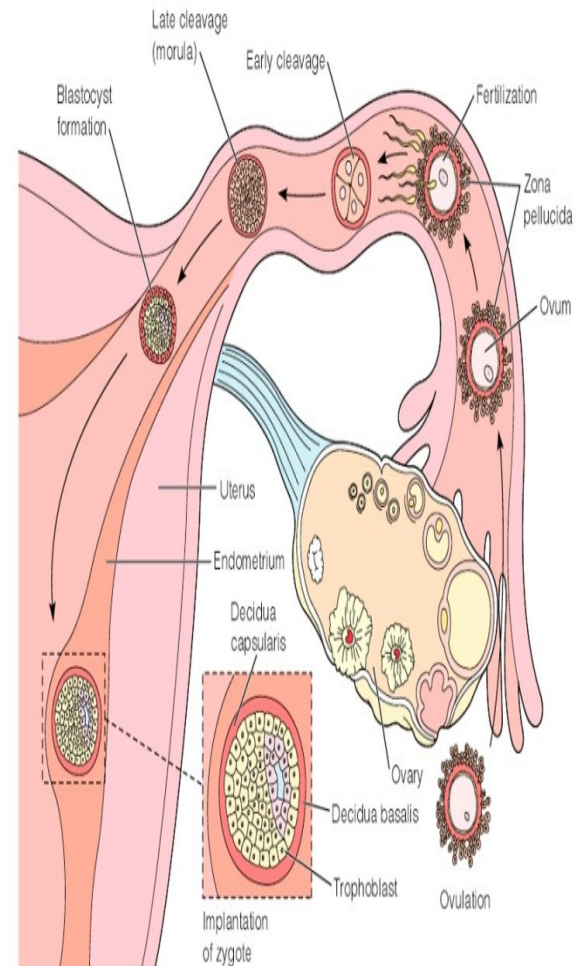


Four-cell stage

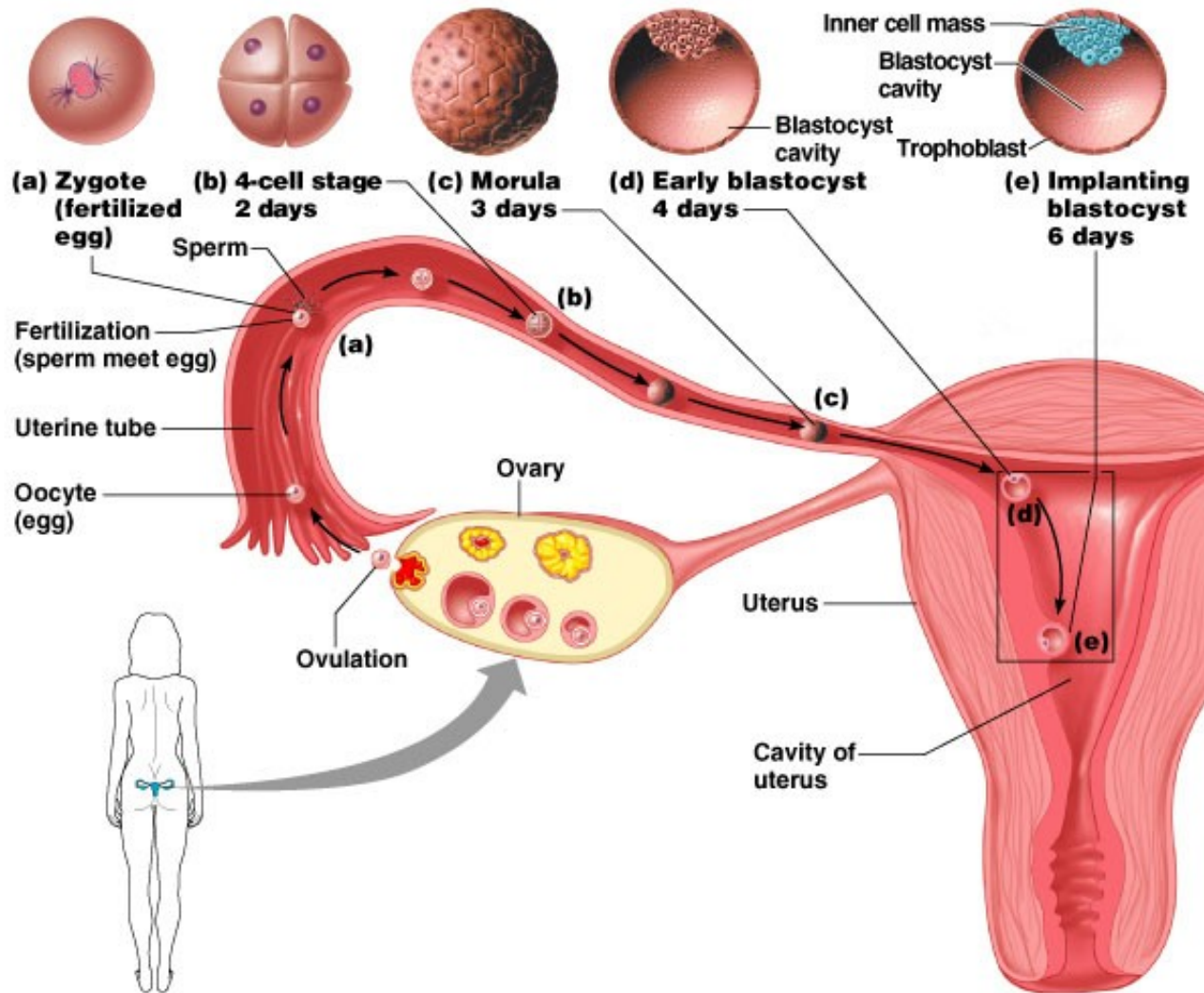


Morula

- The original zygote divides about **30 hours** after conception into two daughter cells called blastomeres.
- Continued subdivisions of the original cell result in increasing numbers of blastomeres.
- During cell division the dividing cells decrease in size. This type of cell division is called cleavage.
- By the time the zygote is ready to enter the uterus, it contains a solid ball of 12 to 16 blastomeres called the morula (from the latin word for mulberry).



Fertilization to Implantation

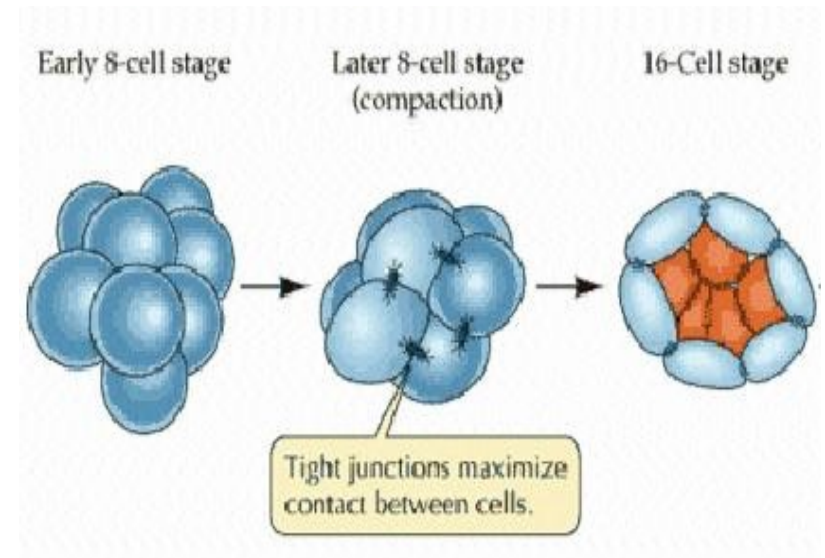


Cont..

- Cleavage occurs as the zygote passes along the uterine tube toward the uterus.
- During cleavage, zygote lies within the thick zona pellucida.

MORULA

- ❑ Approximately, 3 days after fertilization, cells of the compacted embryo divide again to form a 16-cell (12-32) morula (L., morus; mulberry)
- ❑ Compaction segregates inner cells, which communicate extensively by gap junctions, from outer cells.
- ❑ Inner cells of the morula constitute the **inner cell mass**, & surrounding cells compose the **outer cell mass**.

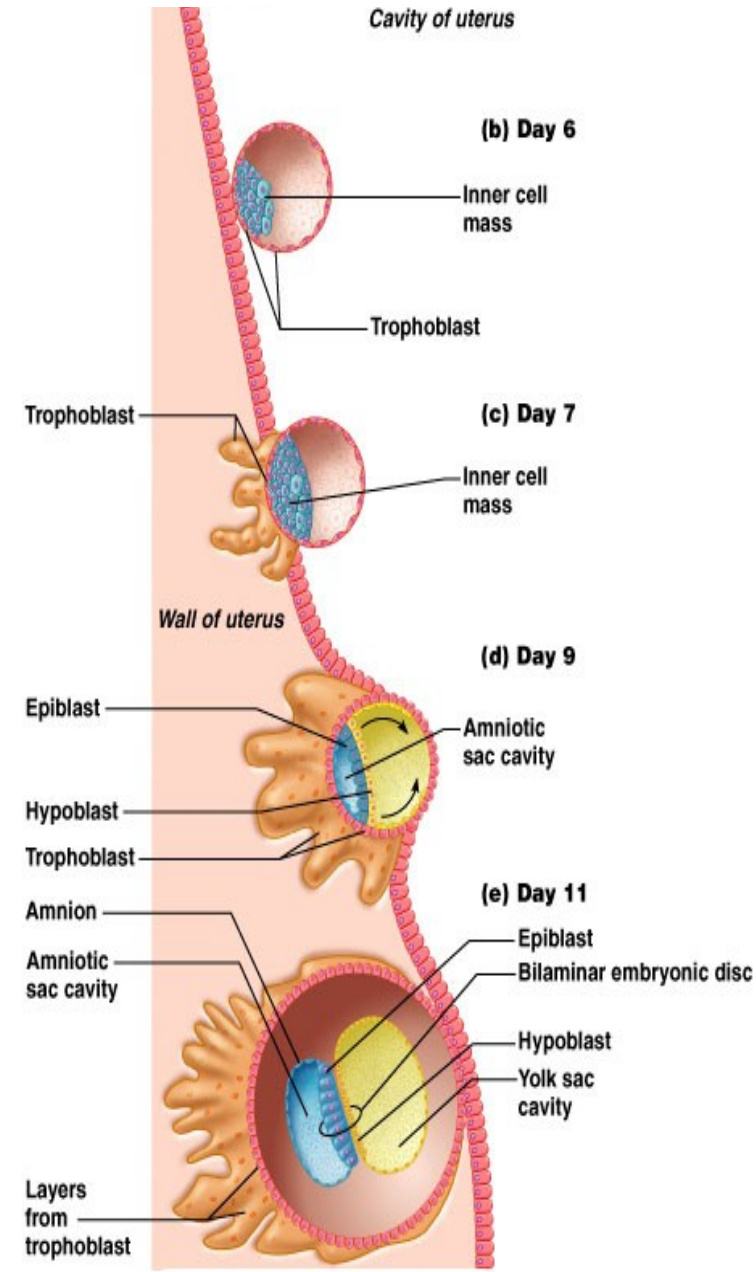


Day 4: Formation of the blastocyst

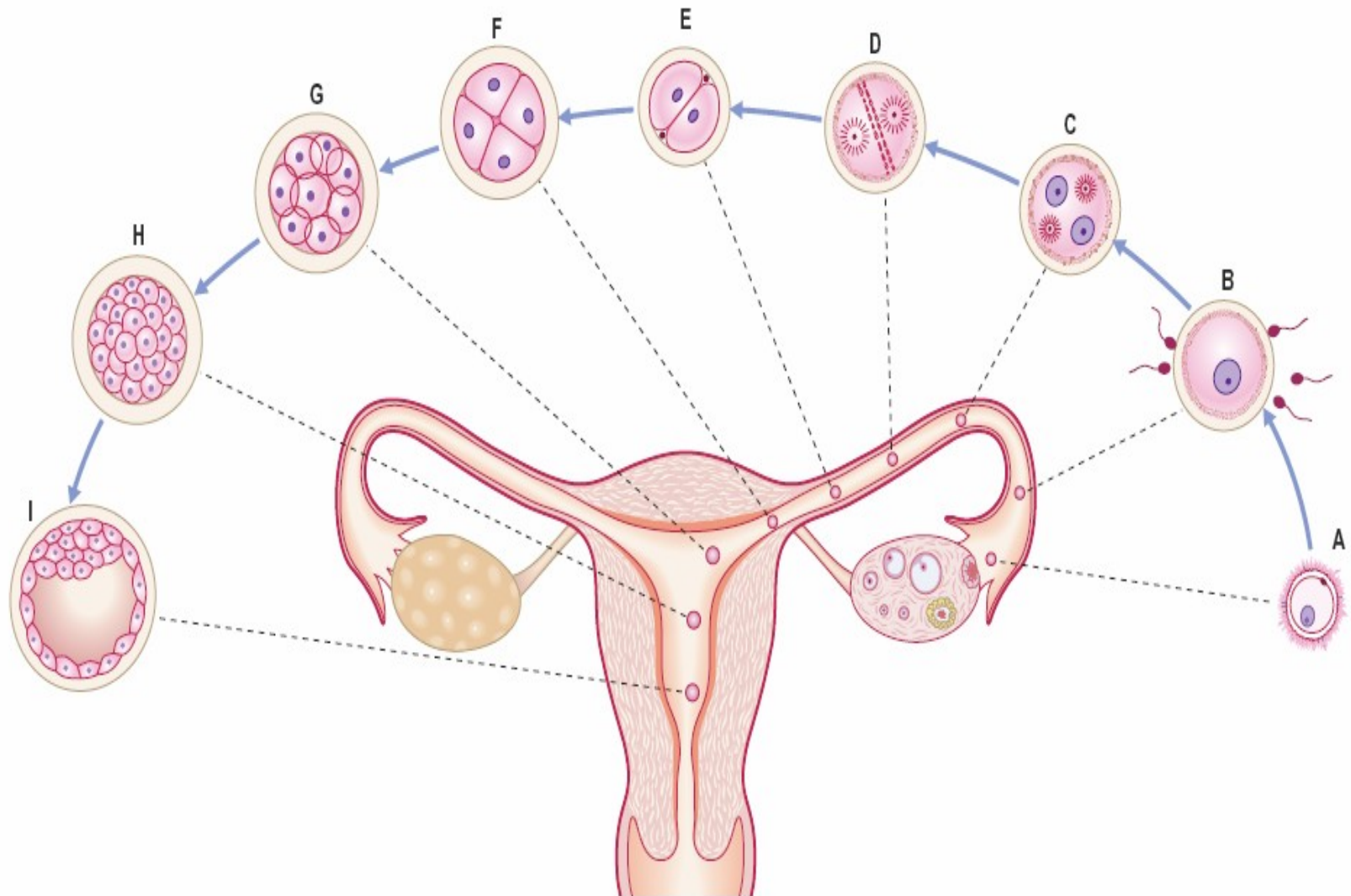
- Fluid within the intercellular spaces of the morula gradually increases, and spaces on one side of the inner cell mass come together, forming a single cavity, the **blastoceles**.
- The outer layer organizes into the trophoblasts, which give rise to the placenta, and the inner layer of cells form the embryo.
- The cavity of the blastocoele fills with fluid, and the conceptus is now called the **blastocyst**.

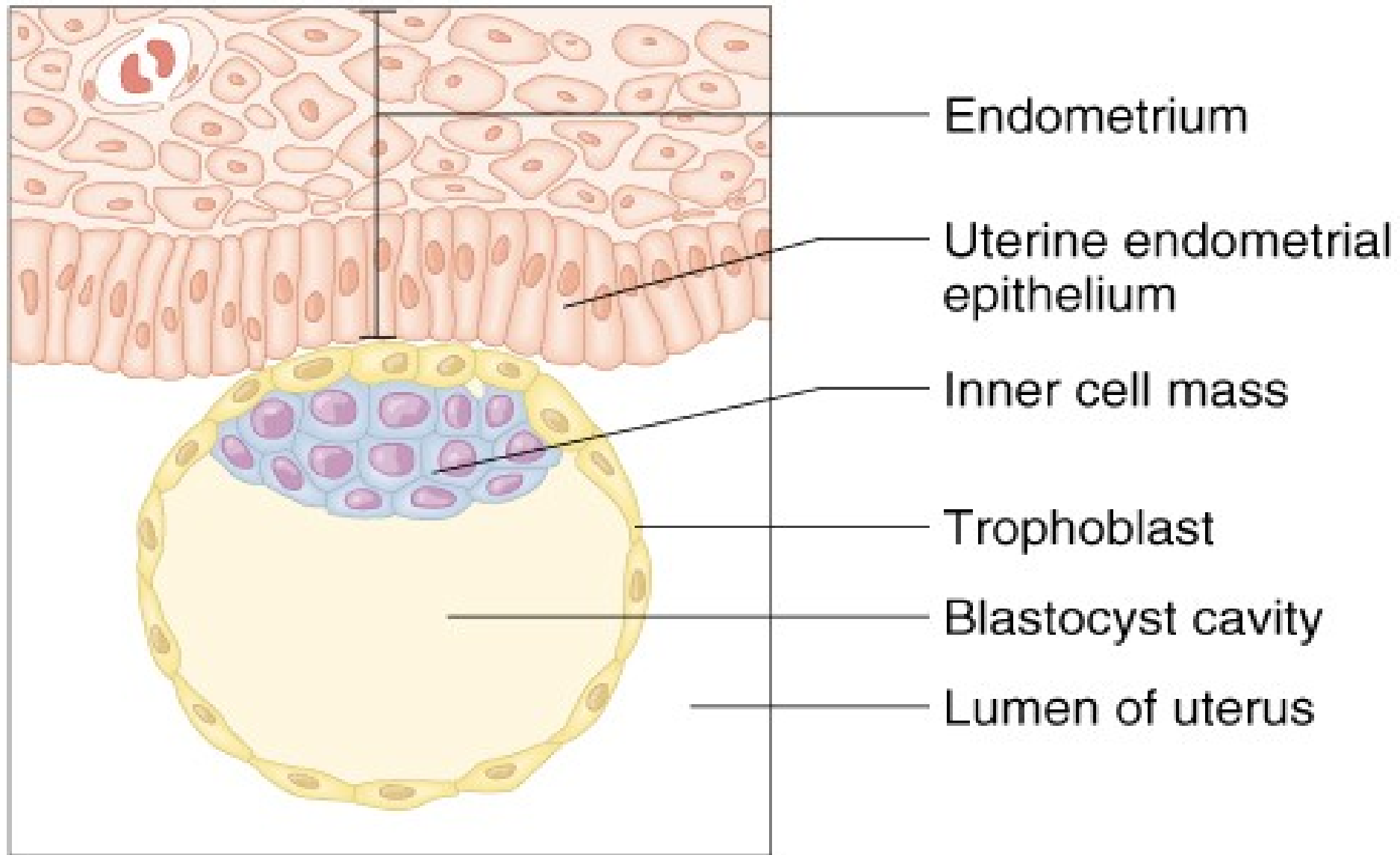
Attachment of the blastocyst

- The blastocyst attaches to the uterine lining in the V-shaped.
- When the trophoblast (the outer cell layer) attaches to the endometrium, it proliferates and separates into an inner cytotrophoblastic layer (fetal side) and an outer syncytiotrophoblastic (placental side).
- The outer layer develops finger like projections that proliferate and superficially attach the blastocyst to the endometrium within 6 days after conception.

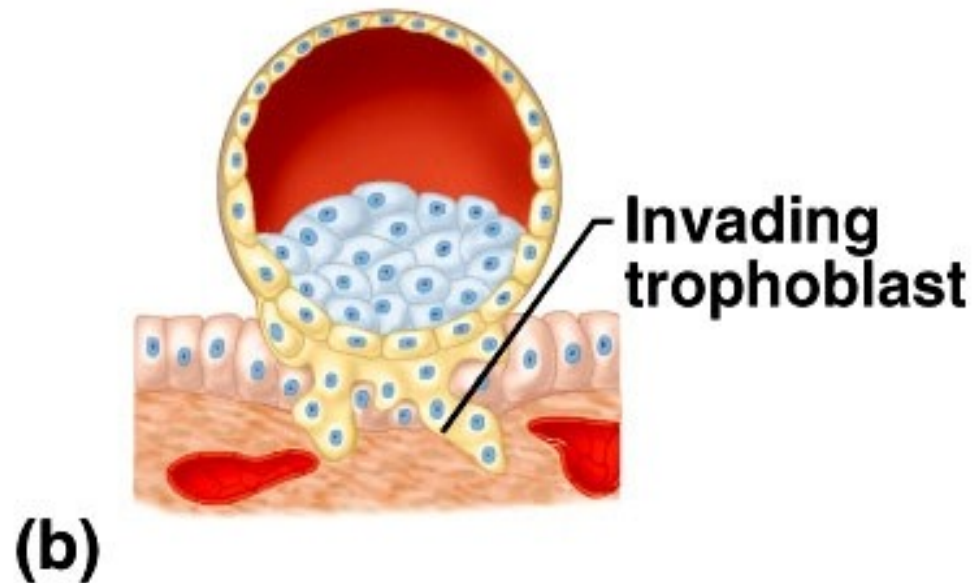
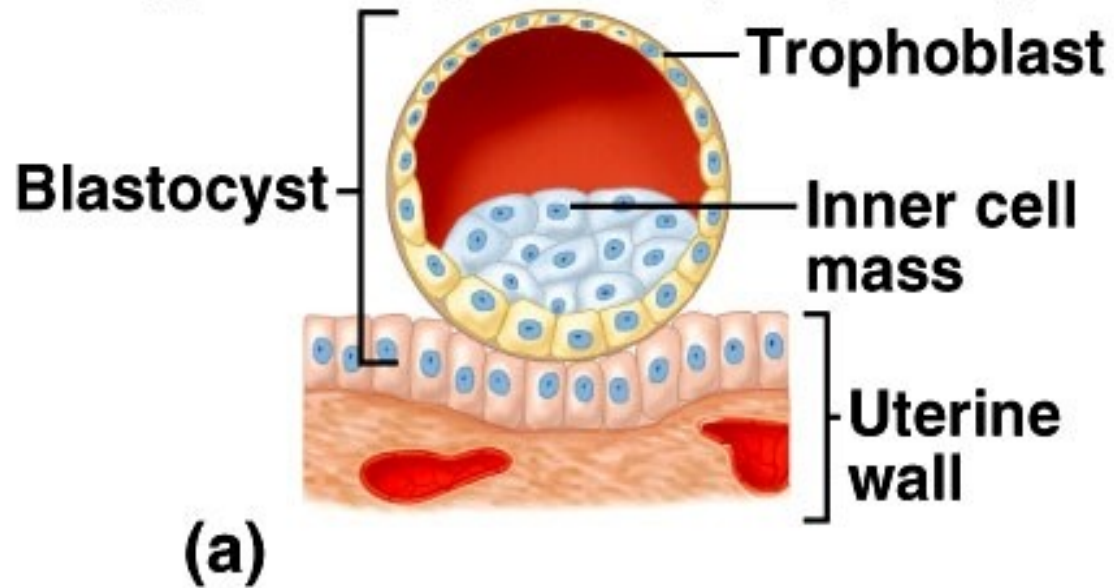


The 1st Week





(a)



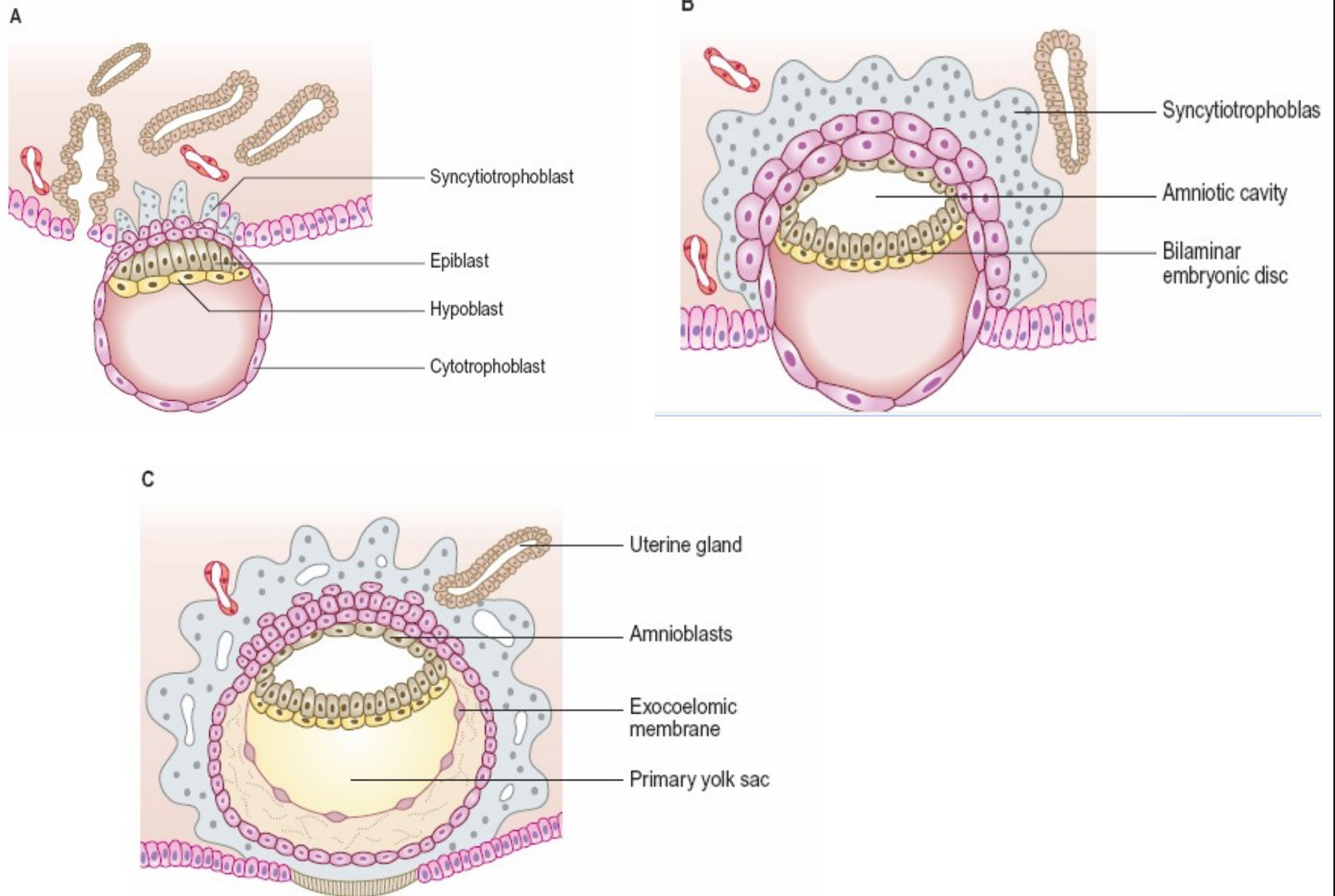


Fig. 1.3 Implantation of blastocyst. (A) A 7-day blastocyst beginning to implant. (B) By 8 days the amniotic cavity appears. (C) By 9 days the syncytiotrophoblast invades the uterine glands and capillaries.



Clinical box

Abnormal sites of implantation can sometimes occur, due to slow transit of the ovum along the uterine tube. The most common site of **ectopic** implantation is the uterine tube itself, though other sites include the peritoneal cavity or on the surface of the ovary. Such embryos do not come to term because the abnormal implantation site is unable to sustain the developing embryo. Furthermore, the invasive trophoblast tissue causes haemorrhage which can be life-threatening.

MAJOR EVENTS OF FIRST WEEK

NORMAL EVENTS

- ↯ *Fertilization and formation of the zygote (30hours).*
- ↯ *Cleavage of the zygote into 12 to 16 blastomeres- the morula (day 2 and 3).*
- ↯ *Formation of the blastocyst (day 5-8).*

POSSIBLE ABNORMAL EVENTS

- *Abnormal implantation*
- *Maternal infection or a genetic defect*
- *Abortion*
- *Ectopic implantation*