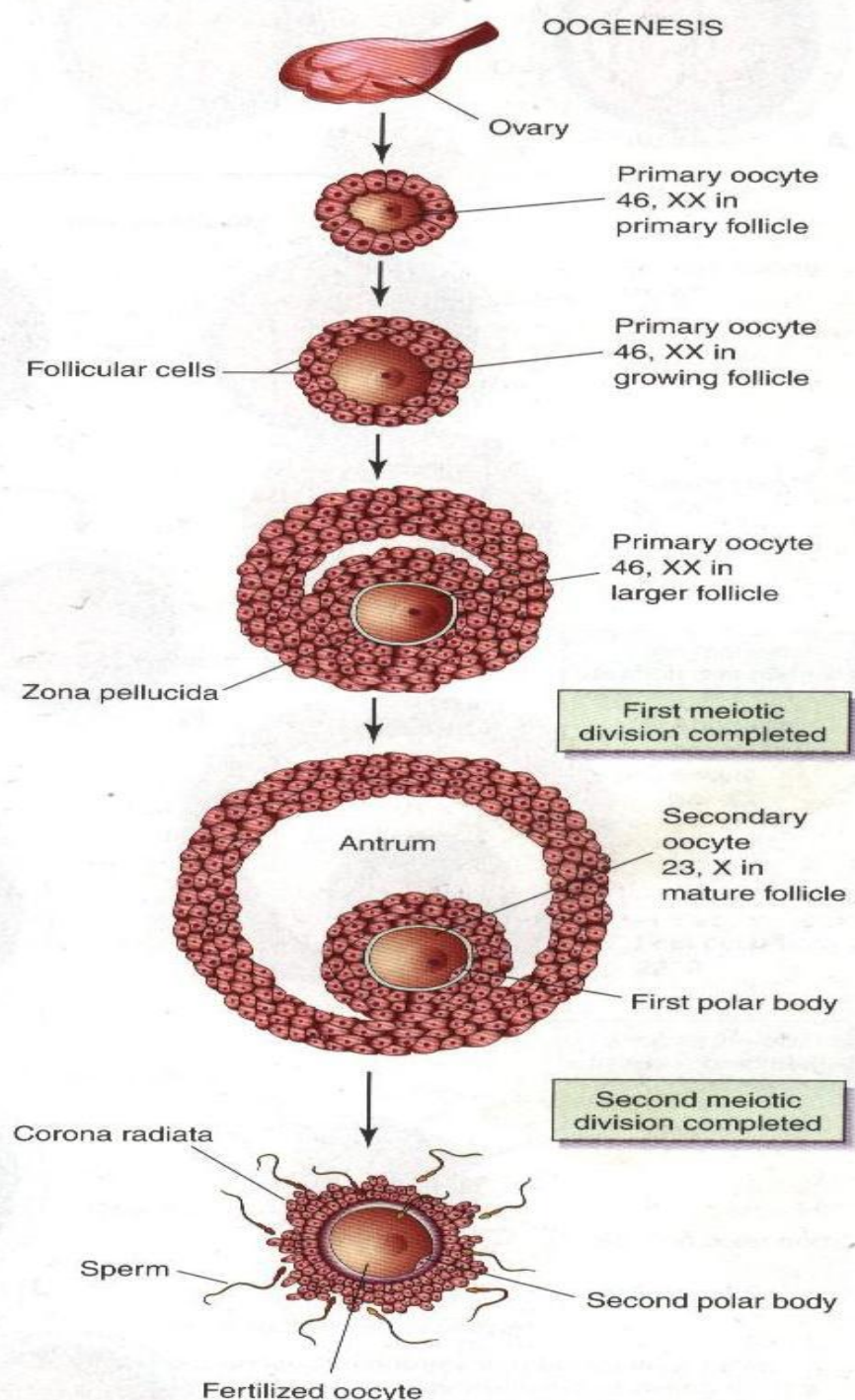
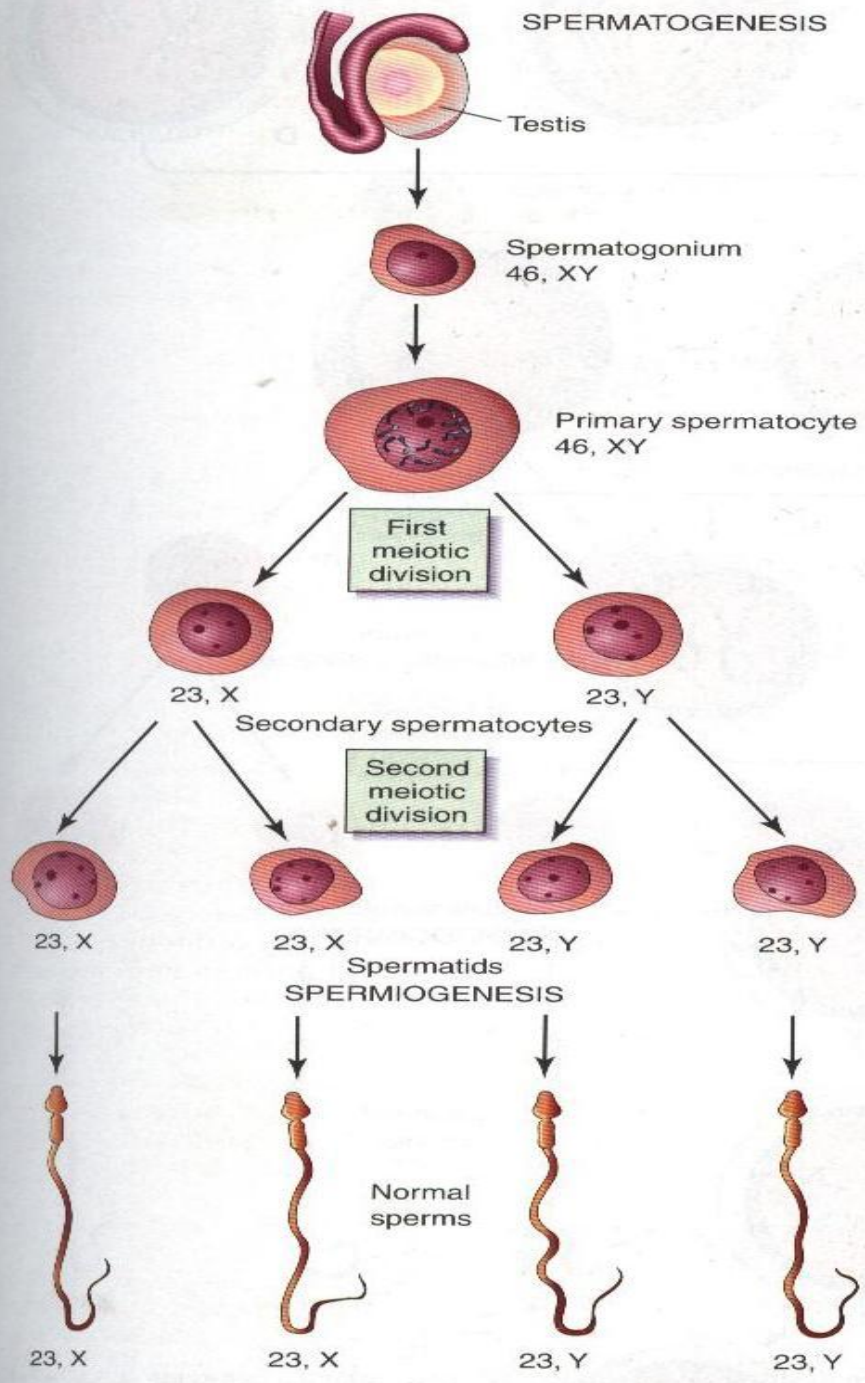
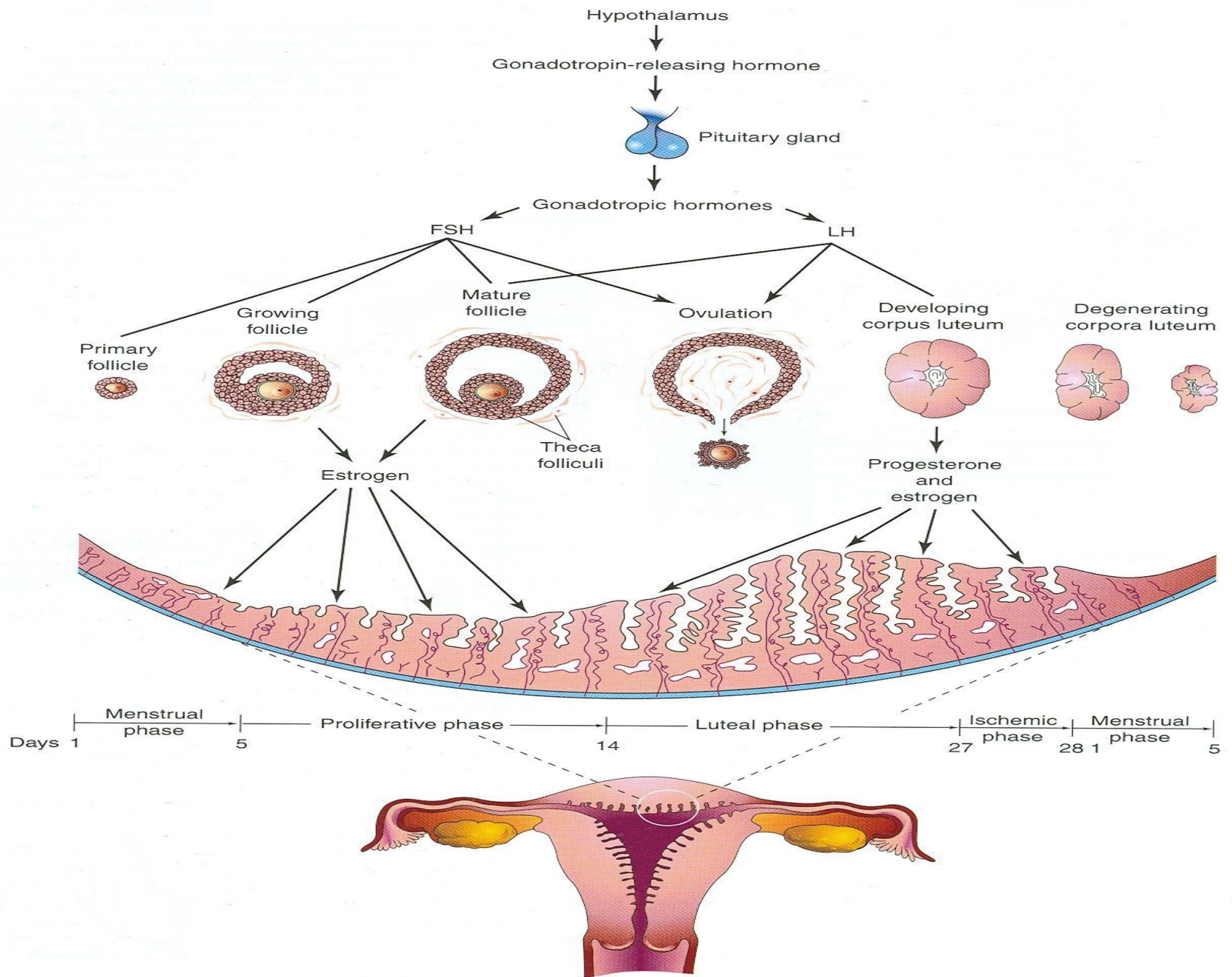


Fertilization and implantation

Combination of female slides + last
year slides





Fertilization

- Is a complex sequence of coordinated molecular events
- Fertilisation normally occurs after 24 hours of ovulation
- Begins with a contact between sperm and ovum
- Ends up with intermingling of **maternal** and **paternal** chromosomes

Site

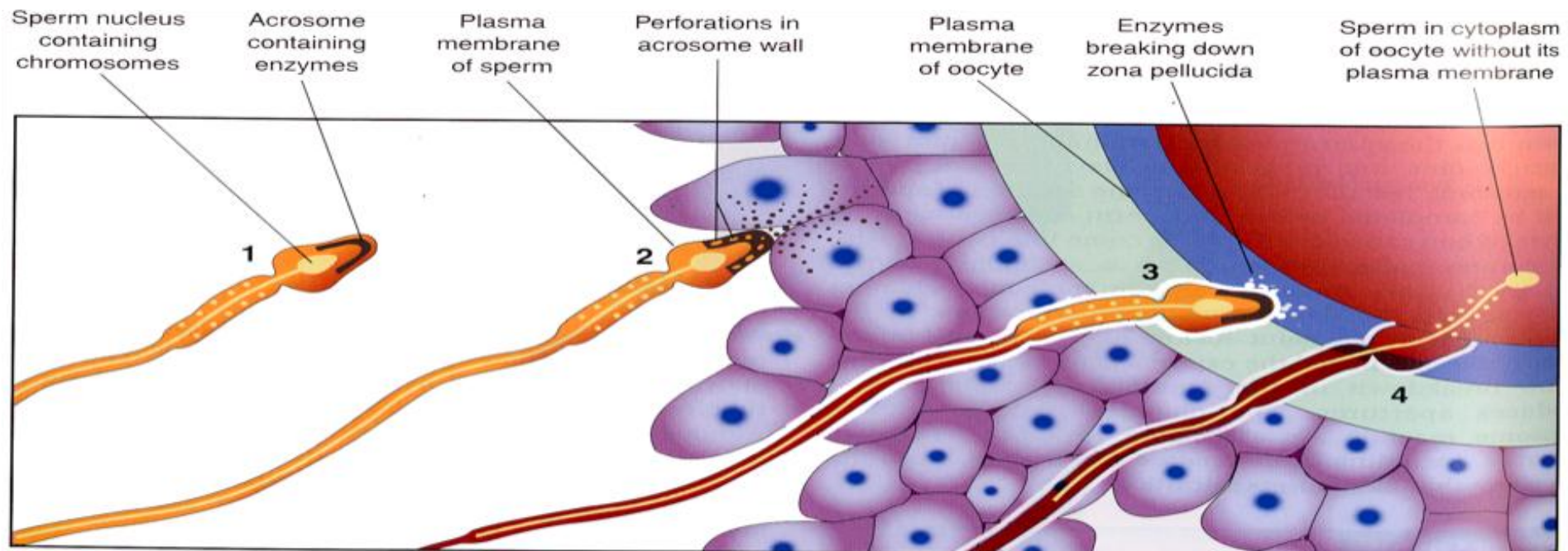
- The usual site of **fertilization** is the lateral 1/3rd of the uterine tubes (ampulla)
- **Fertilization** may occur in other parts of uterine tubes or even outside the tube.
- Fertilization is a process that extends over a period of **4 to 6 hours**.

Sperm Capacitation

- Occurs in the female genital tract before fertilization
- Is stimulated by secretions in the vagina , uterus, and uterine tubes
- Results in capability of the sperm to pass through the corona radiata
- Involves removal of surface coatings and changes in plasma membrane (glycoprotein and seminal proteins)
- This stimulates acrosome reaction

Acrosome reaction

- Fusion of sperm's **plasma membrane and external acrosomal membrane** allows the acrosome contents to be released and facilitate fertilization



Phases of Fertilization

- Passage of sperm through corona radiata
- Penetration of zona pellucida
- Fusion of the plasma membrane of the oocyte and sperm
- Completion of second meiotic division & formation of female pronucleus
- Formation of male pronucleus

Sperm nucleus
containing
chromosomes

Acrosome
containing
enzymes

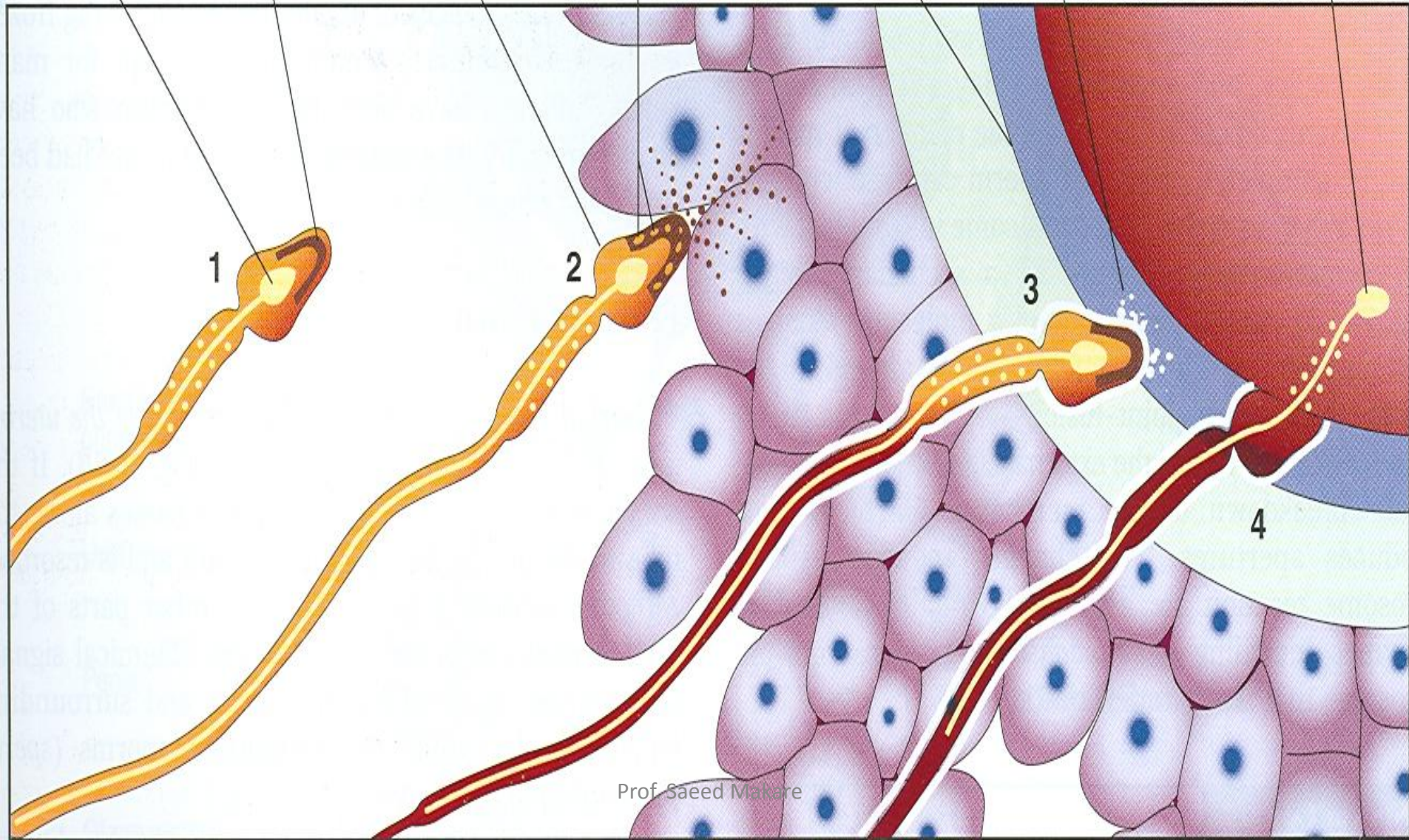
Plasma
membrane
of sperm

Perforations in
acrosome wall

Plasma
membrane
of oocyte

Enzymes
breaking down
zona pellucida

Sperm in cytoplasm
of oocyte without its
plasma membrane

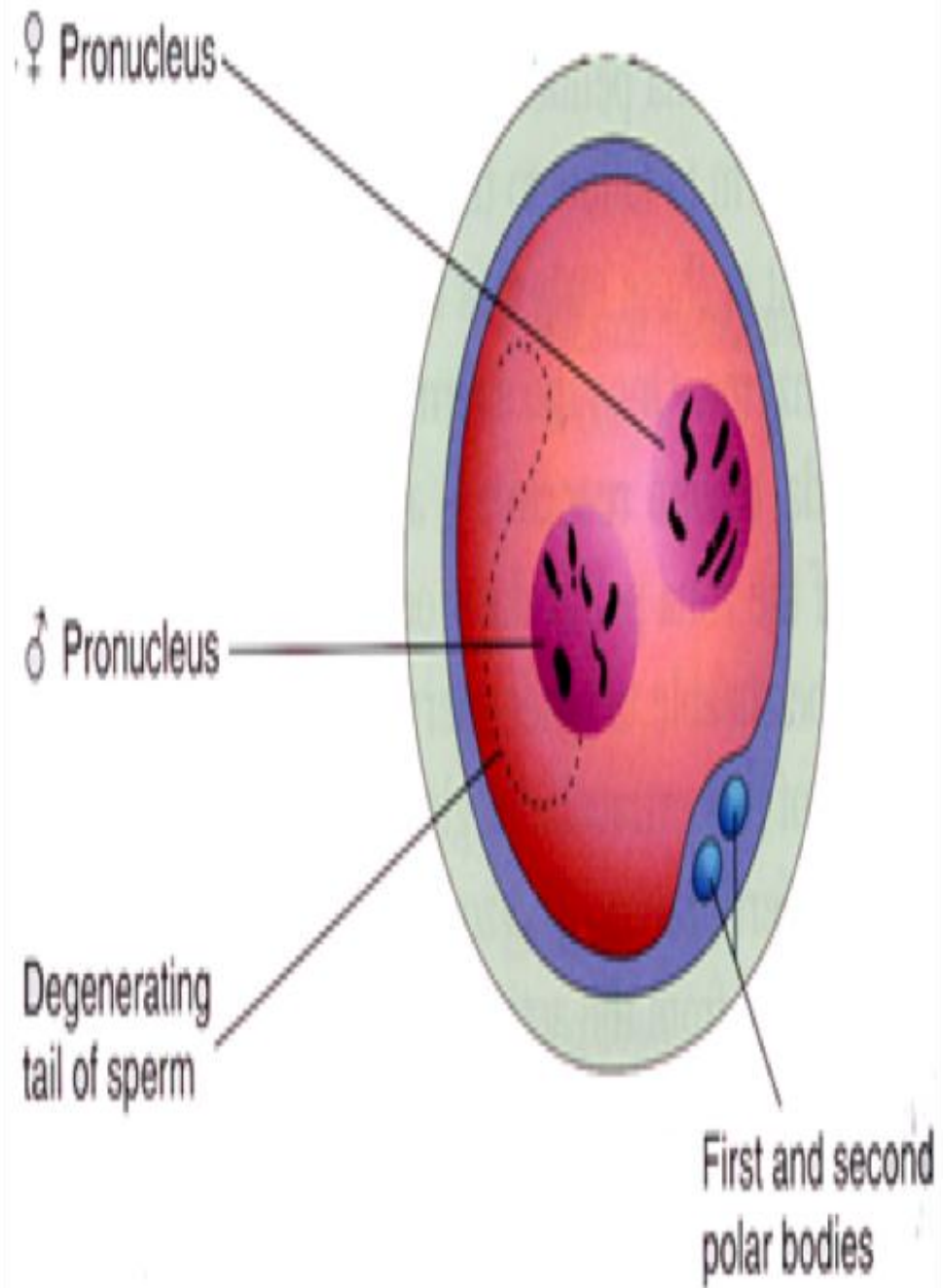
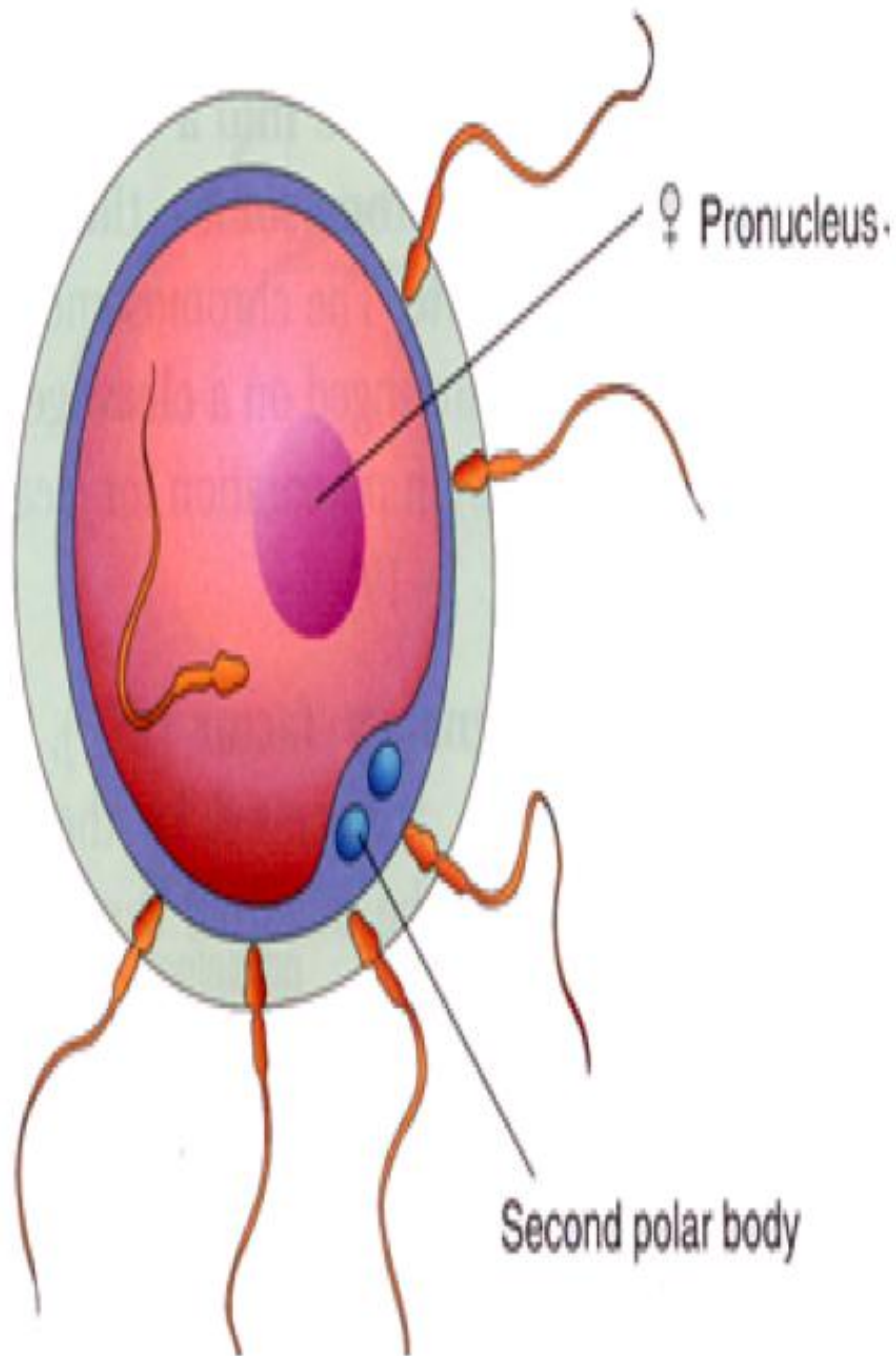


- Passage of sperm through corona radiata.

How ?

- acrosomal enzymes
 - tubal mucosal enzymes
 - movement of sperm's tail
- Penetration of zona pellucida. How?
 - acrosomal enzymes (acrosin)
 - lysosomal enzymes from cortical granules
 - What is the zona reaction ?
 - changes in plasma membrane and zona pellucida that make them impermeable to other sperms

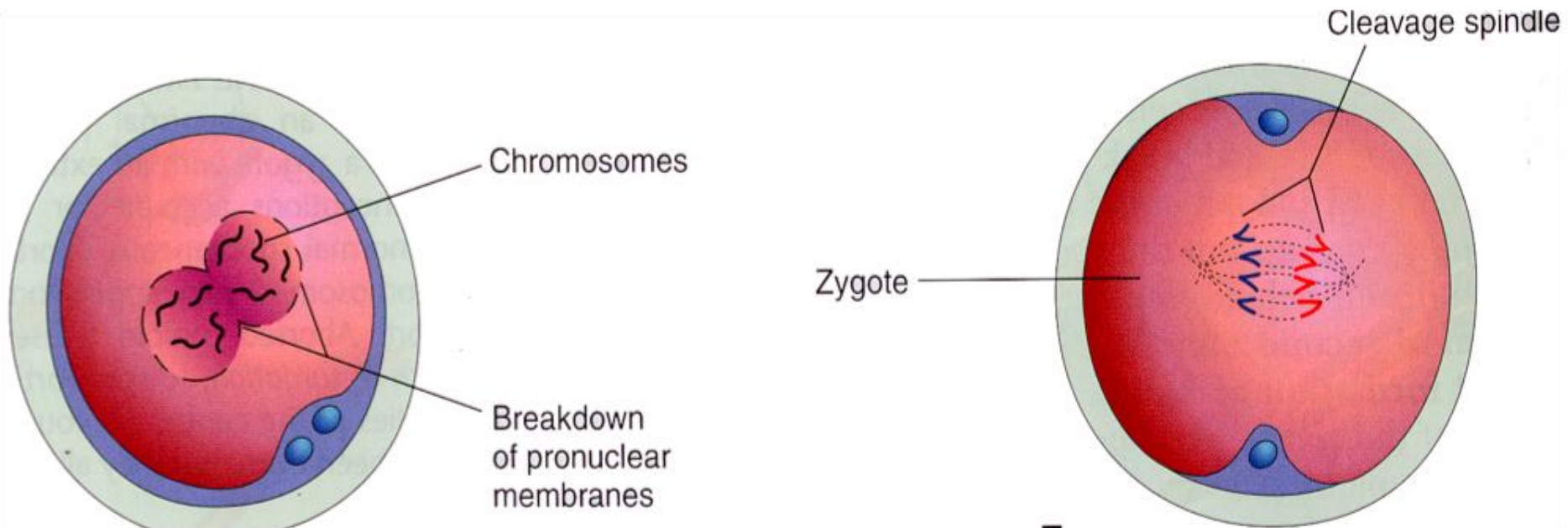
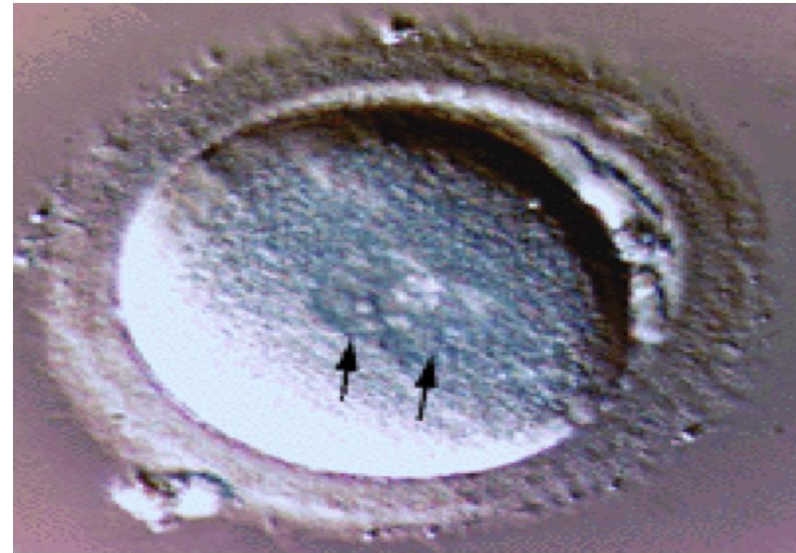
- Fusion of plasma membranes of the oocyte and sperm
 - Head and tail enter , plasma membrane no
- Completion of second meiotic division & formation of female pronucleus and second polar body
 - Nucleus of mature oocyte becomes the female pronucleus
- Formation of male pronucleus
- What is an ootid ? **Ootid** is the oocyte containing two haploid pronuclei



Phases of Fertilization

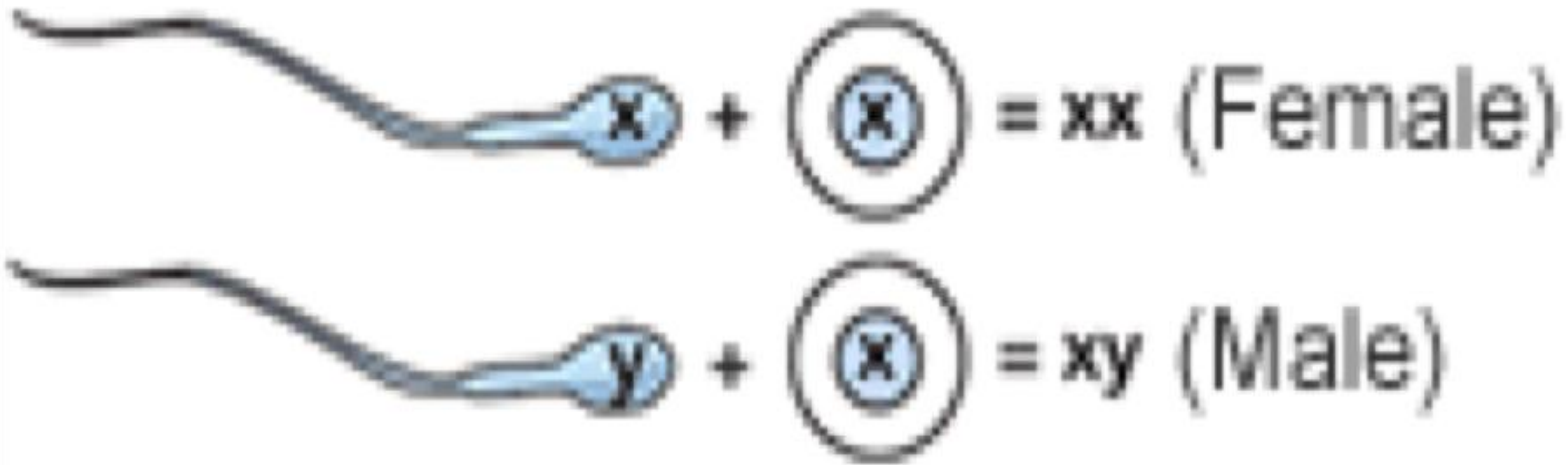
6. Zygote formation:

- pronuclei are fusing
- the ootid becomes a zygote
- zygote contains 46 chromosomes
- Chromosomes become arranged on a cleavage spindle in preparation for cleavage.

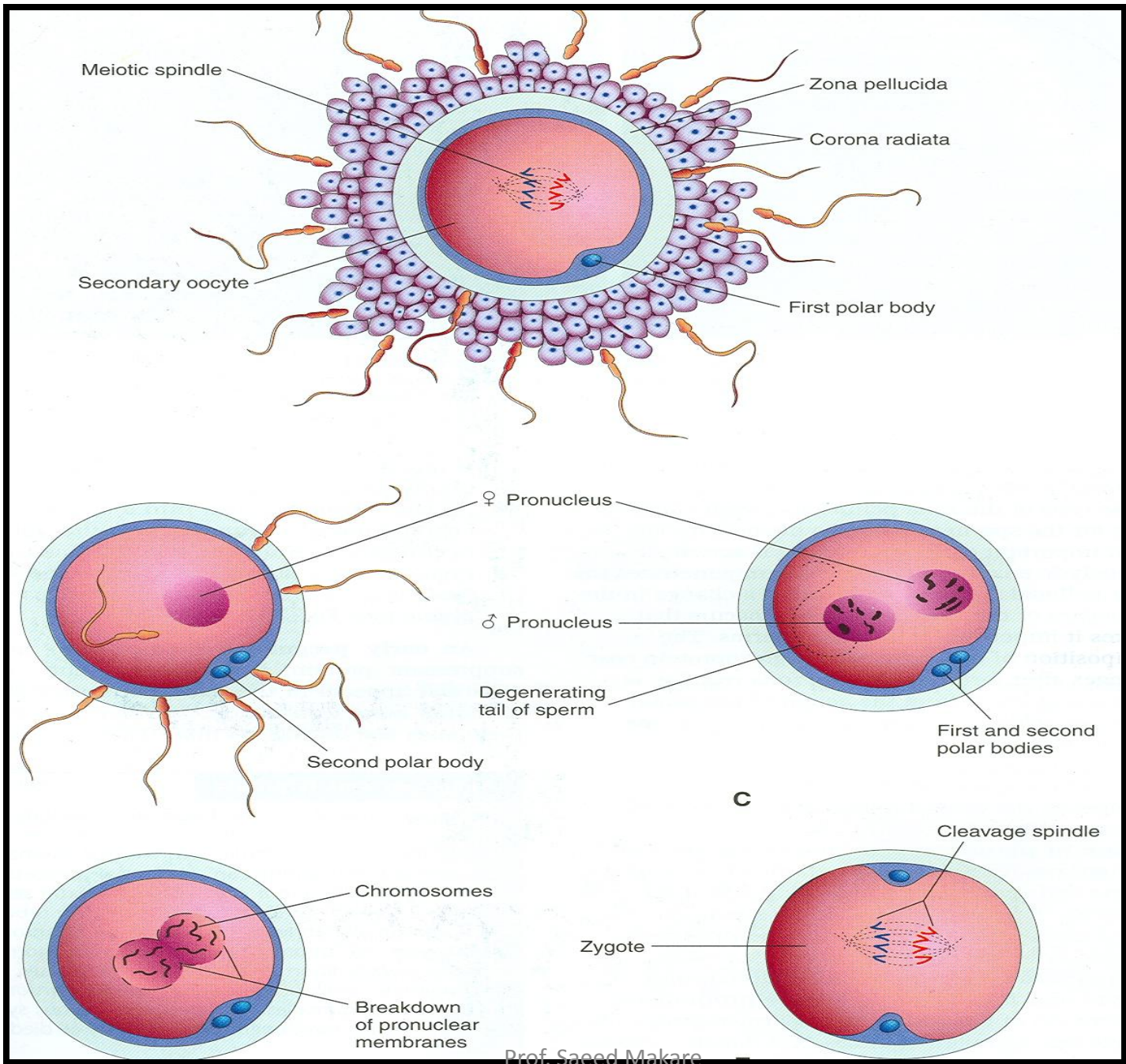


Sex Determination

- Father rather than mother whose gamete determines the sex of the embryo.



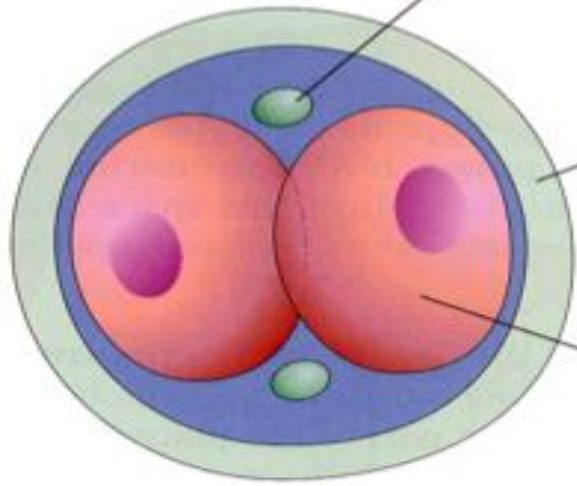
“فجعل منه الزوجين الذكر والأنثى”



Second polar body

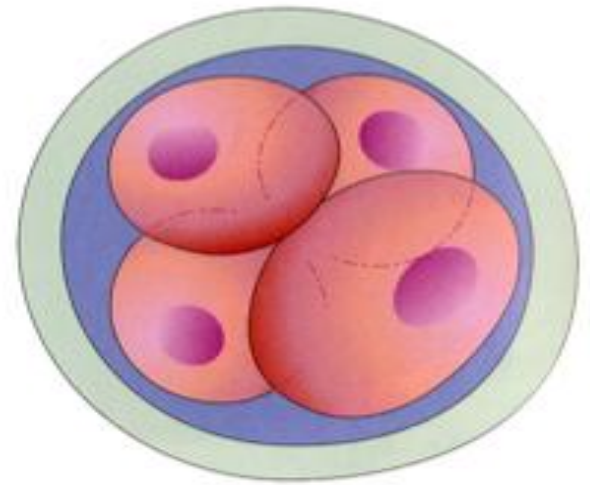
Zona pellucida

Blastomere



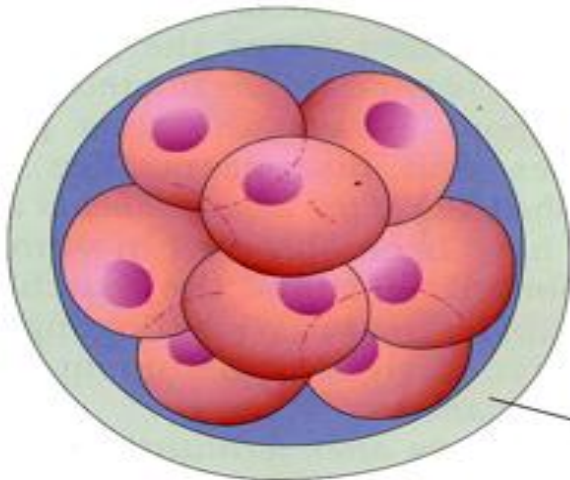
A

2-cell stage



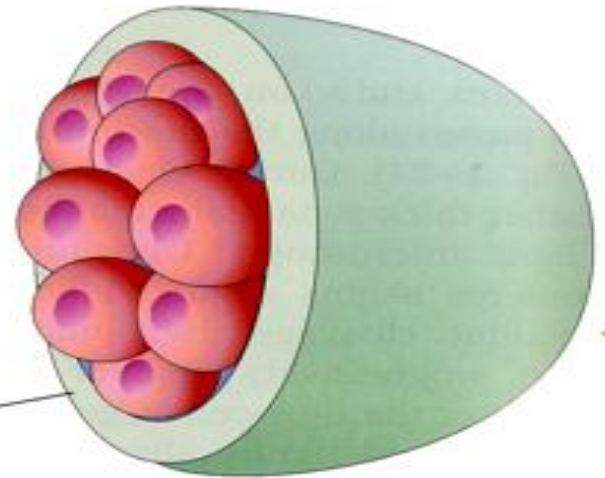
B

4-cell stage



C

8-cell stage



D

Morula

Zona pellucida

Cleavage of Zygote

- It is the repeated mitotic divisions of the zygote
- Rapid increase in the number of cells
- These smaller embryonic cells are called Blastomeres
- Normally occurs in the uterine tube
- Zygote divides first into 2 then 4 & 8 cells
- Zygote lies within the thick zona pellucida during cleavage

- **Compaction:**

- » Changes in the shape and alignment of blastomeres to form a compact ball of cells

- Permits greater cell- to- cell interaction

- **Morula:**

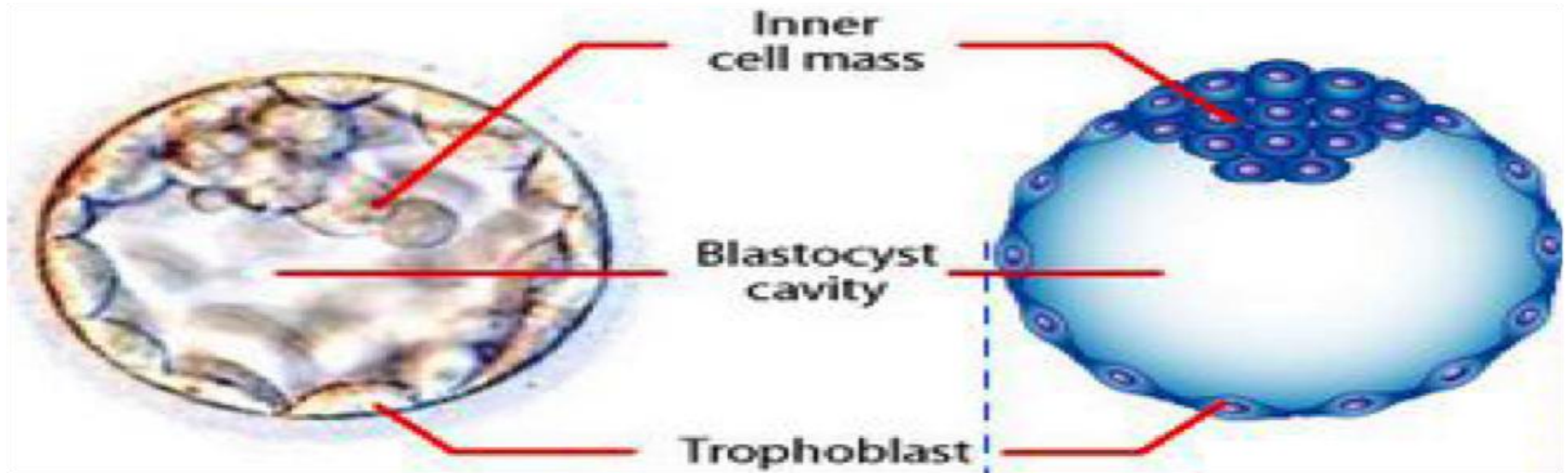
- embryo with 12-32 blastomeres

- zona prevents morula from contact with endometrium.

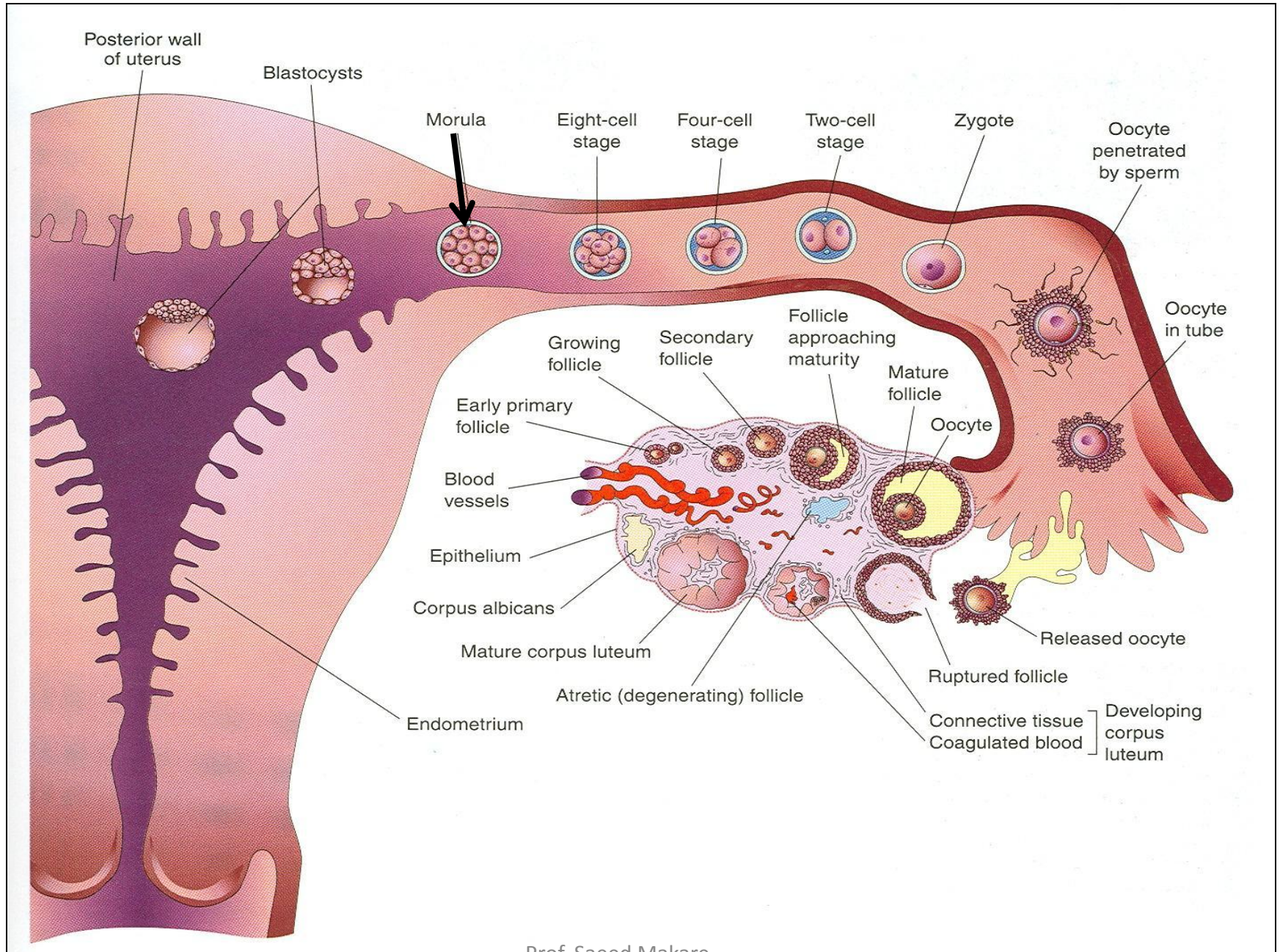
Implantation

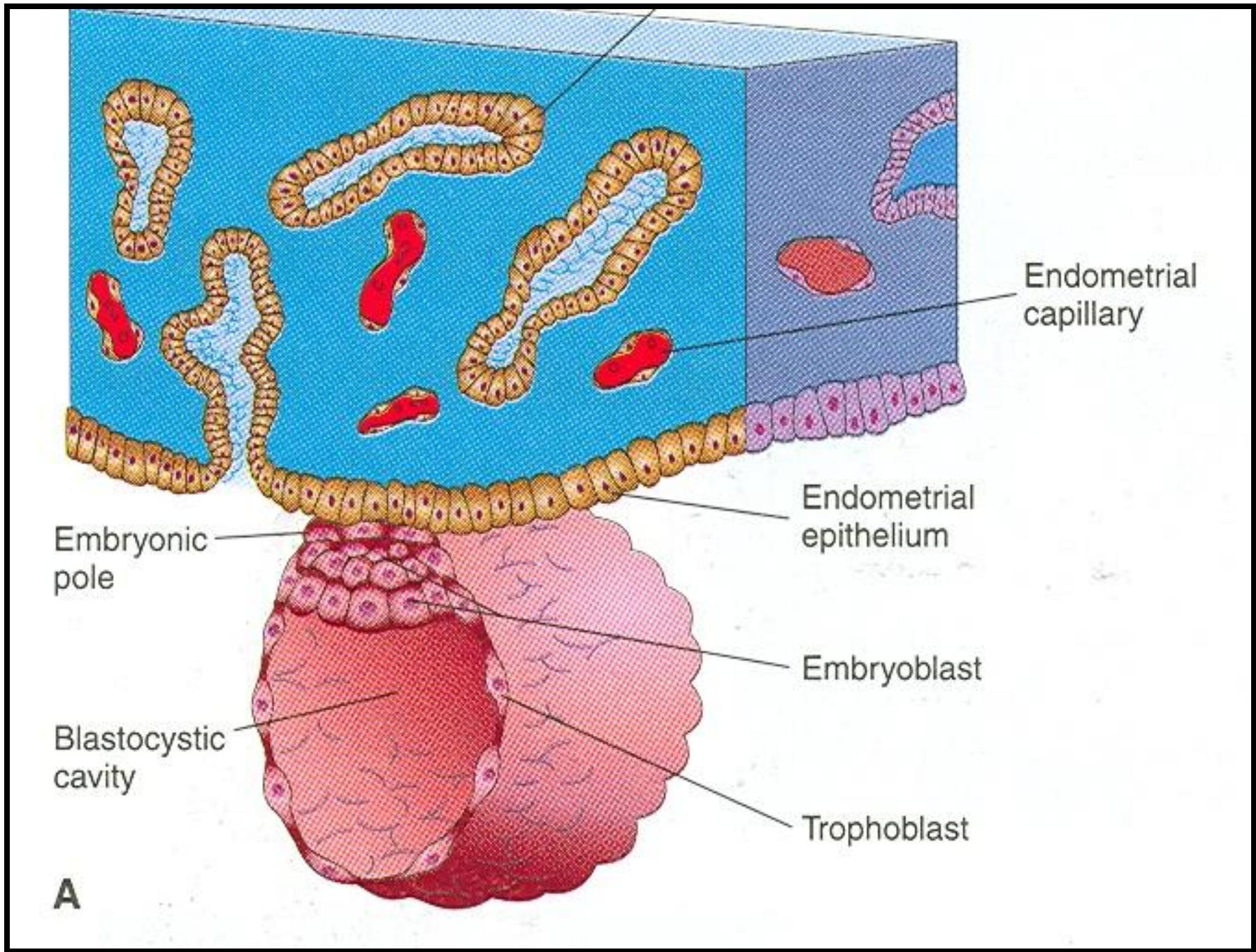
- As the morula enters the uterus a fluid filled space appears inside the morula called Blastocystic cavity
- This fluid separates the blastomeres into 2 parts:
- Thin & outer cell layer called *Trophoblast*
- Inner cell mass called **Embryoblast**

Blastocyst Formation



- Blastocyst consist of:
 - Trophoblast (placenta)
 - Blastocystic cavity: a fluid-filled space
 - Inner cell mass (embryoblast)
- *Zona pellucida* gradually degenerates and disappears
- Hatched blastocyst begins increasing in size and derives nourishment from secretions of the uterine glands.





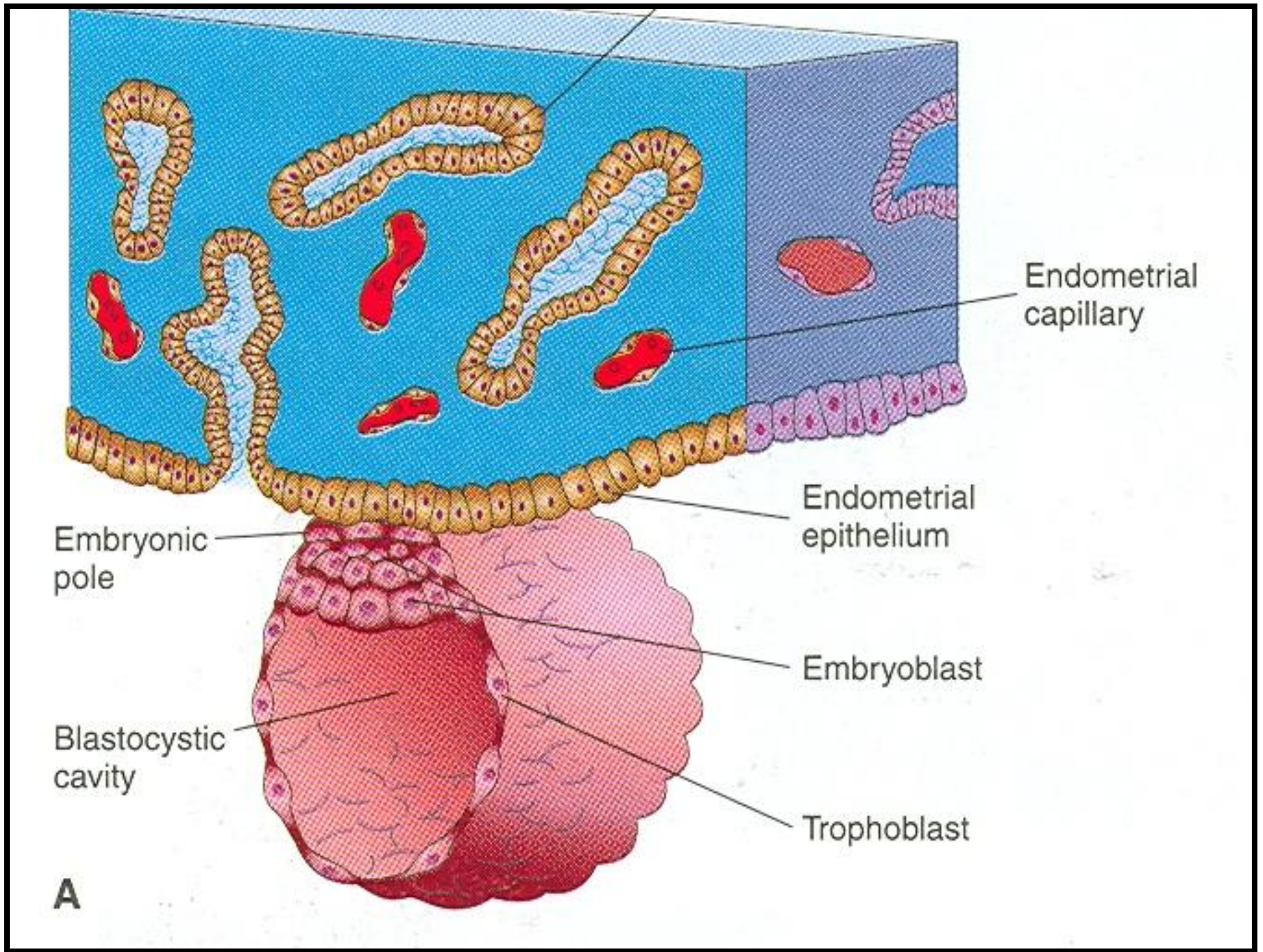
Day 6

- Implantation begins by end of week one
- And end by end of week two
- Where ?
- endometrium of the uterus, superior in the body of the uterus

Trophoblast

As soon the blastocyst attaches to the endometrium the **Trophoblast** differentiates into 2 layers:

- Inner layer called Cytotrophoblast
- Outer layer called Syncytiotrophoblast

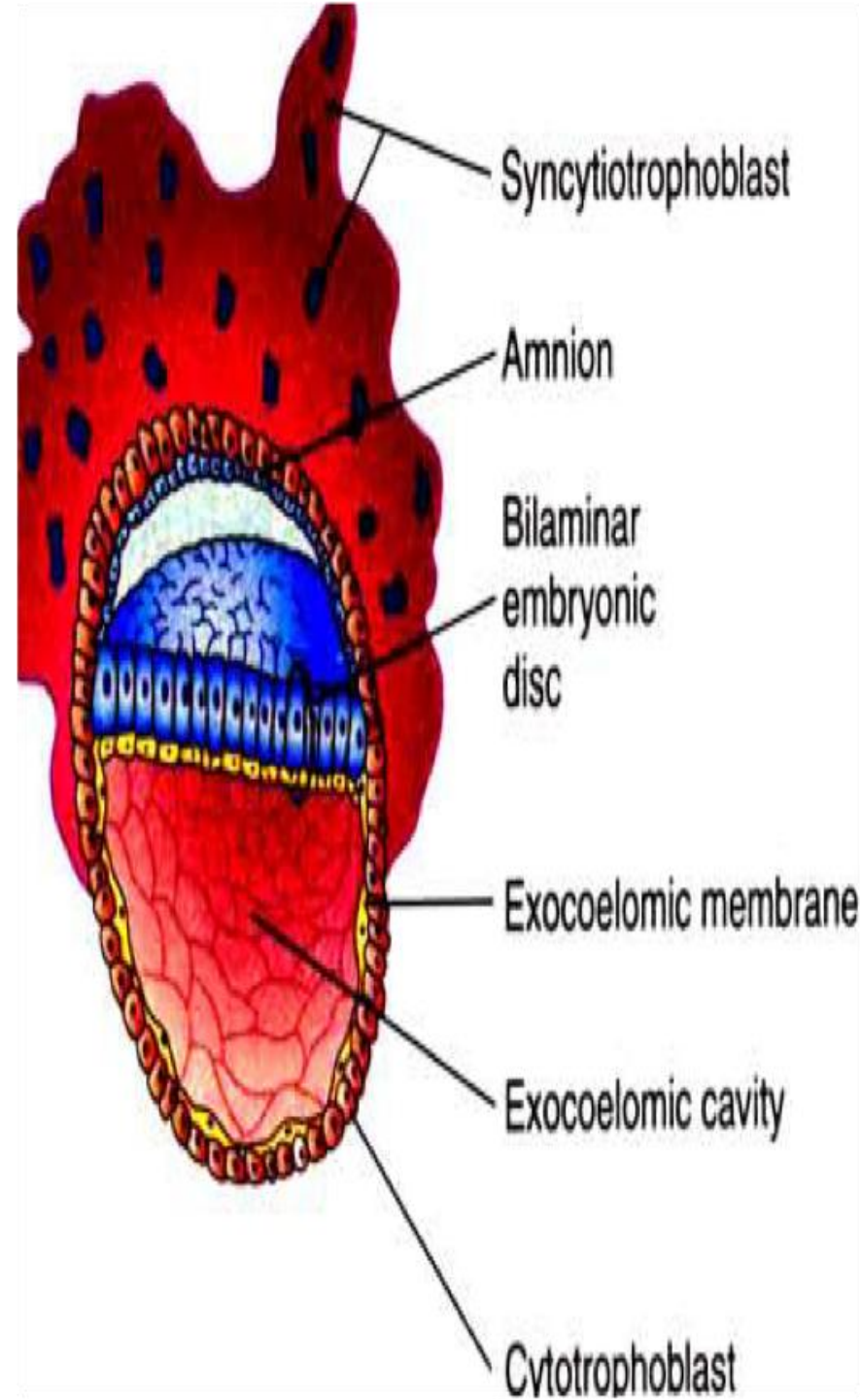
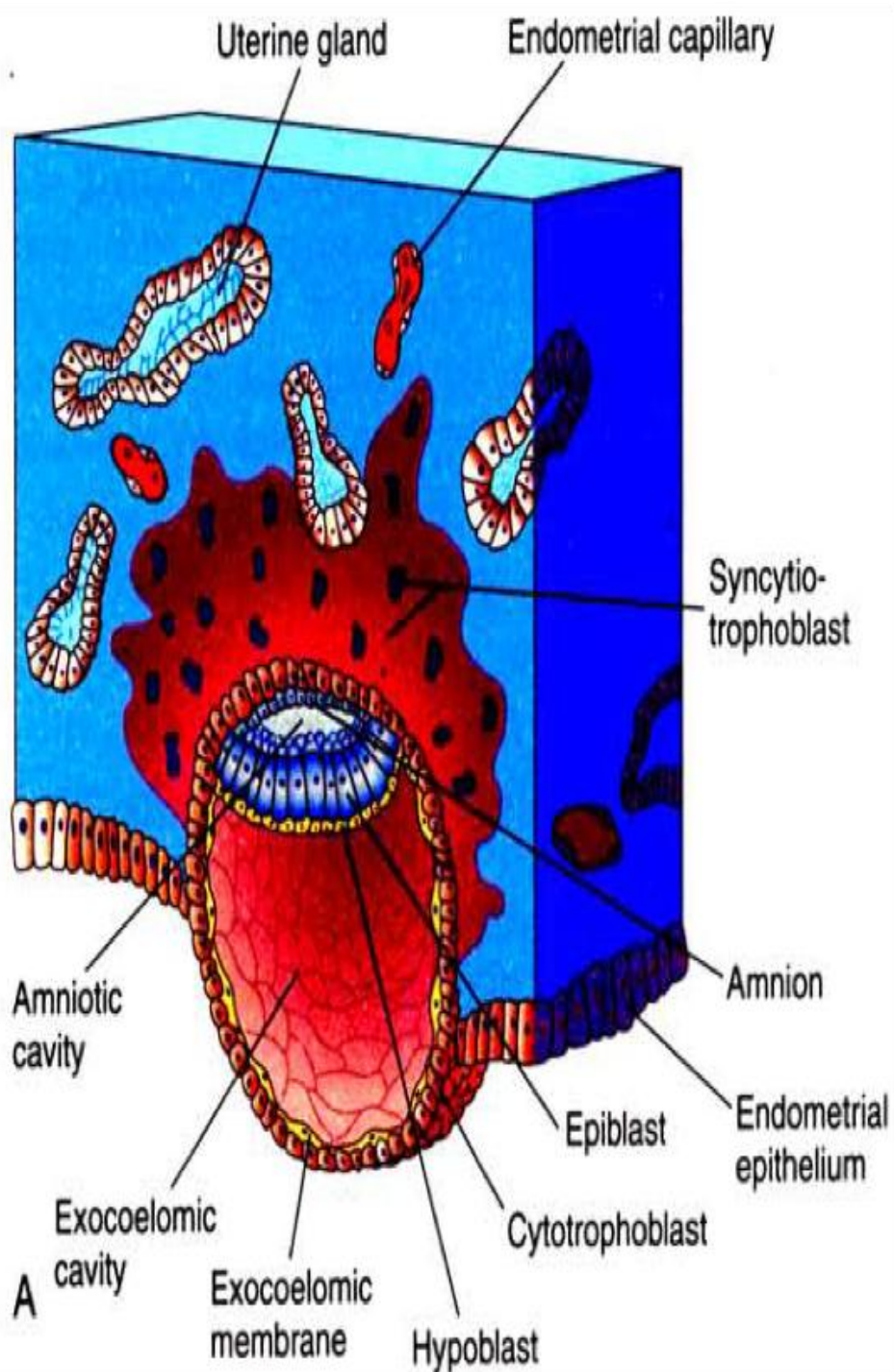


Day 7

- **Trophoblast differentiates into:**
 - **Cytotrophoblast:** mononucleated layer of mitotically active cells that form new syncytiotrophoblast.
 - **Syncytiotrophoblast:**
 - rapidly expanding, multinucleated protoplasmic mass with no cell boundaries
 - secretes **hCG + enzymes** to allow invasion of endometrium by apoptosis.

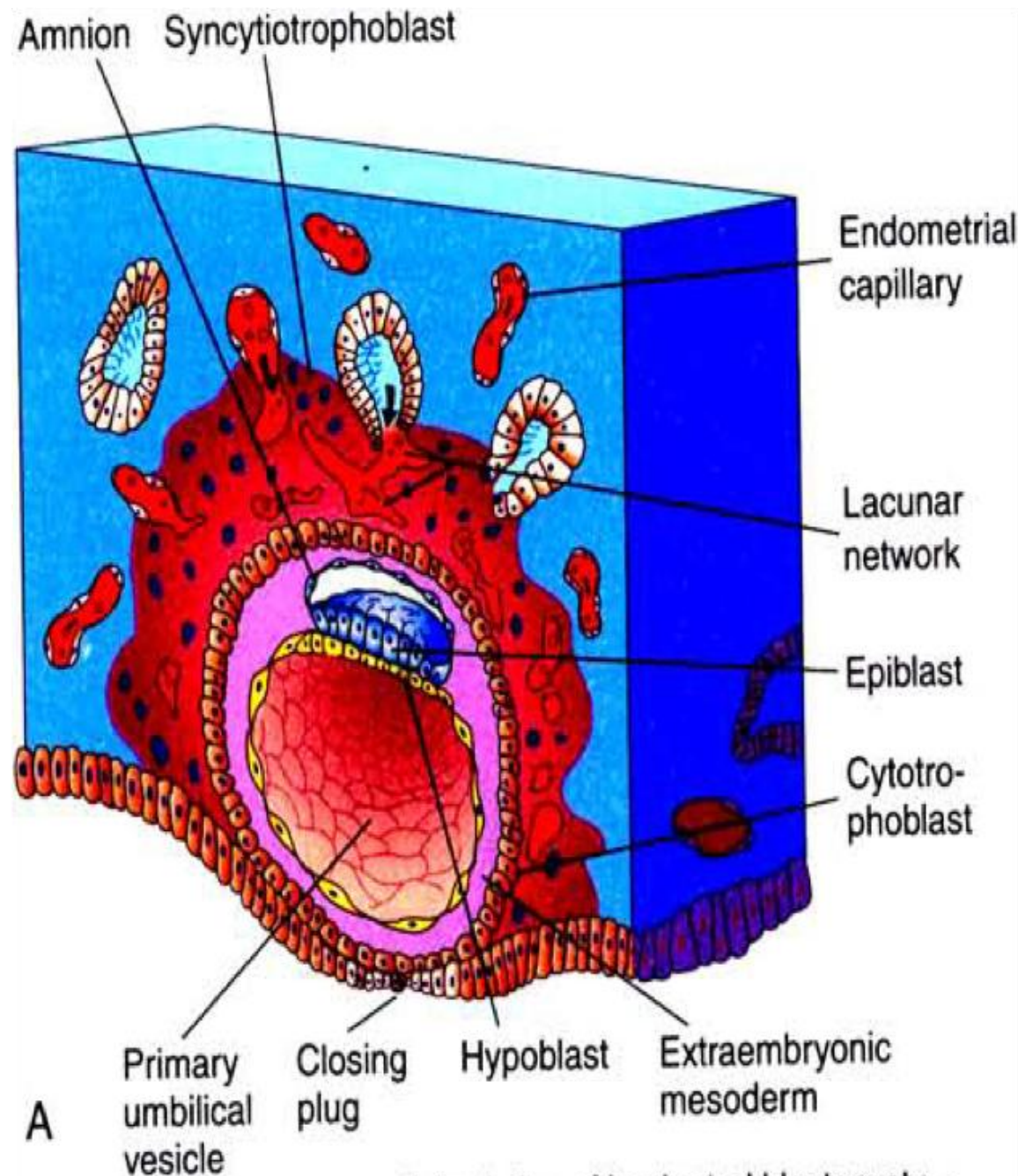
Day 8

- appears as a fluid-filled space in the embryoblast.
- **Amnion** forms by separating amnioblasts from epiblasts and encloses the amniotic cavity.
- Formation of embryonic disc , consists of 2 layers :
 - **Epiblast : floor of amniotic cavity (columnar)**
 - **Hypoblast : roof of exocoelomic cavity (cuboidal)**



Day 10

1. Primary umbilical vesicle formed by multiplying of hypoblasts that line blastocyst cavity.
 2. Extraembryonic mesoderm formed & surrounds amnion & umbilical vesicle.
 3. Closing plug (fibrinous coagulum of blood) formed
- Embryo is completely embedded in the endometrium.

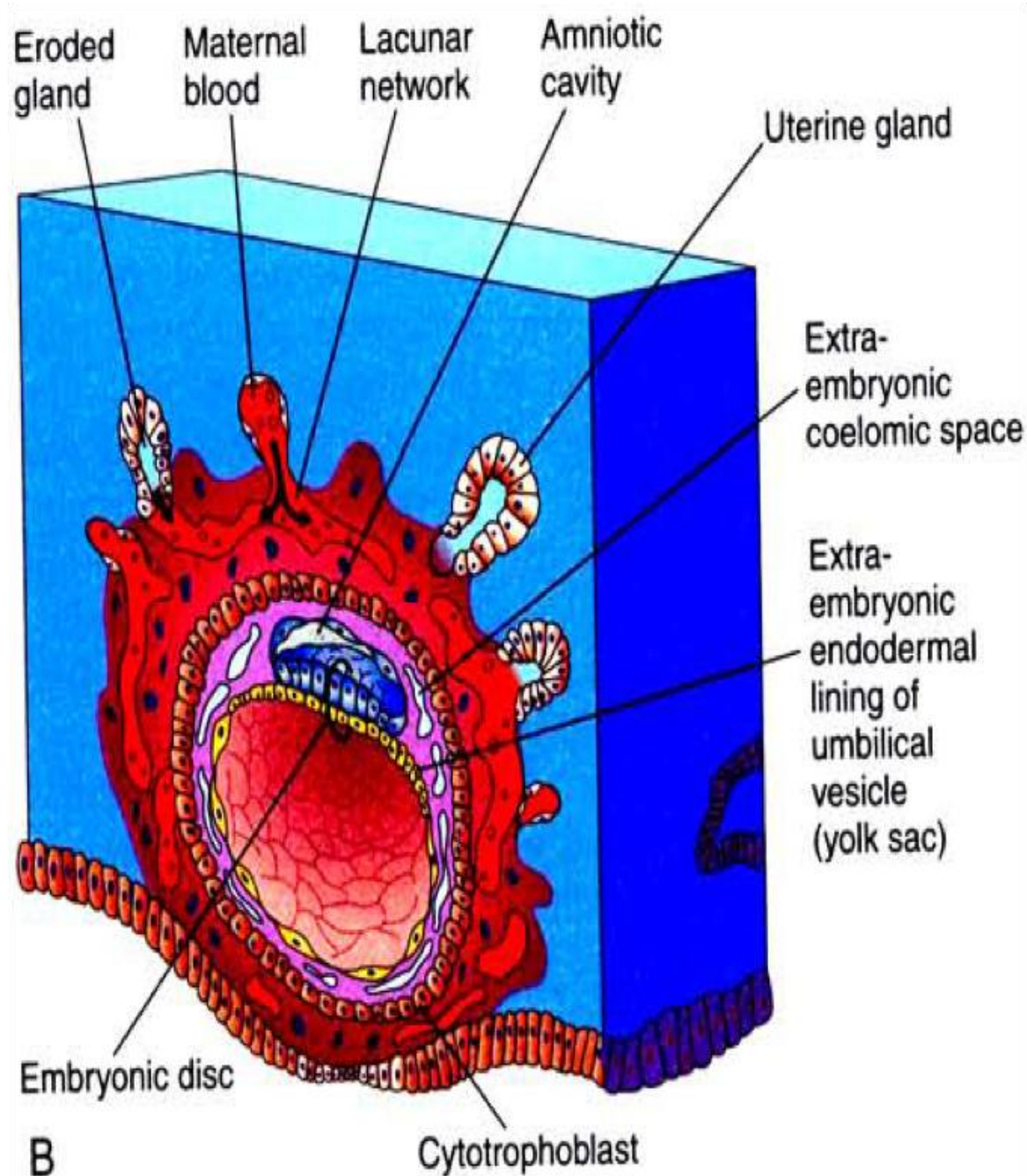


Actual size of implanted blastocyst : •

Day 11- 12

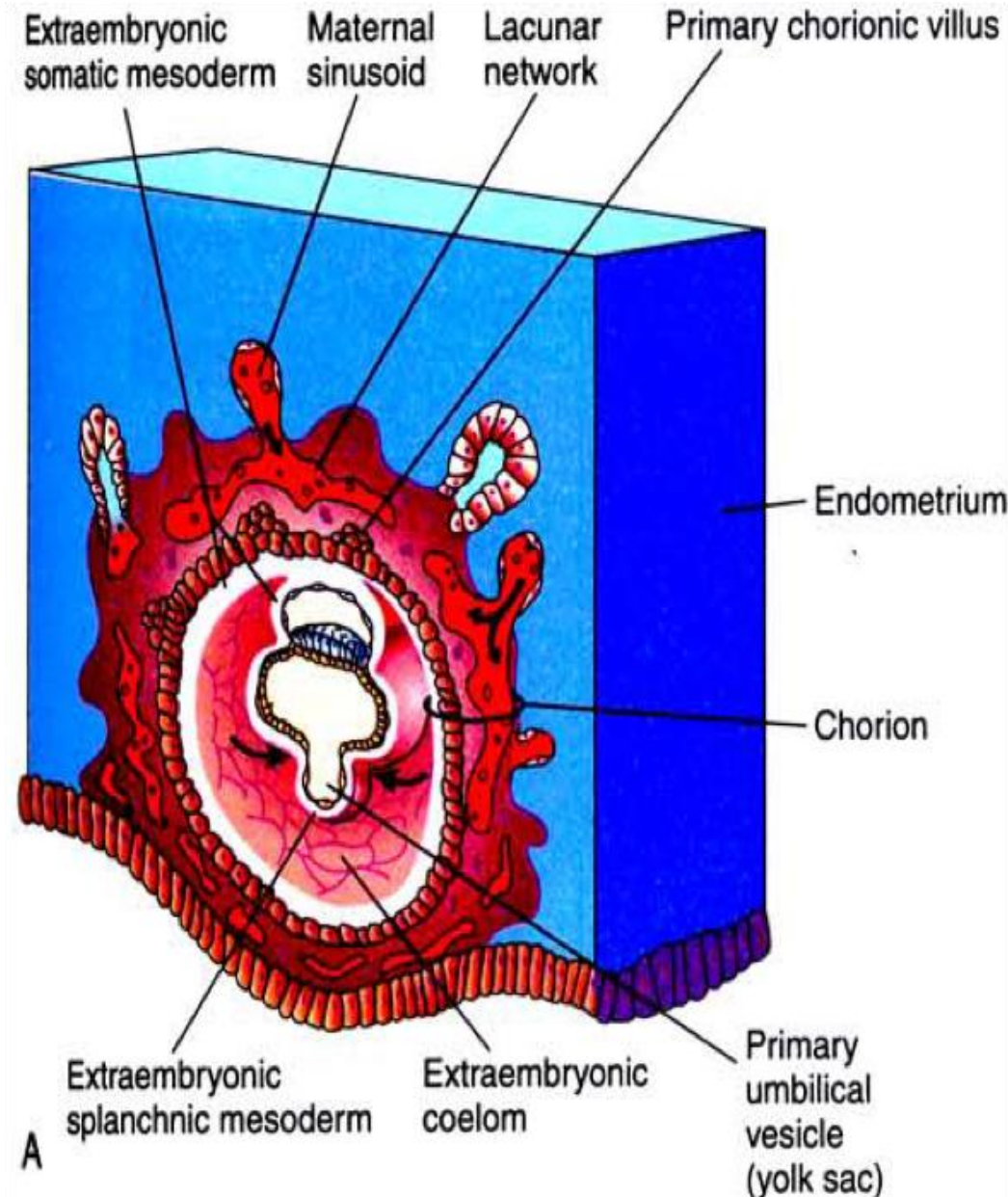
Lacunar networks:

- formed by fusion of adjacent lacunae
- filled with maternal blood and cellular debris



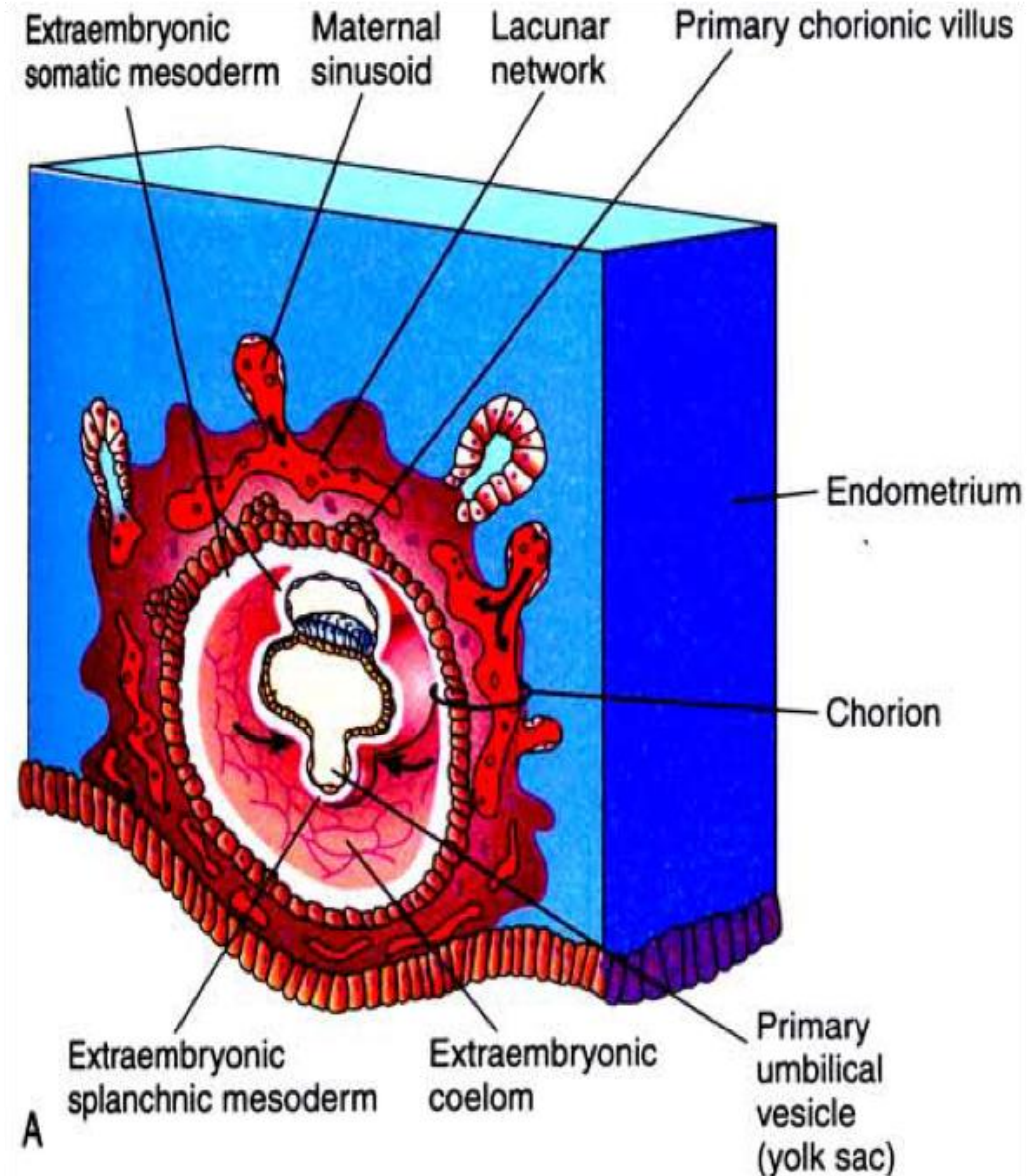
Day 12 - 13

- **Extraembryonic coelomic spaces** appear within extraembryonic mesoderm and fuses to form extraembryonic coelom.
- embryonic coelom splits the extraembryonic mesoderm into 2 layers:
 - **extraembryonic somatic mesoderm**: lines trophoblast and covers the amnion
 - **extraembryonic splanchnic mesoderm**: surround the umbilical vesicle.



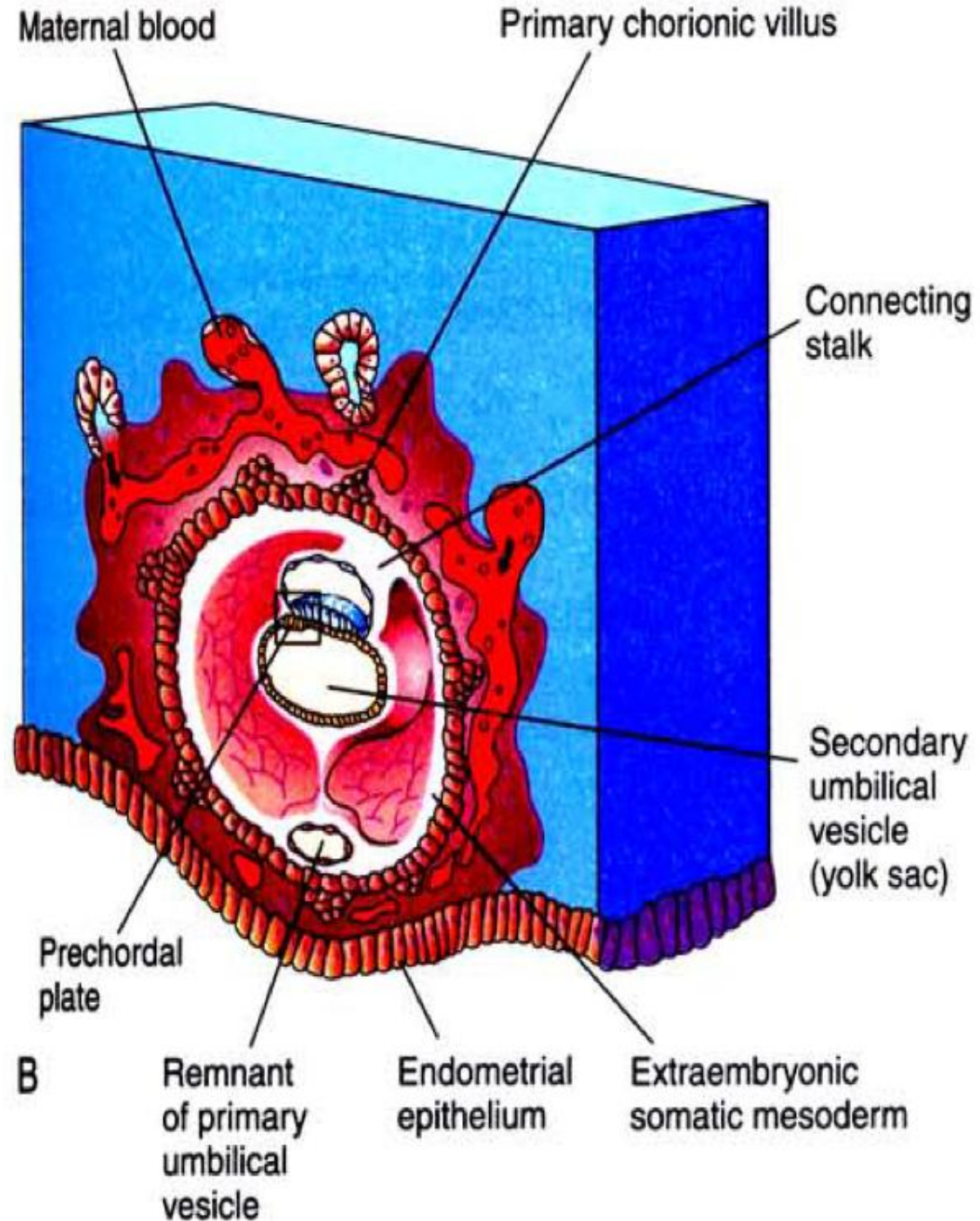
Day 13

- **Chorion:**
- Somatic mesoderm + cytotrophoblast + syncytiotrophoblast = **Chorion** (major part of placenta)
- forms the wall of chorionic sac within which **embryonic disc + amniotic sac + umbilical vesicle** are suspended by **connecting stalk** (precursor of umbilical cord).
- **primary chorionic villi** developed from extensions of cytotrophoblasts.

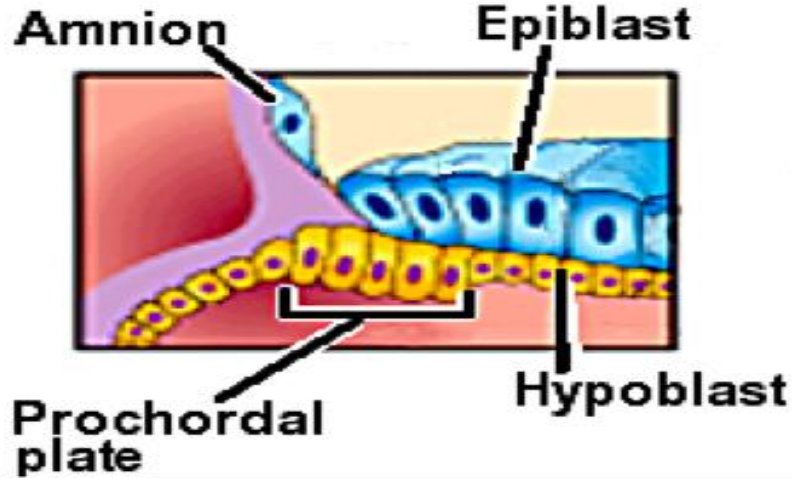


Day 13-14

- primary umbilical vesicle becomes smaller and gradually disappears as **secondary umbilical vesicle** (yolk sac) develops.
- **umbilical vesicle(yolk sac)** :
 - site of origin of **primordial germ cells**
- completely lined by hypoblasts



Day 14: End of 2nd Week

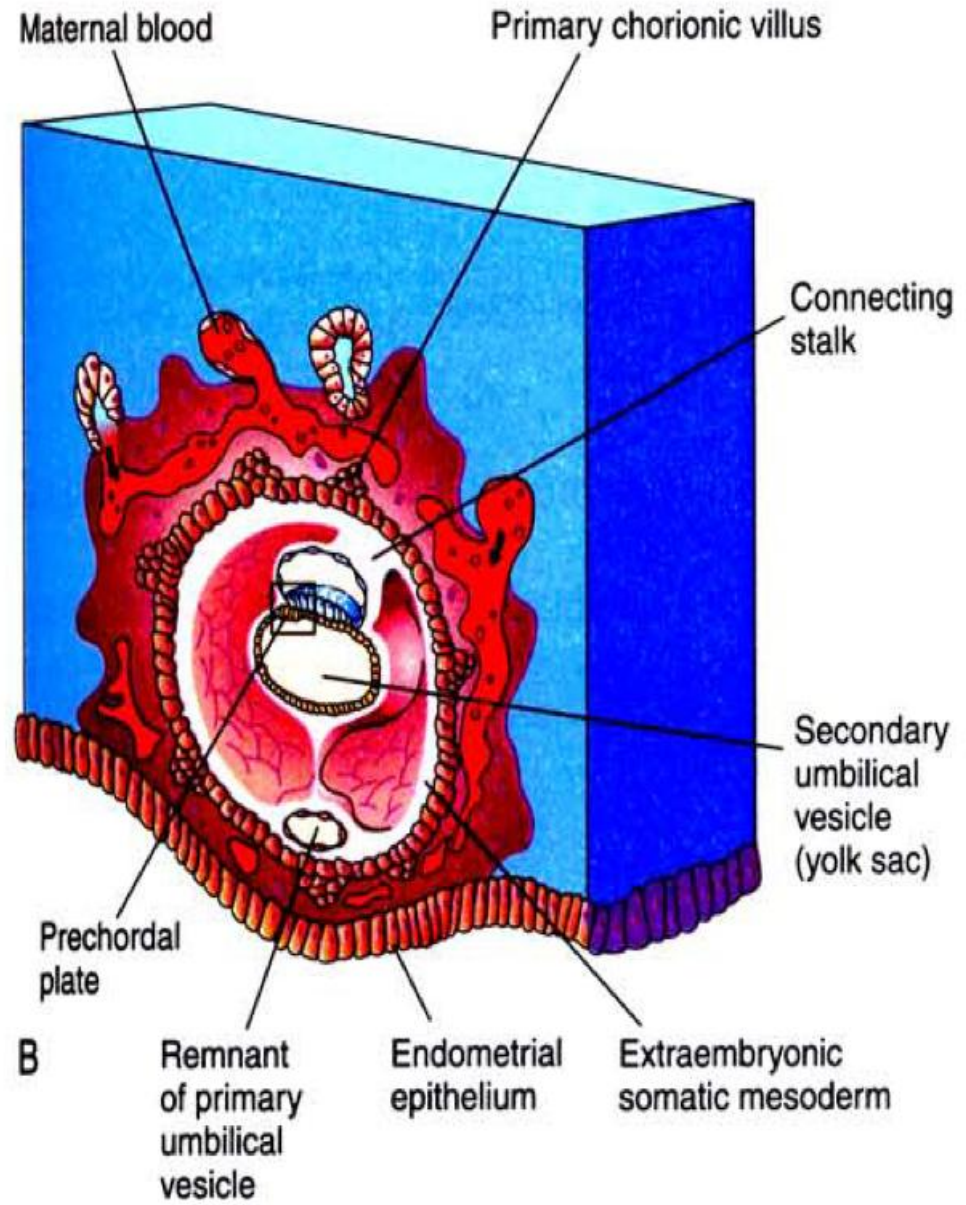


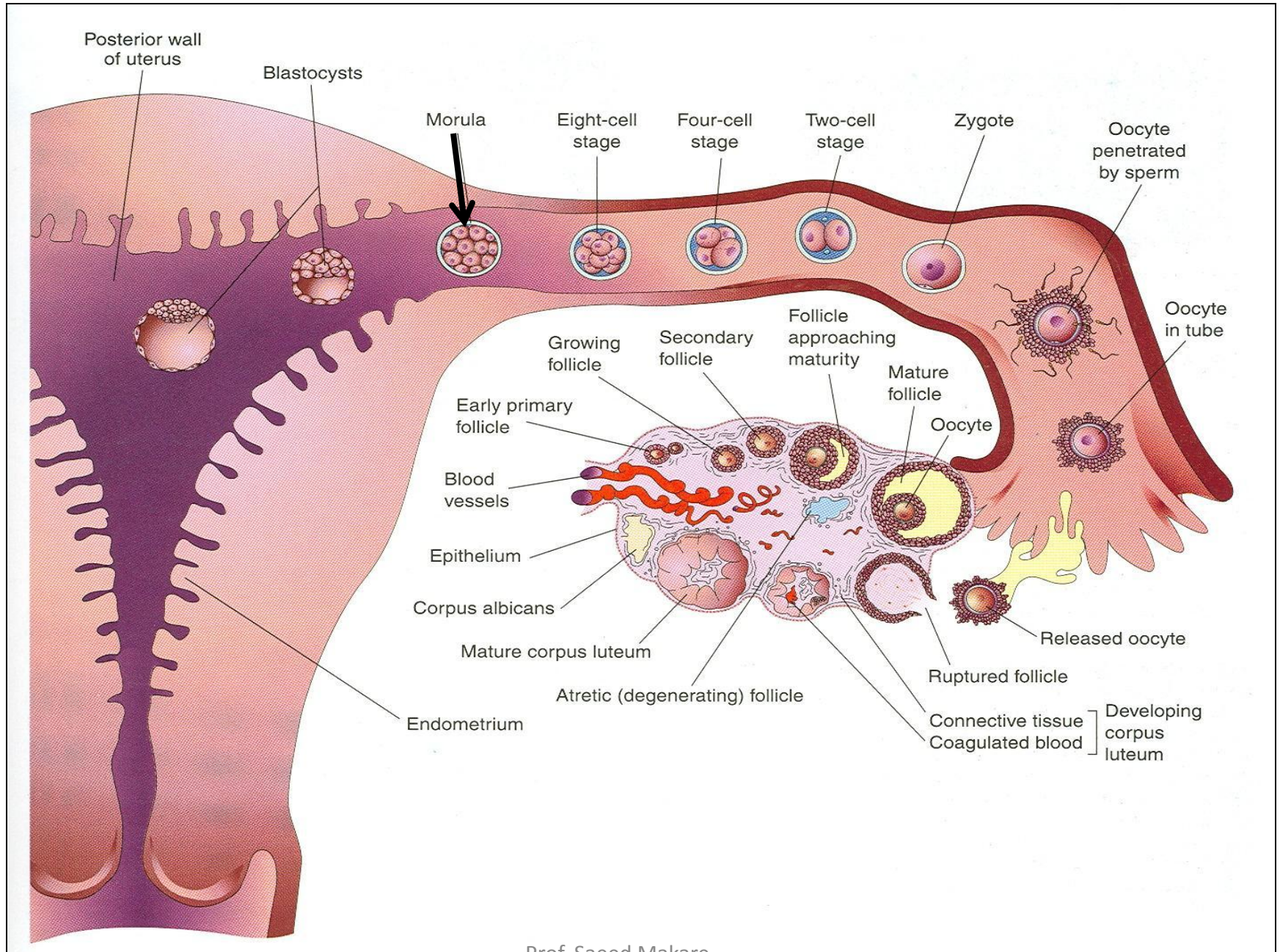
Prechordal plate formed:

—from localized thickening of hypoblasts

- indicates future site of mouth
- important organizer of head region

Defect in endometrial epithelium is repaired





Ectopic Pregnancy

- Pregnancy in which the fertilized embryo implants on any tissue other than the endometrial lining of the uterus.
 - Tubal pregnancy 95%
 - Abdominal 1.5%
 - Ovarian 0,5%
 - Cervical 0.03%

