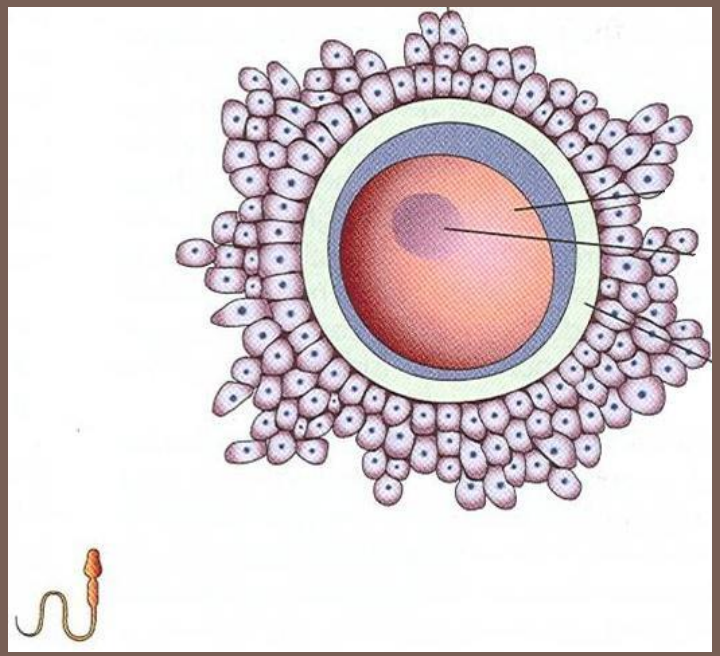


FERTILIZATION & IMPLANTATION

Prof. Ahmed Fathalla Ibrahim

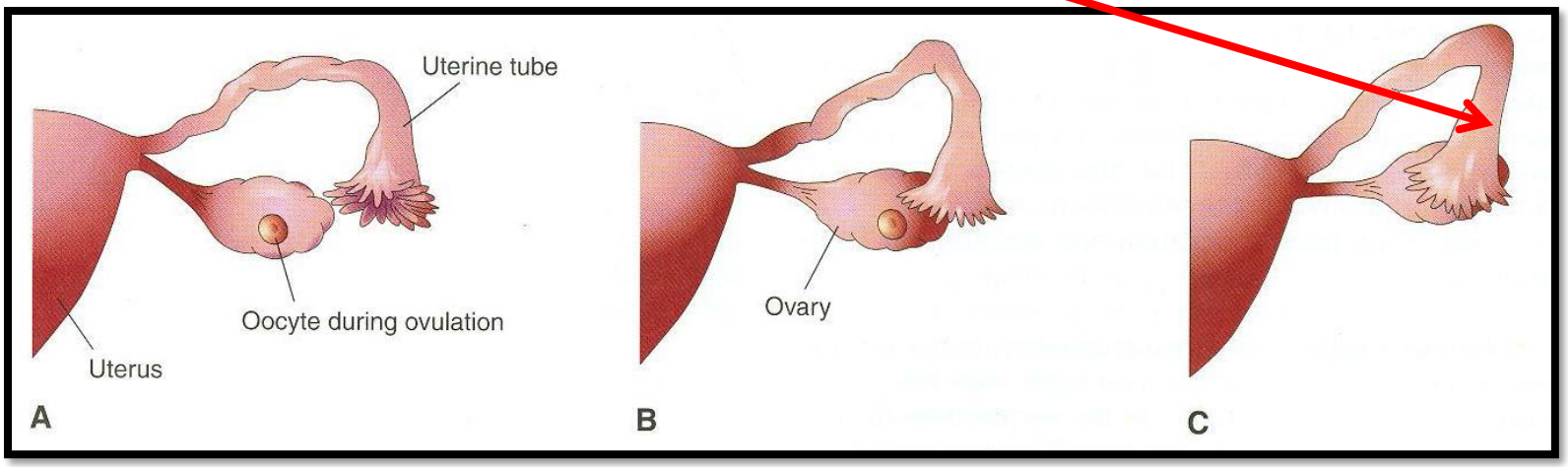
OBJECTIVES

At the end of the lecture, the student should be able to:

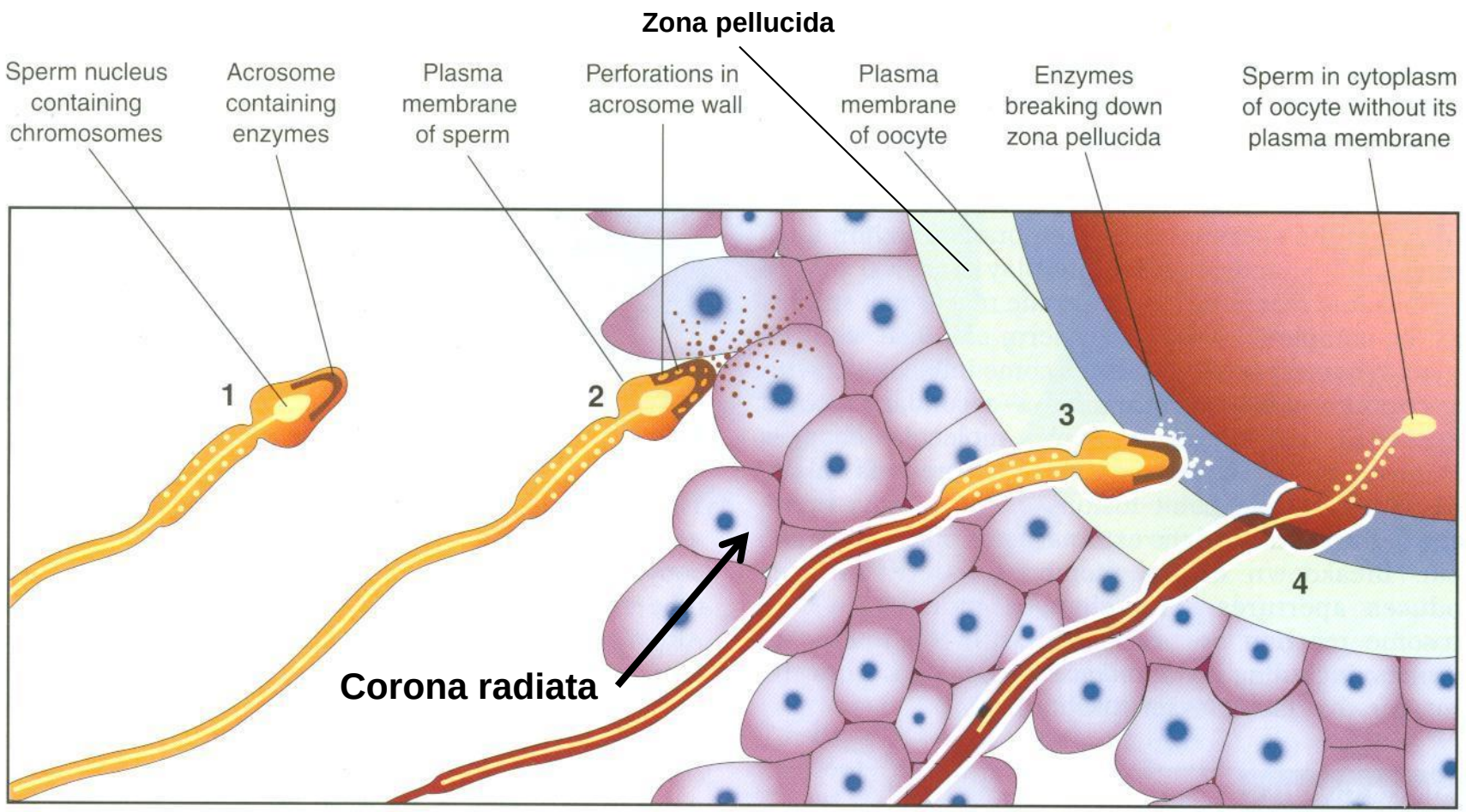
- **Define fertilization, cleavage & implantation.**
- **Enumerate phases & results of fertilization, as well as steps of implantation.**
- **Locate the site/s of fertilization and implantation.**
- **Identify the time of each event.**

FERTILIZATION

- **DEFINITION:** It is the process of fusion of male & female gametes (with haploid numbers of chromosomes = 23 each) to produce a zygote (with diploid number of chromosomes =46)
- **SITE:** In the ampulla (widest part) of uterine tube



FERTILIZATION



Prof. Ahmed Fathalla El Fouhil

SPERM CAPACITATION

- **Before fertilization** , the sperm undergoes "capacitation" which is a period of **conditioning** (around 7 hours) that occurs **in the female reproductive tract** during which the **acrosome prepares the enzymes** used for perforation of walls of the oocyte.

PHASES OF FERTILIZATION

1- Passage of the sperm through **corona radiata.**

2- Passage of the sperm through **zona pellucida.**

These occurs by the action of acrosomal enzymes

3- Fusion of plasma membranes of oocyte & sperm.

4- Completion of 2nd meiotic division of oocyte to become a mature ovum.

PHASES OF FERTILIZATION

5- Formation of female pronucleus: the nucleus of the ovum becomes **the female pronucleus**.

6- Formation of the male pronucleus: the nucleus in the head of sperm enlarges to form **the male pronucleus** & the tail disappears.

7- Fusion of both male & female pronuclei to form the zygote.

WHY

ONLY ONE SPERM PASSES THROUGH PLASMA MEMBRANE OF OOCYTE?

ZONA REACTION

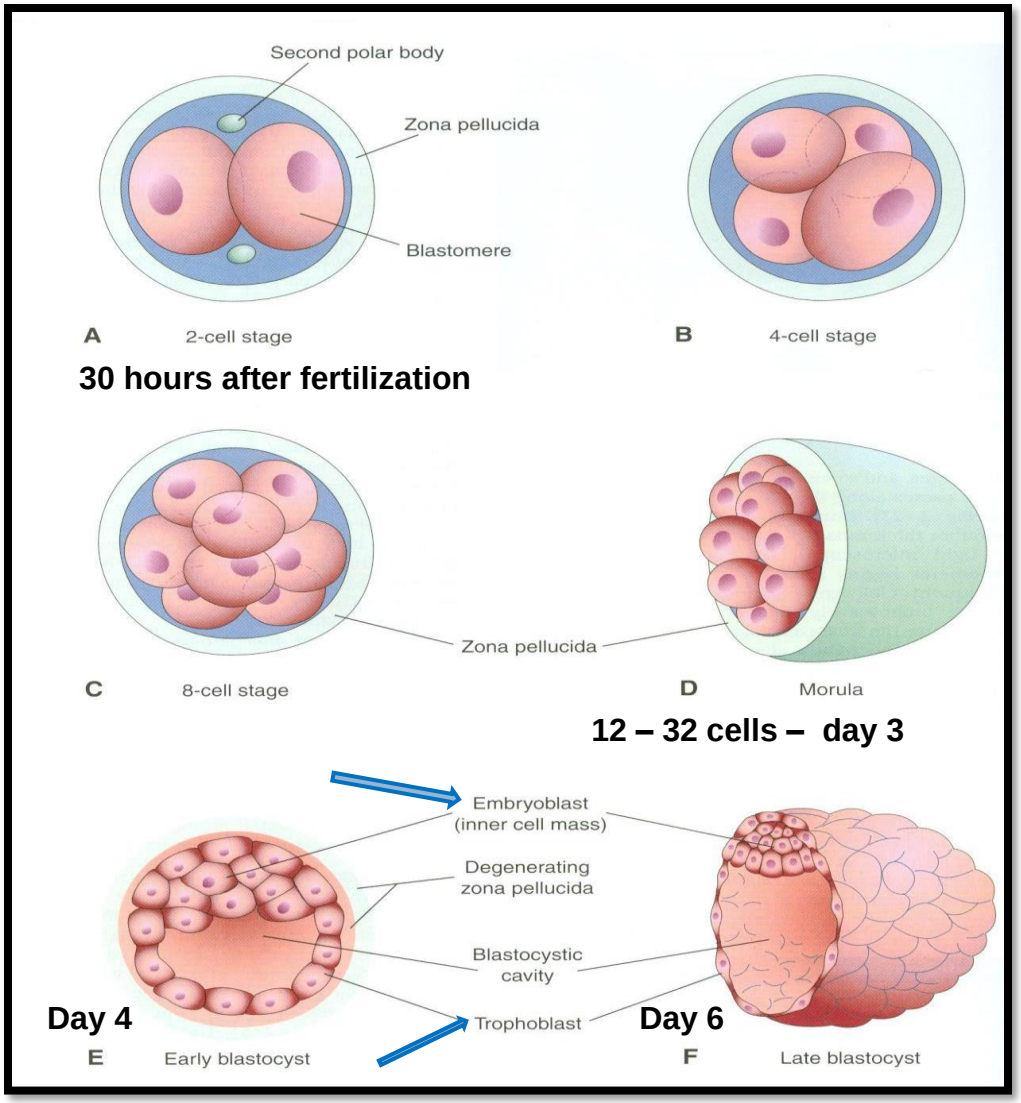
A change in the properties of the zona pellucida occurs that makes it impermeable to other sperms

Prof. Ahmed Fathalla El Fouhil

RESULTS OF FERTILIZATION

- Restoration of the **normal diploid** number of chromosomes (46) in the zygote.
- Determination of the **sex** of the embryo.
- Variation in the **features** of human species because of the mixing of maternal & paternal chromosomes.
- Initiation of cleavage **(cell division)** of zygote.

CLEAVAGE

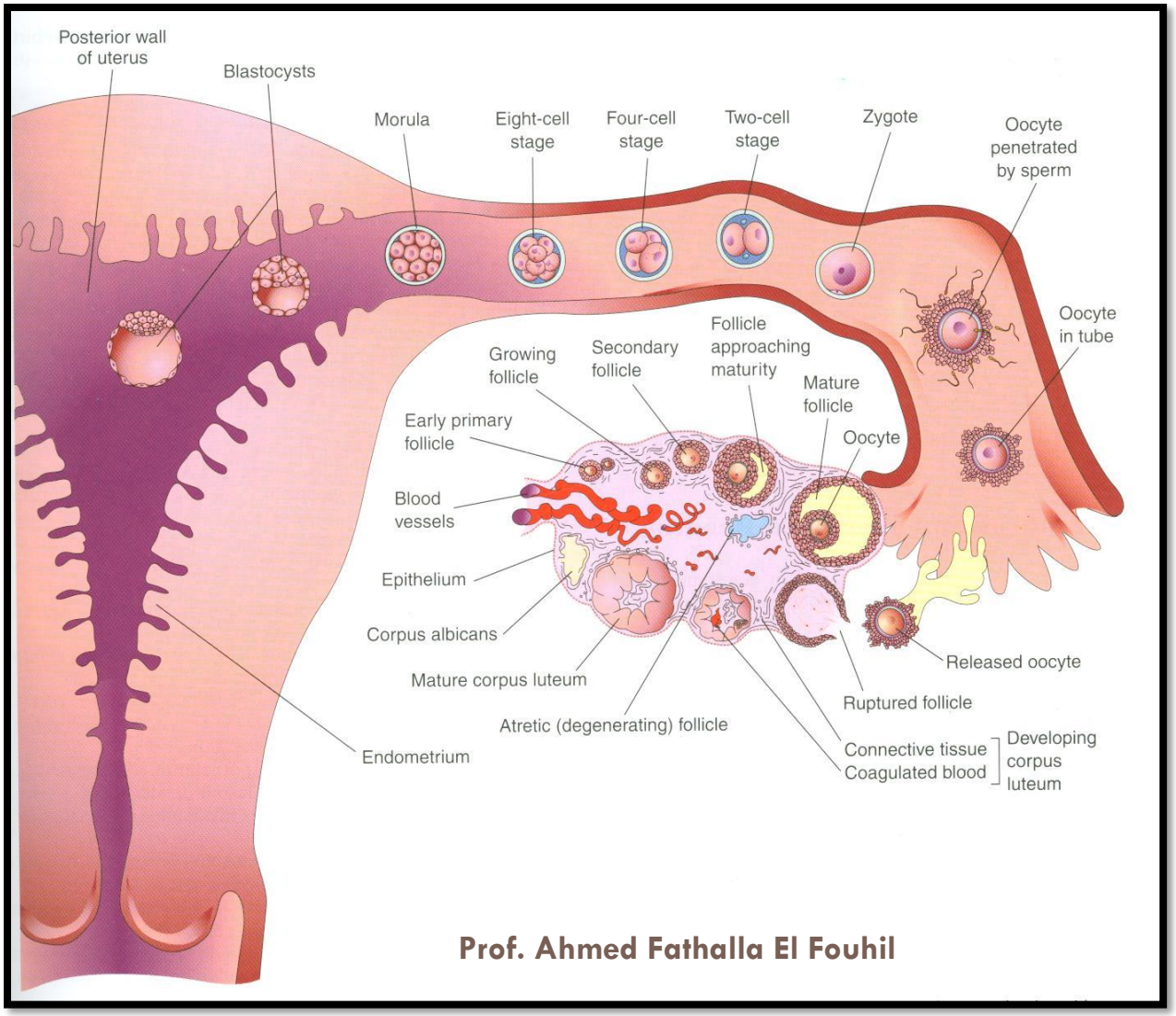


Embryoblast → Embryo

Trophoblast → Fetal membranes

Prof. Ahmed Fathalla El Fouhil

CLEAVAGE


Posterior wall of uterus
Blastocysts
Morula
Eight-cell stage
Four-cell stage
Two-cell stage
Zygote
Oocyte penetrated by sperm
Oocyte in tube
Follicle approaching maturity
Secondary follicle
Growing follicle
Mature follicle
Early primary follicle
Oocyte
Blood vessels
Epithelium
Corpus albicans
Mature corpus luteum
Atretic (degenerating) follicle
Endometrium
Released oocyte
Ruptured follicle
Connective tissue
Coagulated blood
Developing corpus luteum
Prof. Ahmed Fathalla El Fouhil

CLEAVAGE

- Cleavage consists of **repeated mitotic divisions** of the zygote resulting in a rapid increase in the number of the cells.
- Embryonic cells are called ***"blastomers".***
- During cleavage, the dividing zygote passes along the uterine tube **toward the uterus.**

IMPLANTATION

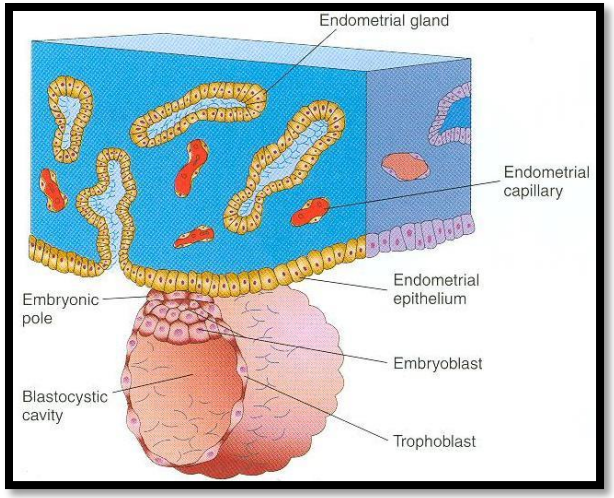
- **DEFINITION: It is the process by which the blastocyst becomes embedded in the endometrium (mucous membrane) of the uterus.**
- **NORMAL SITE: In the upper part of the posterior wall of the uterus.**
- **DURATION: From day 6 to day 10.**
- **IMPORTANT EVENT PRECEDING IMPLANTATION: Zona pellucida disappears at day 5.**

WHAT

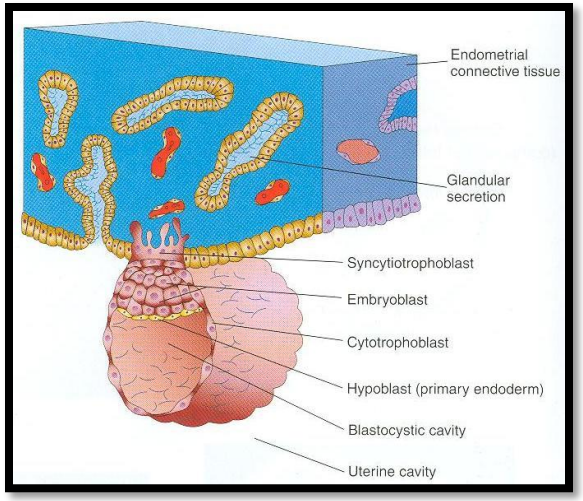
IS THE ROLE OF ZONA PELLUCIDA?

1. **DURING FERTILIZATION:** ZONA REACTION TO MAKE ZONA PELLUCIDA IMPERMEABLE TO OTHER SPERMS
2. **DURING CLEAVAGE:**
   A- KEEPS BLASTOMERS TOGETHER
   B- PREVENTS STICKY BLASTOMERS TO ADHERE TO THE WALL OF UTERINE TUBE

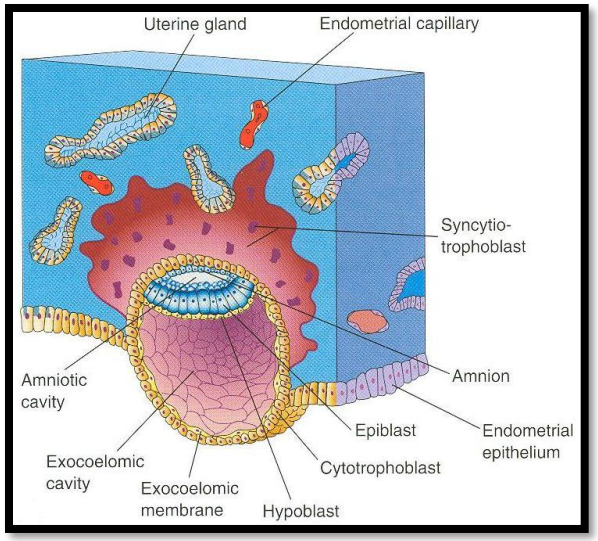
STEPS OF IMPLANTATION



DAY 6: The blastocyst adheres to endometrium



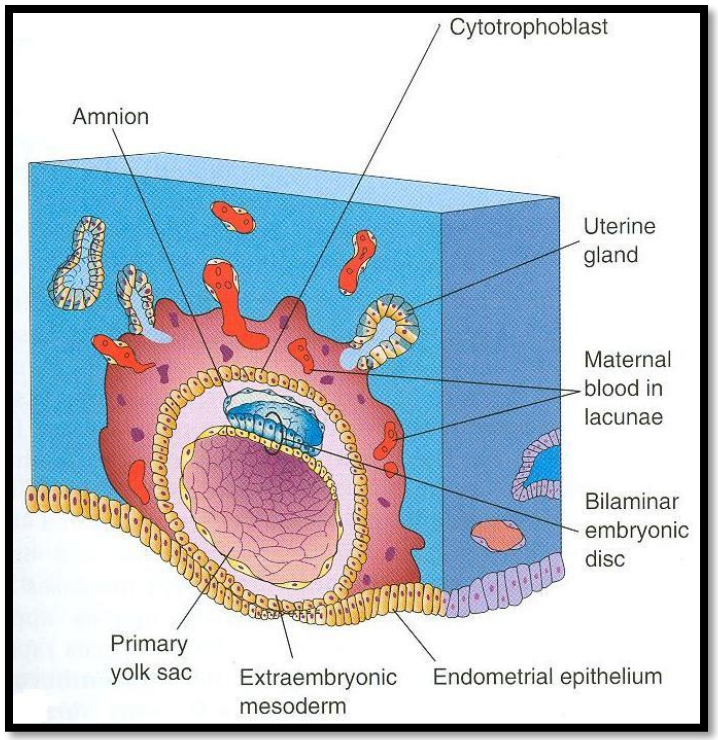
DAY 7: The trophoblast differentiates Into syncytiotrophoblast & cytotrophoblast



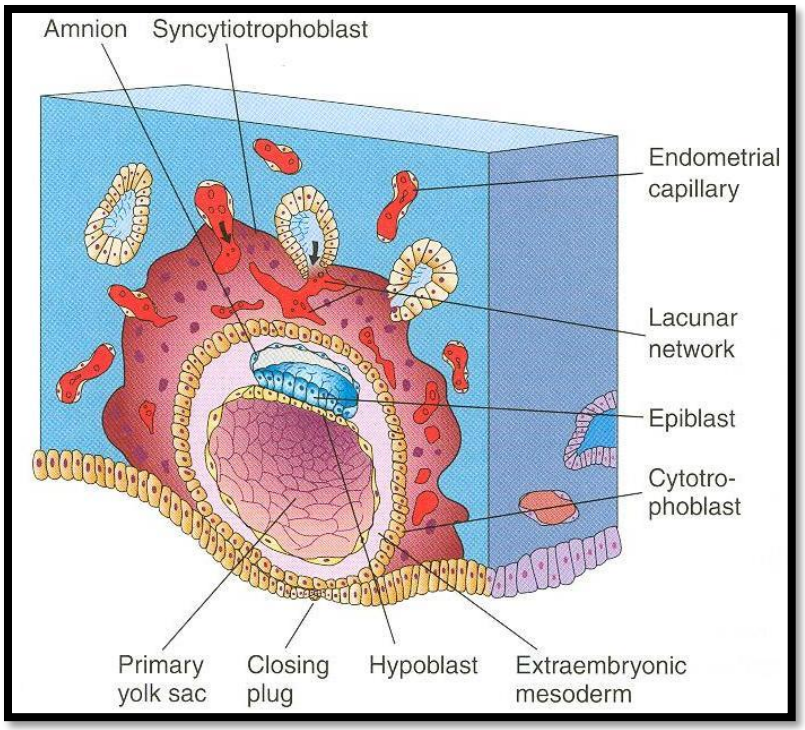
DAY 8: The syncytitrophoblast erodes endometrial tissues & the balstocyst starts to embed in the endometrium

Prof. Ahmed Fathalla El Fouhil

STEPS OF IMPLANTATION



DAY 9: Blood-filled lacunae appear in syncytiotrophoblast



DAY 10: The blastocyst is completely embedded in the endometrium. The defect is filled by a closing plug.

IMPLANTATION SITES

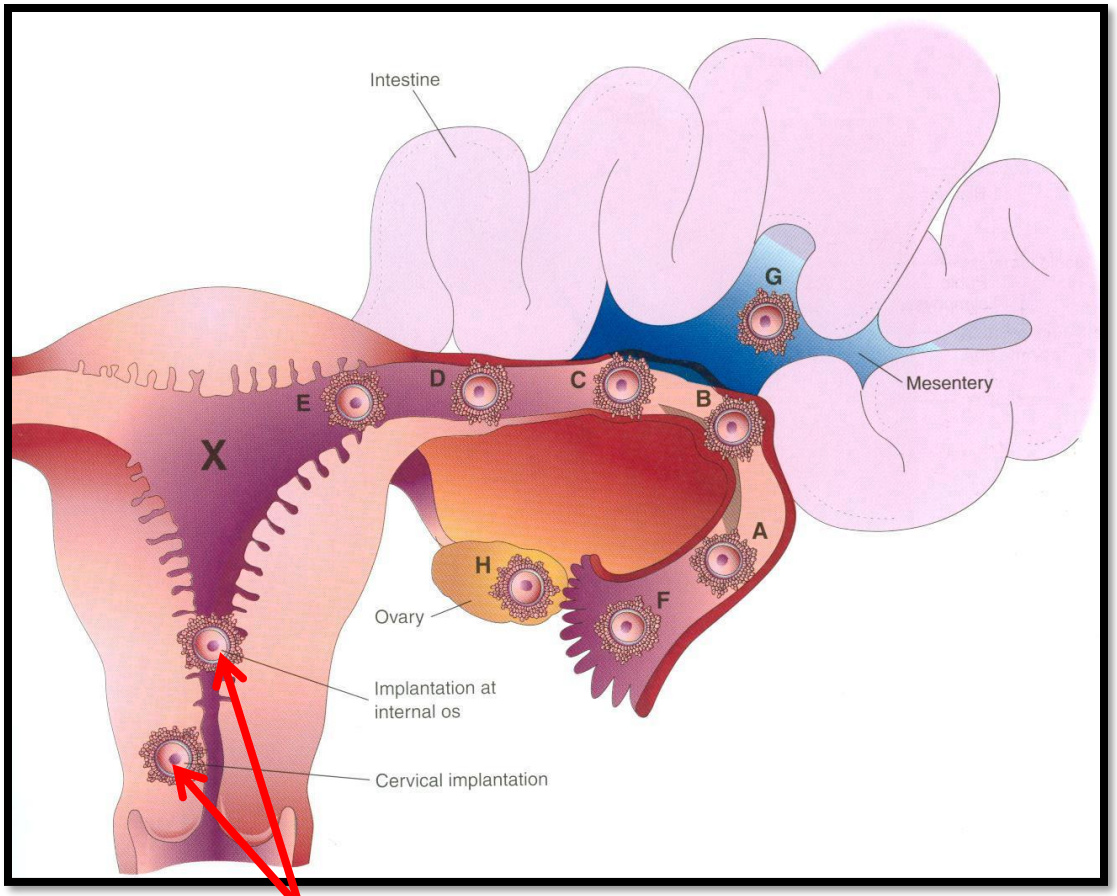
X = USUAL SITE

A-H = ECTOPIC PREGNANCY (PREGNANCY OUTSIDE UTERUS):

A-F = TUBAL PREGNANCY (MOST COMMON ECTOPIC PREGNANCY): MAY LEAD TO RUPTURE OF UTERINE TUBE

G = ABDOMINAL PREGNANCY

H = OVARIAN PREGNANCY (LEAST COMMON ECTOPIC PREGNANCY)



PREGNANCY IN CERVIX MAY OCCUR: LEADS TO ANTEPARTUM HEAMORRHAGE & PLACENTA PREVIA

Prof. Ahmed Fathalla El Fouhil

SUMMARY - 1

- **Fertilization** is fusion of **male & female gametes** (with **23** chromosomes each) to produce a **zygote** (with **46** chromosomes). It occurs in **the ampulla** of uterine tube.
- **Fertilization begins** by penetration of one sperm through corona radiata then zona pellucida & **ends** by fusion of male & female pronuclei to form the zygote.
- **Cleavage is repeated mitotic divisions** of the zygote into ***blastomers***. ***T***he dividing zygote passes along the uterine tube **toward the uterus**.

SUMMARY - 2

- **Implantation** is the process by which the blastocyst becomes **embedded in the endometrium** of the uterus. It usually occurs in **the upper part of the posterior wall of the uterus** from **day 6 to day 10.**
- **Tubal pregnancy** is the most common ectopic pregnancy.

QUESTION 1

- **WHICH ONE OF THE FOLLOWING IS THE FIRST PHASE IN FERTILIZATION?**

1. **Passage of sperm through zona pelluida.**
2. **Fusion of male & female pronuclei.**
3. **Passage of sperm through corona radiata.** ⬅
4. **Fusion of plasma membranes of oocyte & sperm.**

QUESTION 2

- **AT WHICH ONE OF THE FOLLOWING DAYS IMPLANTATION BEGINS?**

1. Day 5
2. Day 6 ⟵
3. Day 7
4. Day 8

Prof. Ahmed Fathalla El Fouhil