

First week of development

By:

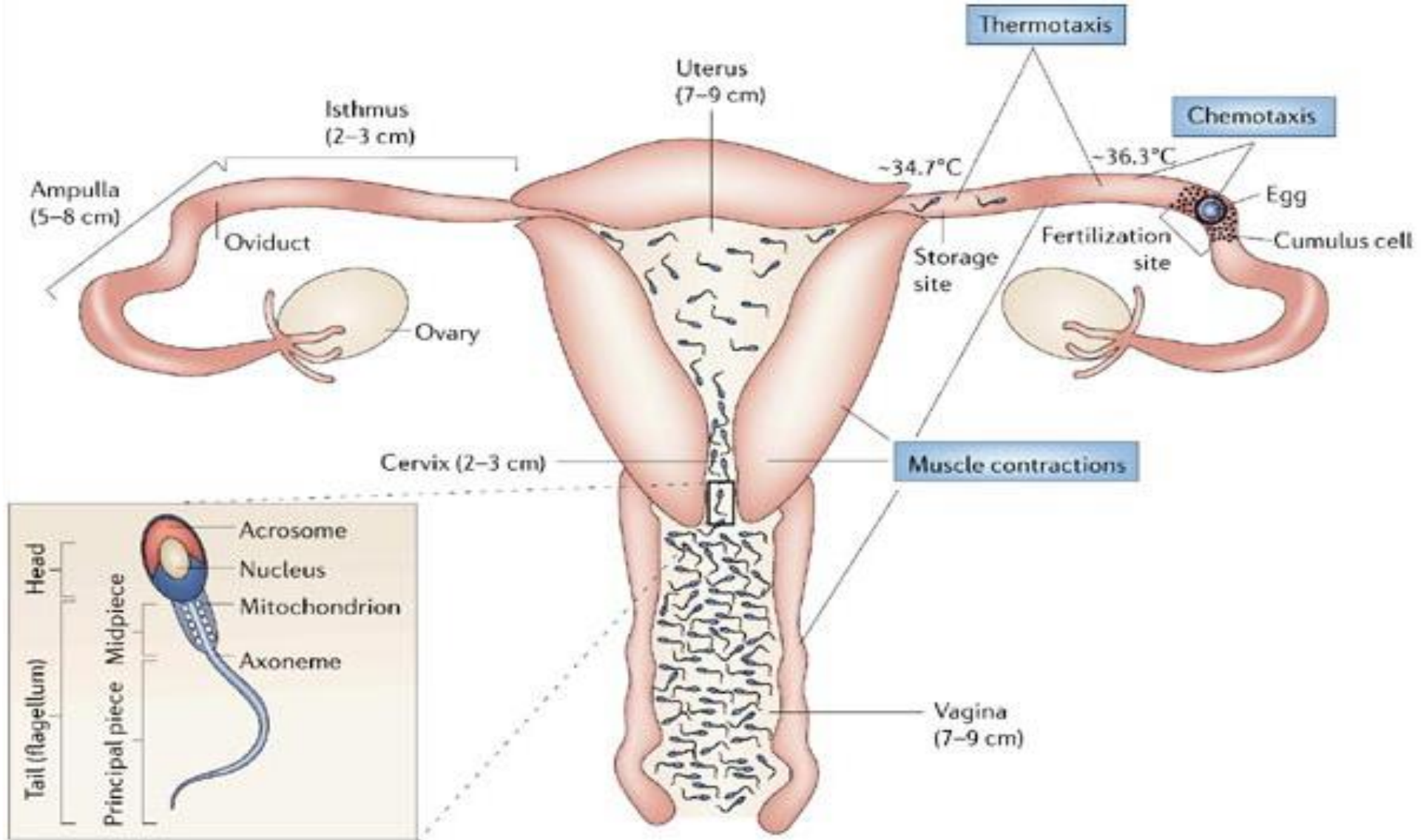
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FERTILIZATION:

- The process by which male and female gametes fuse, occurs in the **ampullary region (ampulla) of the uterine tube.**

Sperm transport:

- 200-600 million deposit around the external Os of the cervix.
- Prostaglandin in the semen stimulate uterine motility & assist in movement of sperm to site of fertilization.



Sperm and ovum transport

- The sperm move 2-3mm\ min. its speed varies with PH environment (sperm move slowly in acid environment of vagina but more rapidly in the alkaline environment of uterus).
- Motile sperm takes 5 to 45 min to reach the fertilization site.
- Only 300 to 500 reach the site of fertilization.

- Oocyte transport:

- ❖ Oocyte is carried into tube by:

1. Sweeping movement of the fimbriae.
2. Motion of cilia on epithelial lining.
3. Peristaltic muscular contraction of the tube.

Spermatozoa are not able to fertilize the oocyte immediately but must undergo:

1. Capacitation .

Is a period of **conditioning** in the female reproductive tract that lasts approximately 7 hours.

During this time **a glycoprotein coat** and **seminal plasma proteins** are removed from the plasma membrane that overlies the acrosomal region of the spermatozoa.

2. The acrosome reaction:

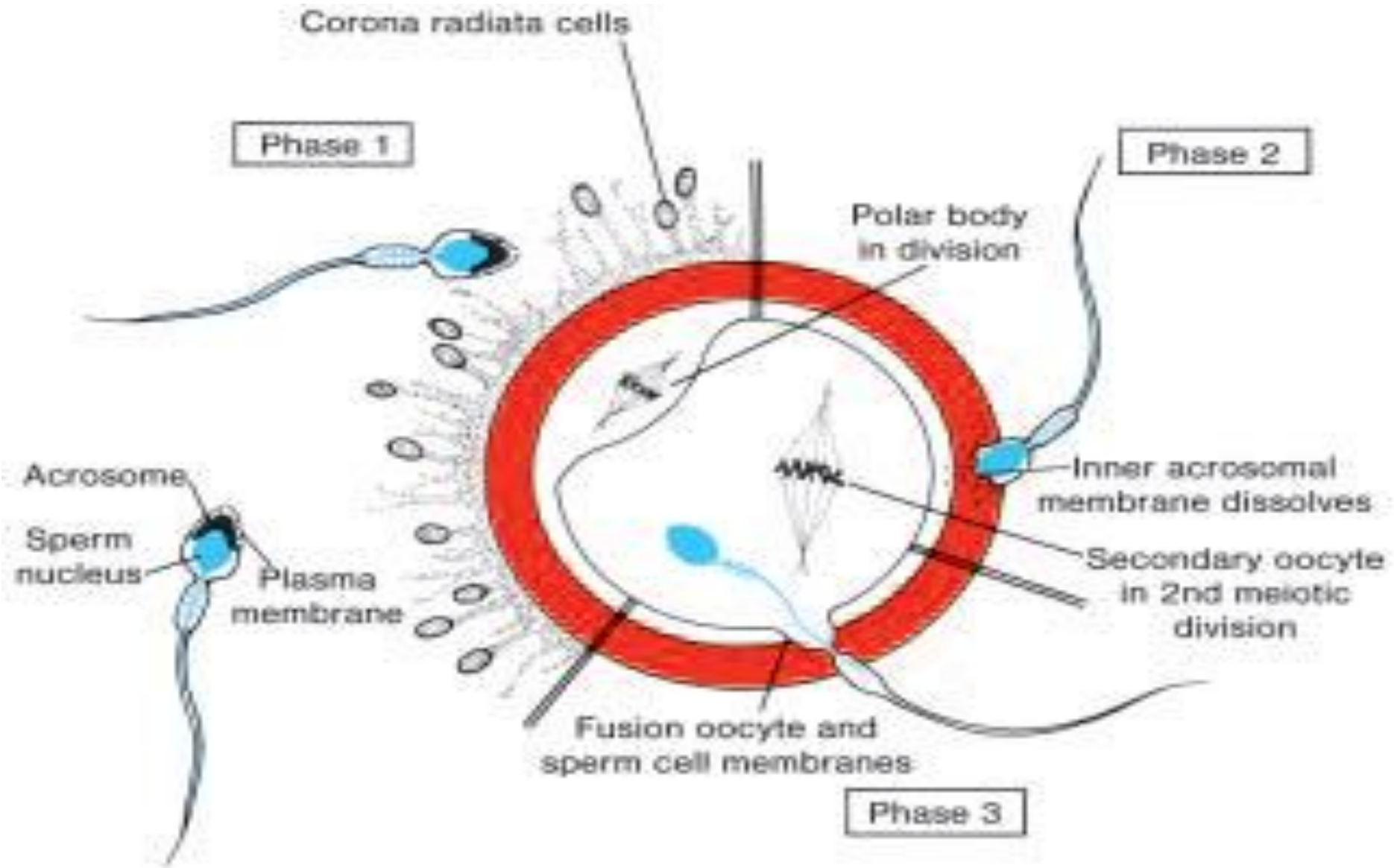
Which occurs after binding to the zona pellucida. This reaction culminates in the release of enzymes needed to penetrate the zona pellucida which are:

- **Hyaluronidase.**
- **Acrosine.**
- **Tyrosine-kinase.**

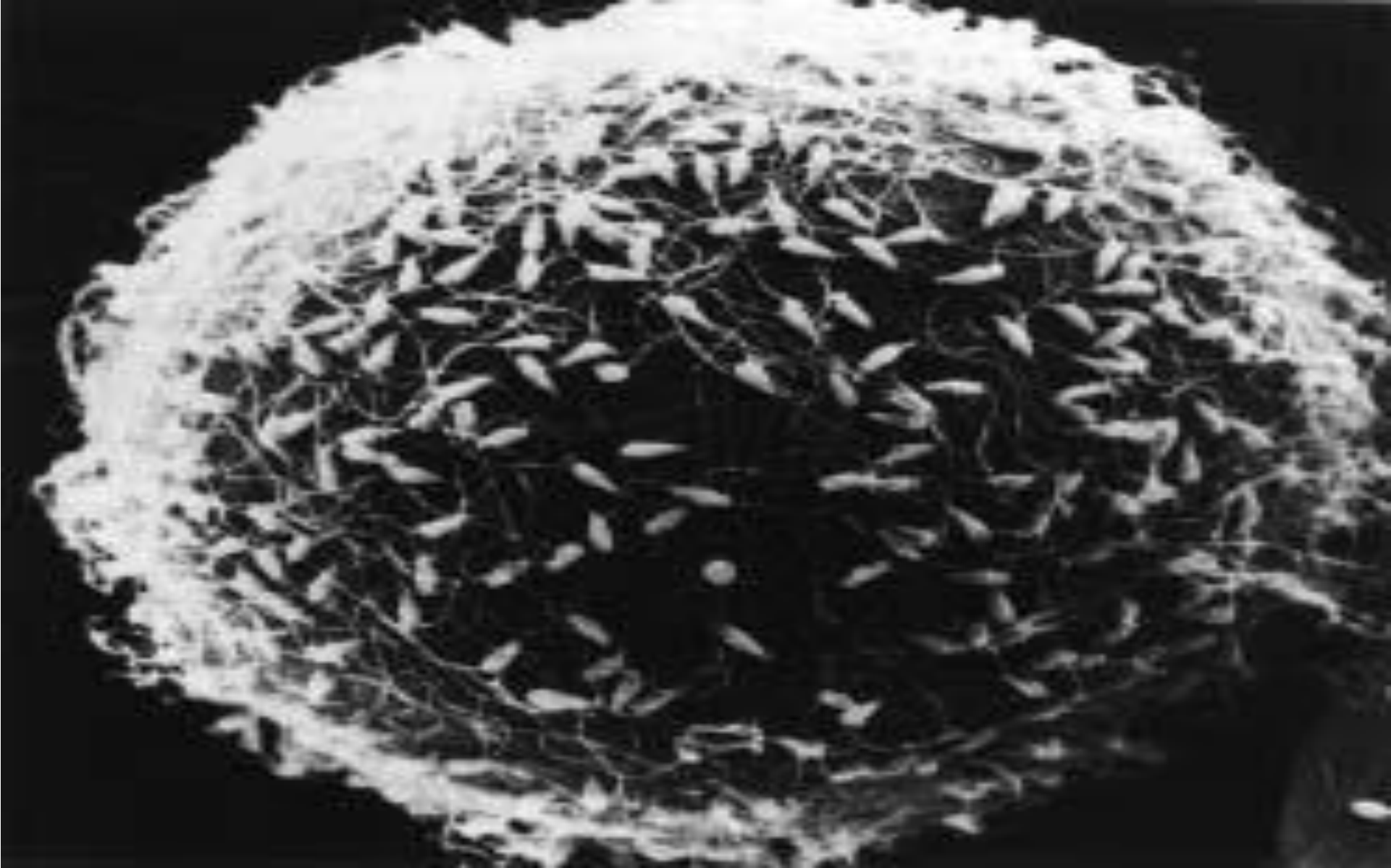
- **Phases of fertilization:**

- ***Phase 1:*** penetration of corona radiata (Only one sperm fertilizes the egg).
- ***Phase 2:*** penetration of zona pellucida.
- ***Phase 3:*** fusion of sperm with the ovum and production of zygote.

Adhesion of sperm is mediated by integrins on oocyte and ligand & disintegrins on sperm then plasma membrane of sperm & egg fuse.



The three phases of Fertilization



Scanning electron micrograph of sperm binding to the zona pellucida

As soon as the spermatozoon has entered the oocyte, the egg responds in three ways:

1. Cortical and zona reactions:

As a result of the release of cortical oocyte granules, which contain lysosomal enzymes:

- a) The oocyte membrane becomes impenetrable to other spermatozoa.
- b) The zona pellucida alters its structure and composition to prevent sperm binding and penetration.

2. Resumption of the second meiotic division:

One of the daughter cells, which receives hardly any cytoplasm, is known as the **second polar body**; the other daughter cell is the **definitive oocyte**.

Its chromosomes (22+X) arrange themselves in a vesicular nucleus known as the **female pronucleus**.

3. Metabolic activation of the egg:

The activating factor is probably carried by the spermatozoon.

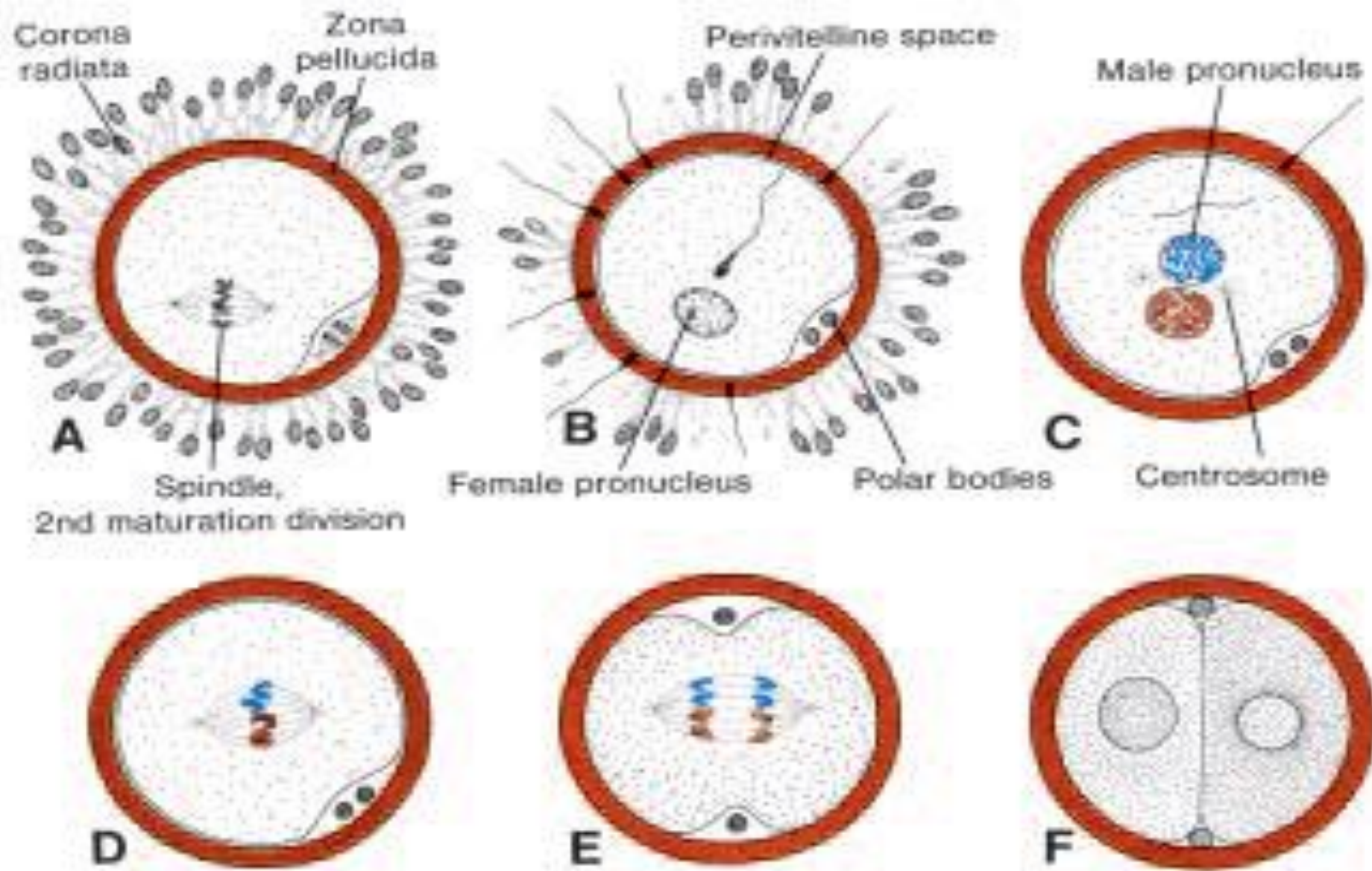
The spermatozoon, meanwhile, moves forward until it lies close to the female pronucleus.

Its nucleus becomes swollen and forms the male pronucleus the tail detaches and degenerates.

- Results of fertilization:

1. The zygote is formed.
2. The typical number of chromosomes (46) is restored (23 chromosomes from the sperm & 23 chromosomes from the ovum).
3. The sex is defined: If spermatozoon carrying a Y chromosome unite with ovum X the embryo will be a male (XY) and if X and X female (XX).
4. Initiation of cleavage.

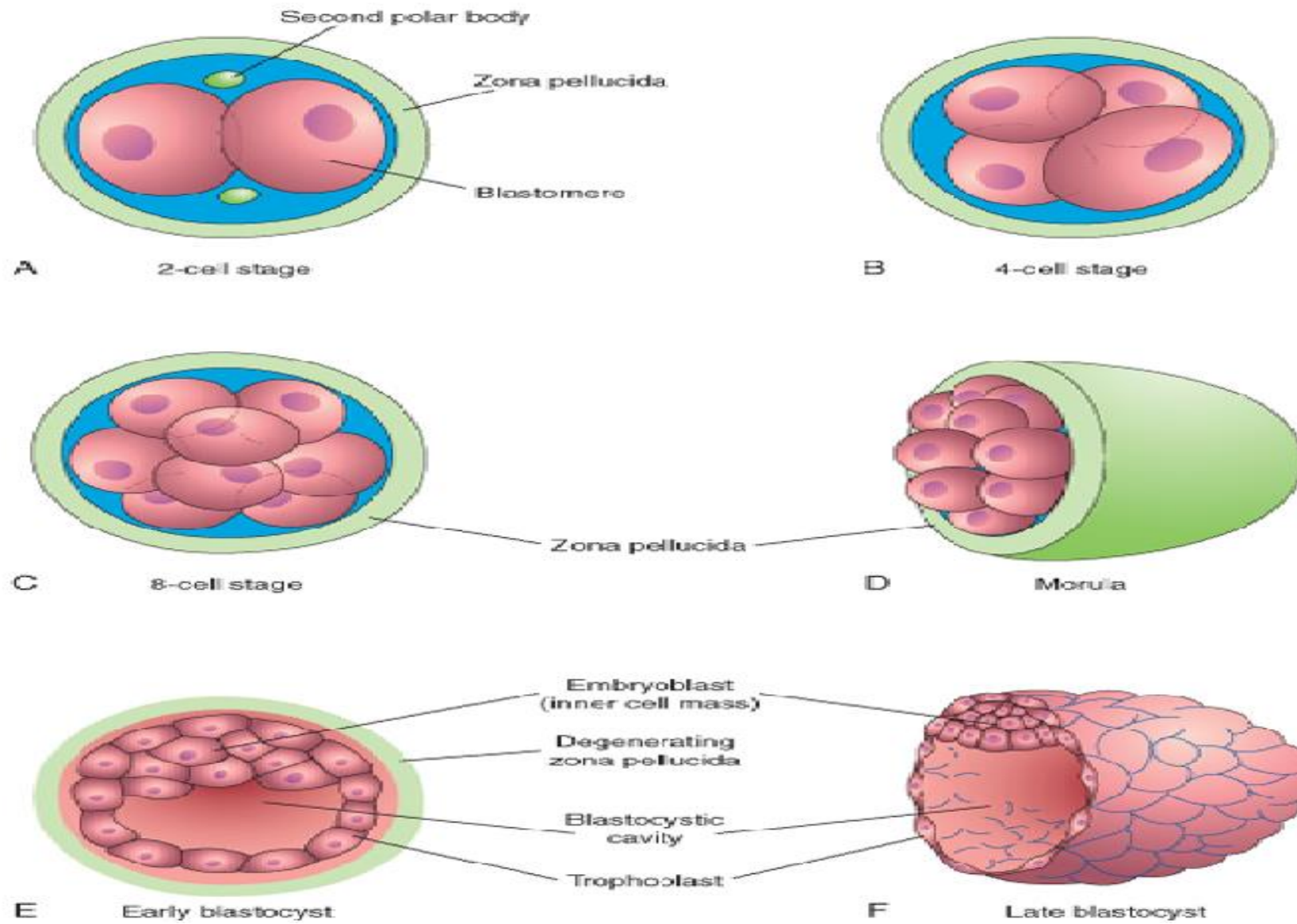
Without fertilization, the oocyte usually degenerates 24 hours after ovulation.



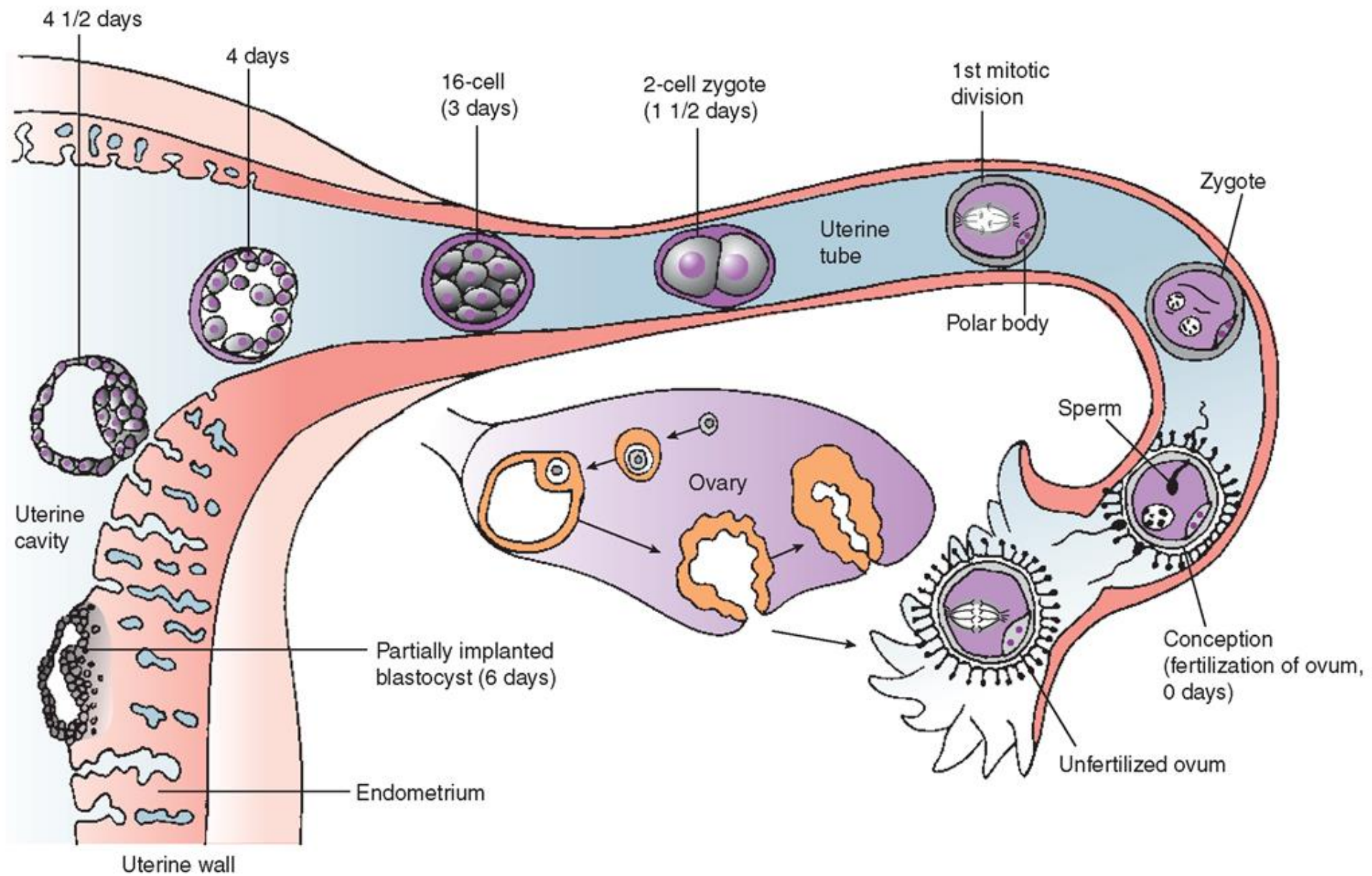
Result of fertilization

Segmentation (Cleavage):

- It is a series of mitotic division of the zygote.
- These cells, which become smaller, are known as **blastomeres**. During this period, blastomeres are surrounded by the **zona pellucida**, which disappears at the end of the **fourth day**.
- ❖ **Zygote (One cell stage)** : day zero
- ❖ **Two cell stage**: day 1
- ❖ **Fourth cell stage**: day 2
- ❖ **Eighth cell stage**: day 3
- ❖ **Morula stage (16-32 cells)**: late day 3 or day 4
- ❖ **Blastocyst stage**: day 5



Segmentation (Cleavage)

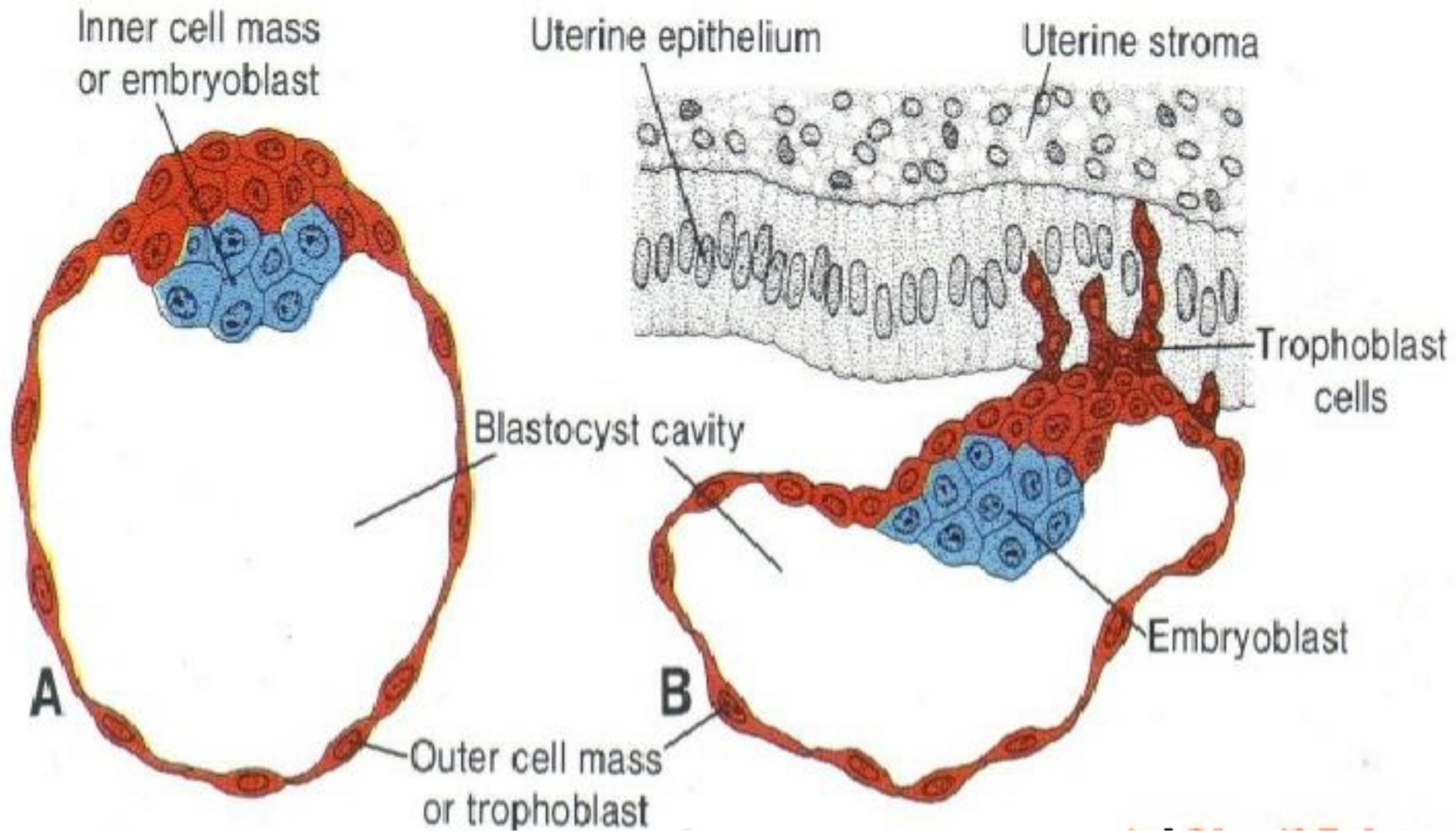


Segmentation (Cleavage)

Blastocyst Formation

- The **blastocyst** is cystic organ having cavity called blastocele.
- Has no fixed number of cells but usually around 100 in early blastocyst and can reach more than 200 cells in late blastocyst before implantation in day 6 or 7.
- Its cells are arranged into 2 masses as follows:
 - 1) An outer cell mass which will form the **trophoblast**.
 - 2) An inner cell mass will form **embryoblast**.

7th day:



Blastocyst Formation

Implantation

- The wall of the uterus consists of three layers:
 - A. Endometrium** or mucosa lining the inside wall
 - B. Myometrium**, a thick layer of smooth muscle;
 - C. Perimetrium**, the peritoneal covering lining the outside wall
- At the time of implantation, the mucosa of the uterus is in the **secretory phase**, during which time uterine glands and arteries become coiled and the tissue becomes succulent.

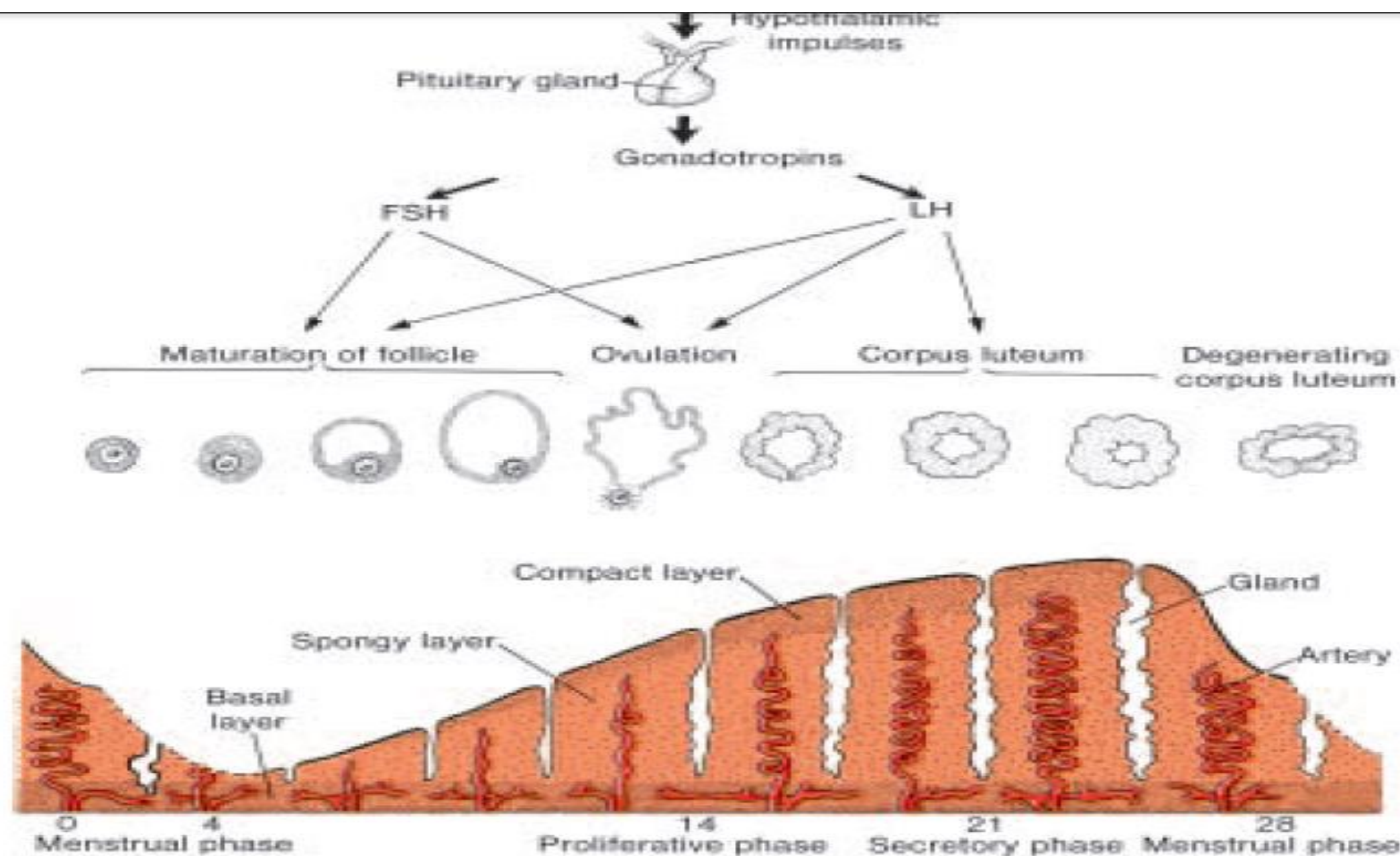


Figure 2.13 Changes in the uterine mucosa (endometrium) and corresponding changes in the ovary during a regular menstrual cycle without fertilization.

Implantation continue...

As a result, three distinct layers can be recognized in the endometrium:

1. A superficial **compact layer**.
2. An intermediate **spongy layer**.
3. A thin **basal layer**.

Normally, the human blastocyst implants in the endometrium more commonly superiorly along the **posterior wall of the body of the uterus**, where it becomes embedded between the openings of the glands.

Clinical correlations:

Anovulation:

- Some women do not ovulate (cessation of ovulation-anovulation) because of an inadequate release of gonadotropins.
- In some of these women, ovulation can be induced by the administration of gonadotropins or an ovulatory agent such as **clomiphene citrate**.

In vitro fertilization (IVF):

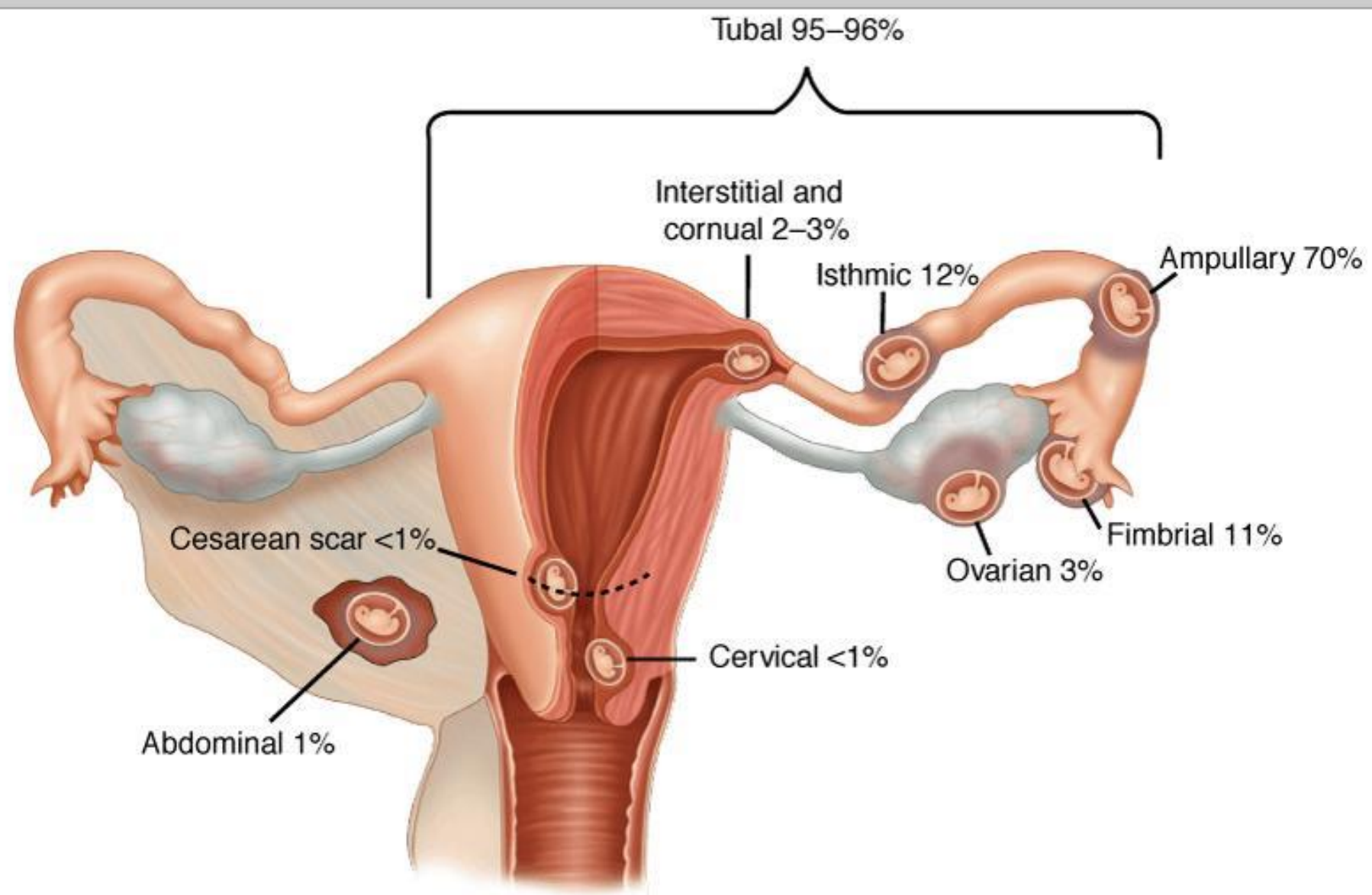
For oocytes and transfer of the cleaving zygotes into the uterus .

Male infertility:

- Severe male infertility, in which the ejaculate contains very few live sperm (**oligozoospermia**) or even no live sperm (**azoospermia**), can be overcome using **intracytoplasmic sperm injection (ICSI)**.
- Male infertility may result from:
 - a low sperm count\ poor sperm motility.
 - medications and drugs.
 - endocrine disorders.
 - exposure to environmental pollutants.
 - cigarette smoking.
 - abnormal sperms, or obstruction of a genital duct such as in the **ductus deferens**.

Abnormal sites of implantation:

- If the implantation occurred near to cervix it is called **placenta praevia**
- ❖ Extra uterine implantation: **ectopic pregnancy**
 1. **Tubal.**
 2. **Ovarian**
 3. **Abdominal..**



Abnormal sites of implantation:

Thank You