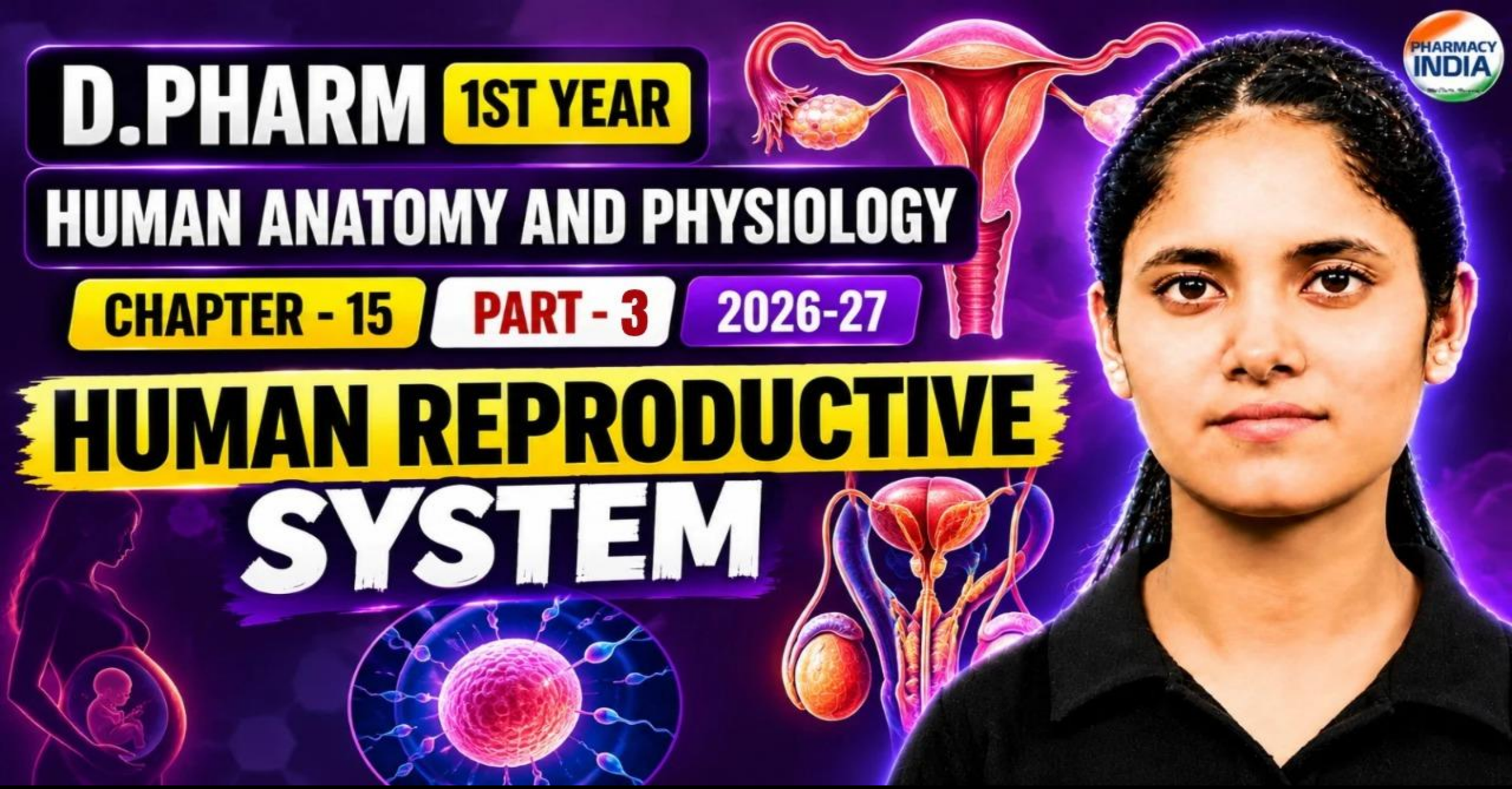

D.PHARM
1ST YEAR
HUMAN ANATOMY AND PHYSIOLOGY
CHAPTER - 15
PART - 3
2026-27
HUMAN REPRODUCTIVE SYSTEM
PHARMACY INDIA
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Oogenesis

1. Multiplication Phase (Before Birth)

- Primordial germ cells divide by **mitosis** to form **oogonia (2n)**.
- Oogonia multiply rapidly in the fetal ovary.

2. Growth Phase

- Oogonia grow in size and become **primary oocytes (2n)**.
- Each primary oocyte starts **meiosis I** but **stops at prophase I.**
- At birth, a female has about 1–2 million primary oocytes, all arrested in prophase I.

3. Maturation Phase (After Puberty)

This phase resumes at puberty during each menstrual cycle.

(a) Completion of Meiosis I

One primary oocyte completes meiosis I to form:

- **Secondary oocyte (n)** (large cell)
- **First polar body (n)** (small, non-functional)

(b) Meiosis II Begins

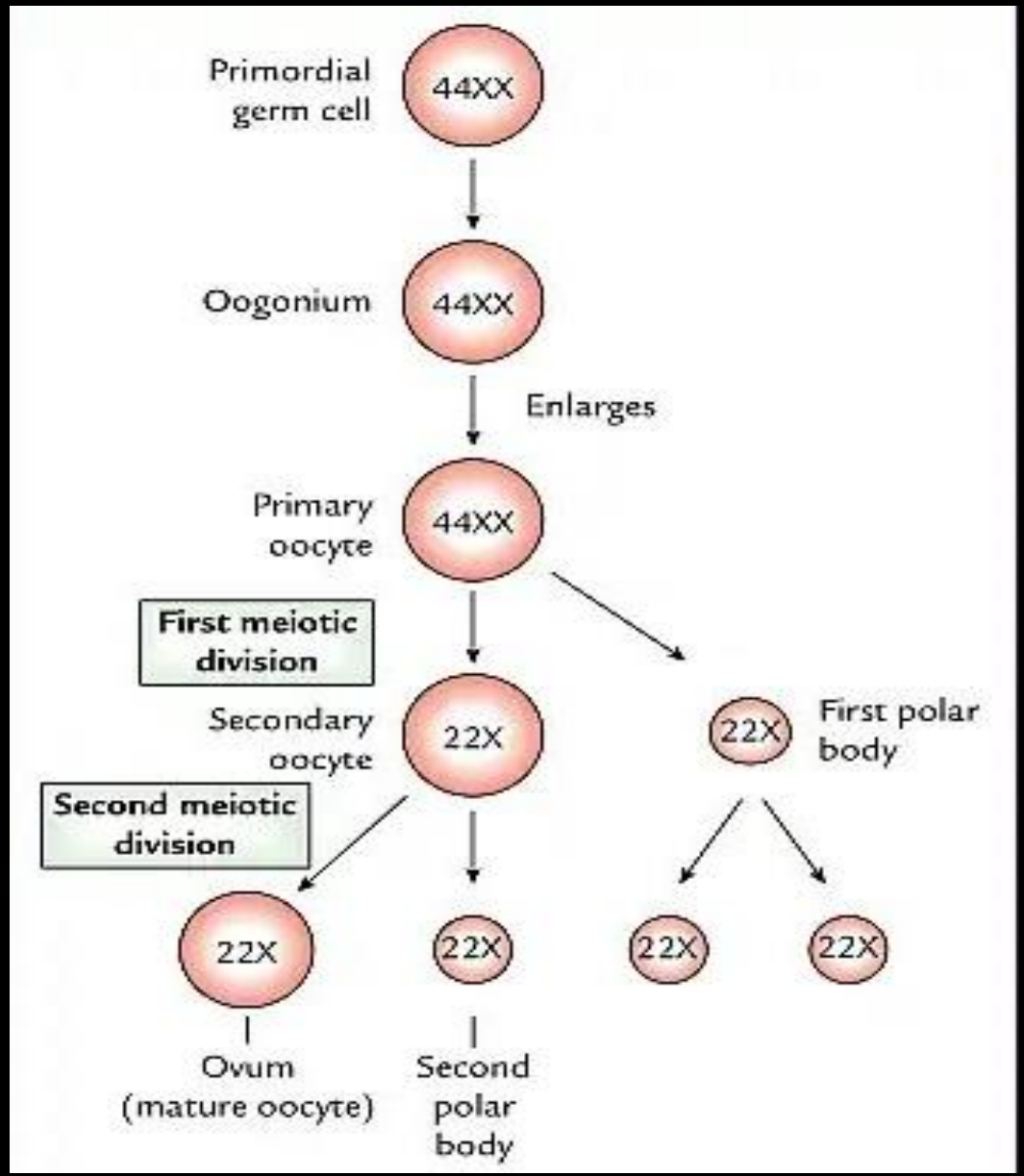
The secondary oocyte starts **meiosis II** but stops at **metaphase II**.

This is the stage at which ovulation occurs.

(c) Completion of Meiosis II (Only if Fertilization Occurs)

If sperm fertilizes the secondary oocyte:

- Meiosis II completes
- Forms:
  - **Ovum (n)** (mature egg)
  - **Second polar body (n)**


Primordial germ cell
44XX
Oogonium
44XX
Enlarges
Primary oocyte
44XX
First meiotic division
Secondary oocyte
22X
22X
First polar body
Second meiotic division
22X
22X
22X
22X
Ovum (mature oocyte)
Second polar body

Spermatogenesis

1. Multiplication Phase

- **Spermatogonia (2n)** are diploid stem cells present in seminiferous tubules.
- They divide by **mitosis** to produce more spermatogonia.
- Some spermatogonia differentiate into **primary spermatocytes (2n)**.

2. Growth Phase

- Primary spermatogonia increase in size and become **primary spermatocytes (2n)**.

3. Maturation Phase

- **Meiosis I**

Each **primary spermatocyte (2n)** undergoes meiosis I.

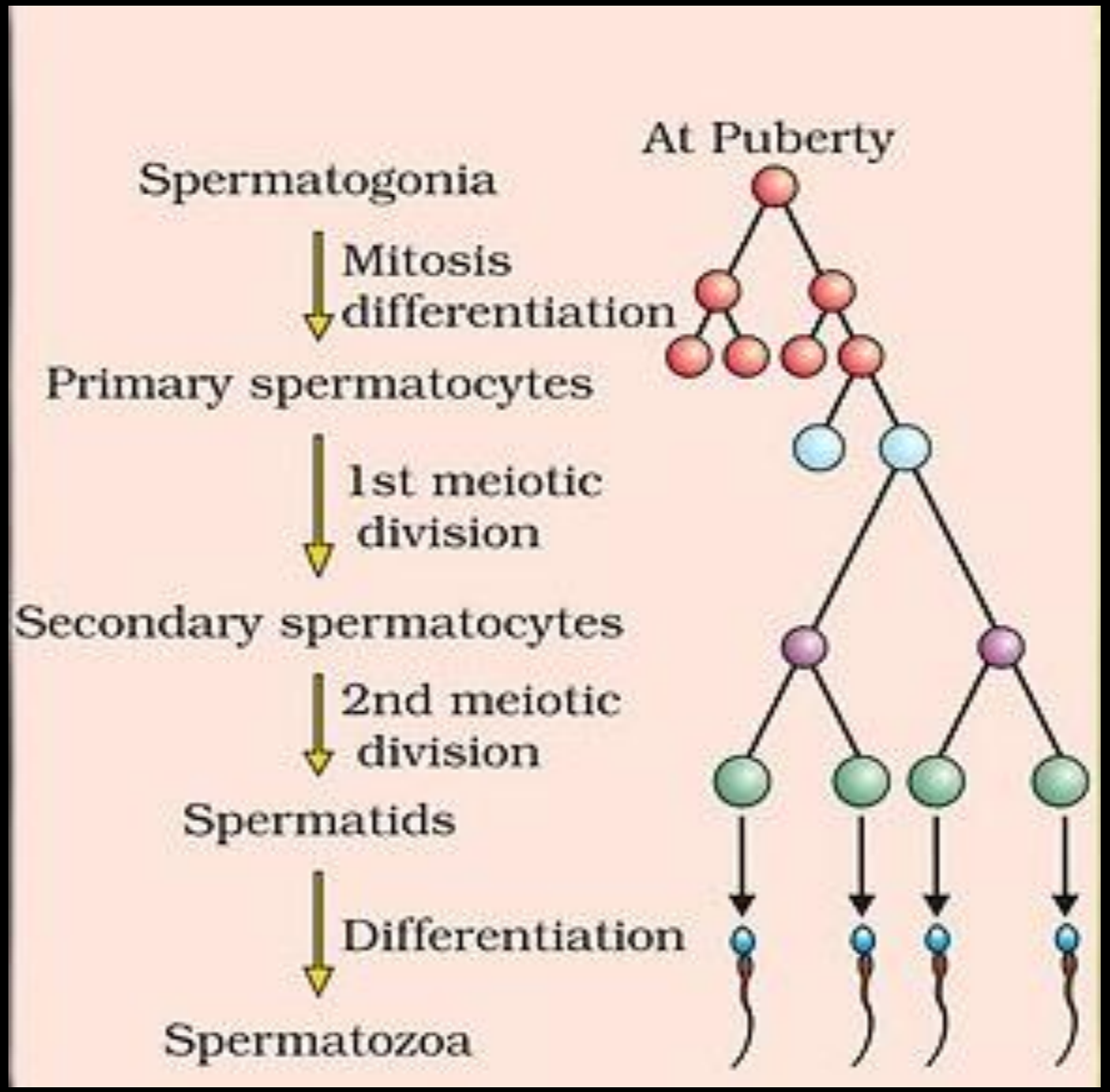
It produces **two secondary spermatocytes (n)**.

- **Meiosis II**

Each secondary spermatocyte undergoes meiosis II.

This forms **four spermatids (n)**.

- **Spermiogenesis-** the transformation of spermatids to mature sperms or spermatozoa.
- **Spermiation**- The process of release of mature sperms from seminiferous tubules.


At Puberty
Spermatogonia
Mitosis
differentiation
Primary spermatocytes
1st meiotic
division
Secondary spermatocytes
2nd meiotic
division
Spermatids
Differentiation
Spermatozoa

Fertilisation

1. Sperm Transport

- After ejaculation, millions of sperm enter the **female reproductive tract**.
- Only a few hundred reach the **fallopian tube** where the ovum is present.

2. Capacitation

- Sperm undergo biochemical changes in the female tract.
- This process increases the **motility and fertilizing ability of sperm**.

3. Acrosomal Reaction

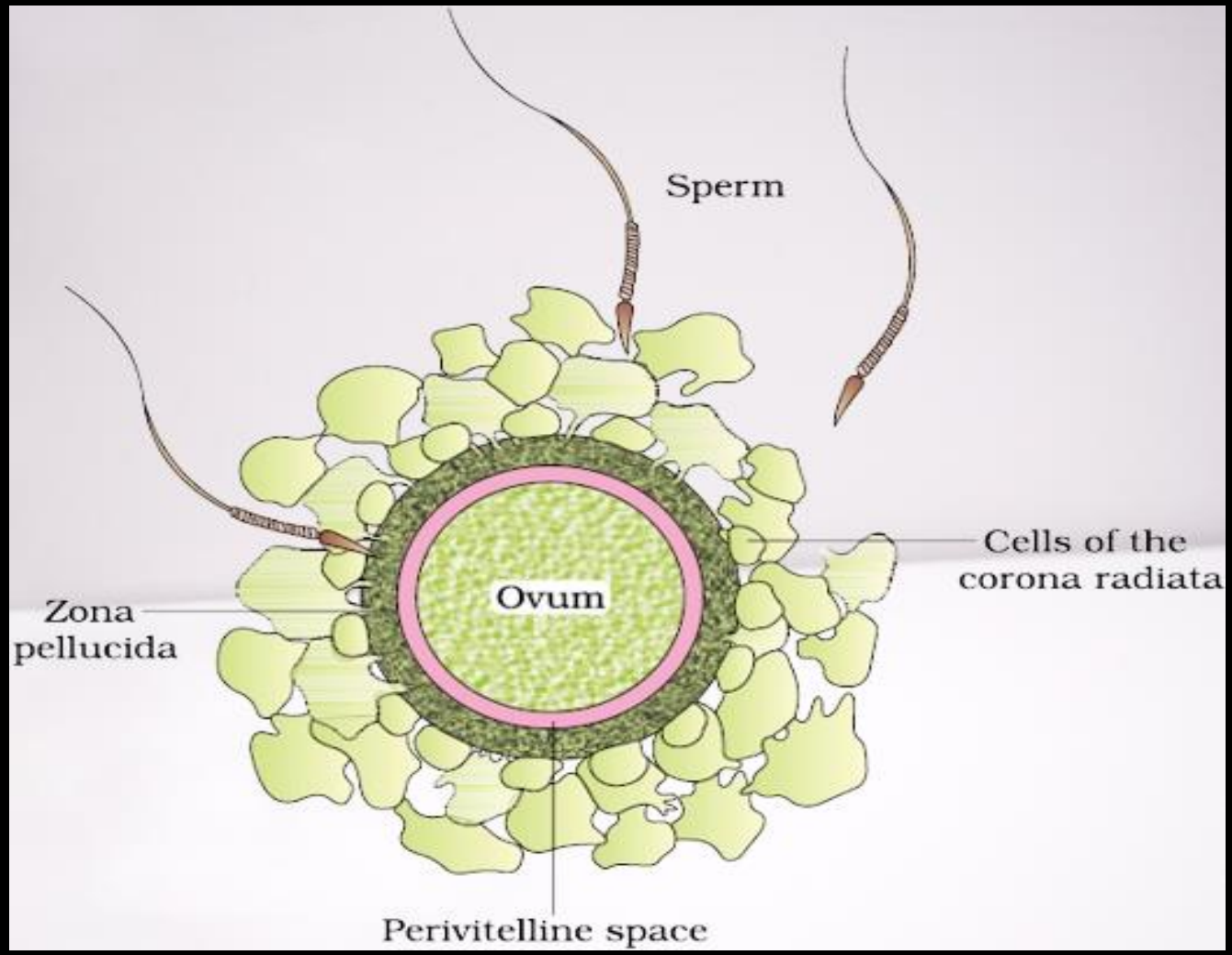
- Enzymes from the **acrosome of sperm** (e.g., hyaluronidase) help the sperm penetrate the **zona pellucida** surrounding the ovum.

4. Fusion of Gametes

- The sperm membrane fuses with the **ovum membrane**.
- The sperm nucleus enters the ovum.

5. Formation of Zygote

- The **male pronucleus** and **female pronucleus** fuse.
- This restores the **diploid chromosome number (46 chromosomes)** and forms a **zygote**.


Sperm
Cells of the
corona radiata
Ovum
Zona
pellucida
Perivitelline space

Implantation

1. Formation of Blastocyst

- After fertilization, the **zygote** undergoes several **mitotic divisions (cleavage)**.
- It forms **morula**, which later develops into a **blastocyst**.

2. Movement to Uterus

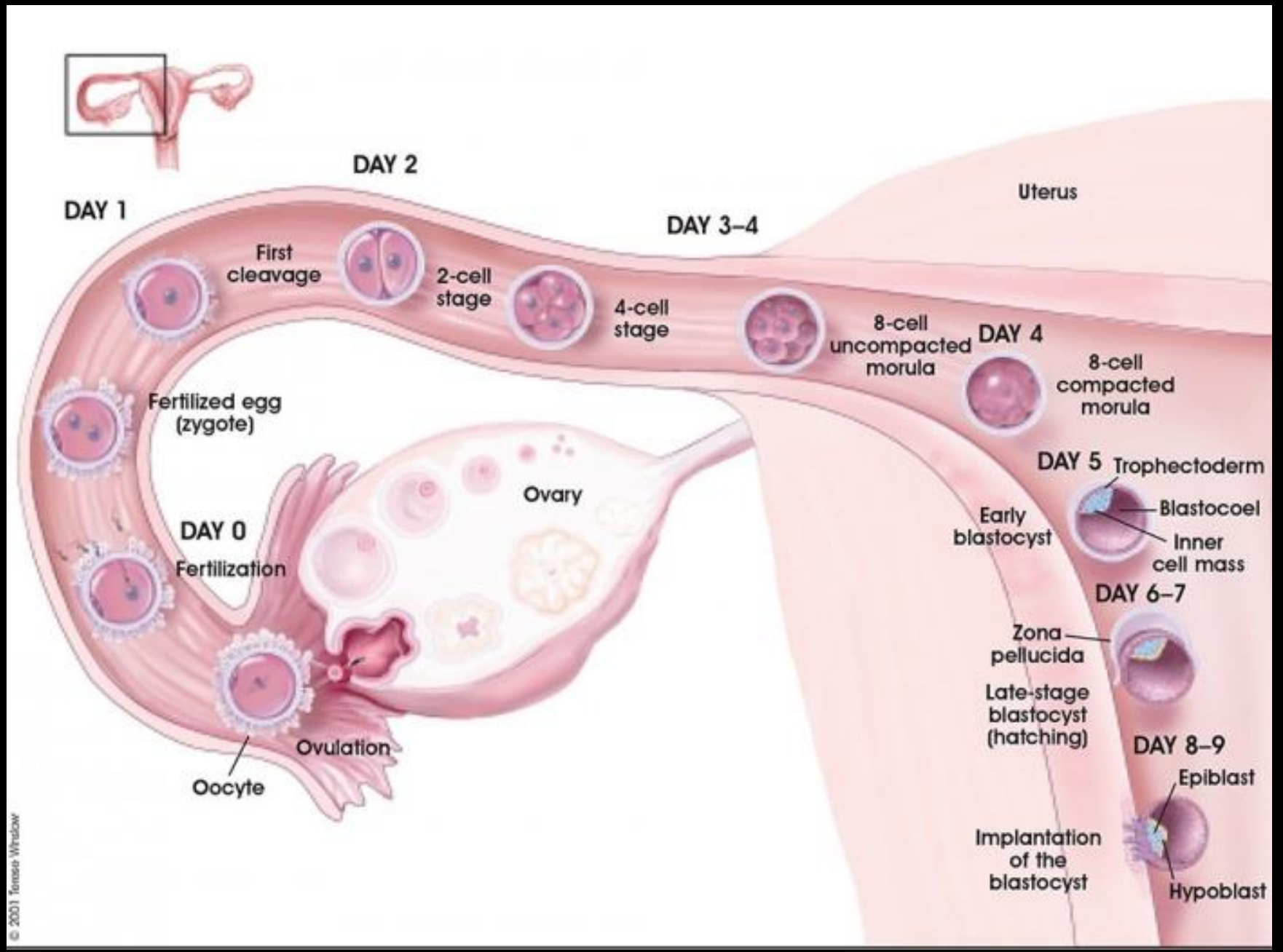
- The blastocyst travels through the **fallopian tube** to the **uterus**.
- This process takes about **4–5 days**.

3. Attachment

- Around **6–7 days after fertilization**, the blastocyst attaches to the **uterine endometrium.**

4. Embedding

- The outer cells of the blastocyst (**trophoblast**) invade the endometrium.
- The embryo becomes firmly embedded in the uterine wall.


DAY 1
DAY 2
DAY 3–4
DAY 4
DAY 5
DAY 6–7
DAY 8–9
DAY 0
Uterus
First cleavage
2-cell stage
4-cell stage
8-cell uncompacted morula
8-cell compacted morula
Fertilized egg (zygote)
Ovary
Fertilization
Ovulation
Oocyte
Trophectoderm
Blastocoel
Early blastocyst
Inner cell mass
Zona pellucida
Late-stage blastocyst (hatching)
Epiblast
Implantation of the blastocyst
Hypoblast

Menstrual Cycle

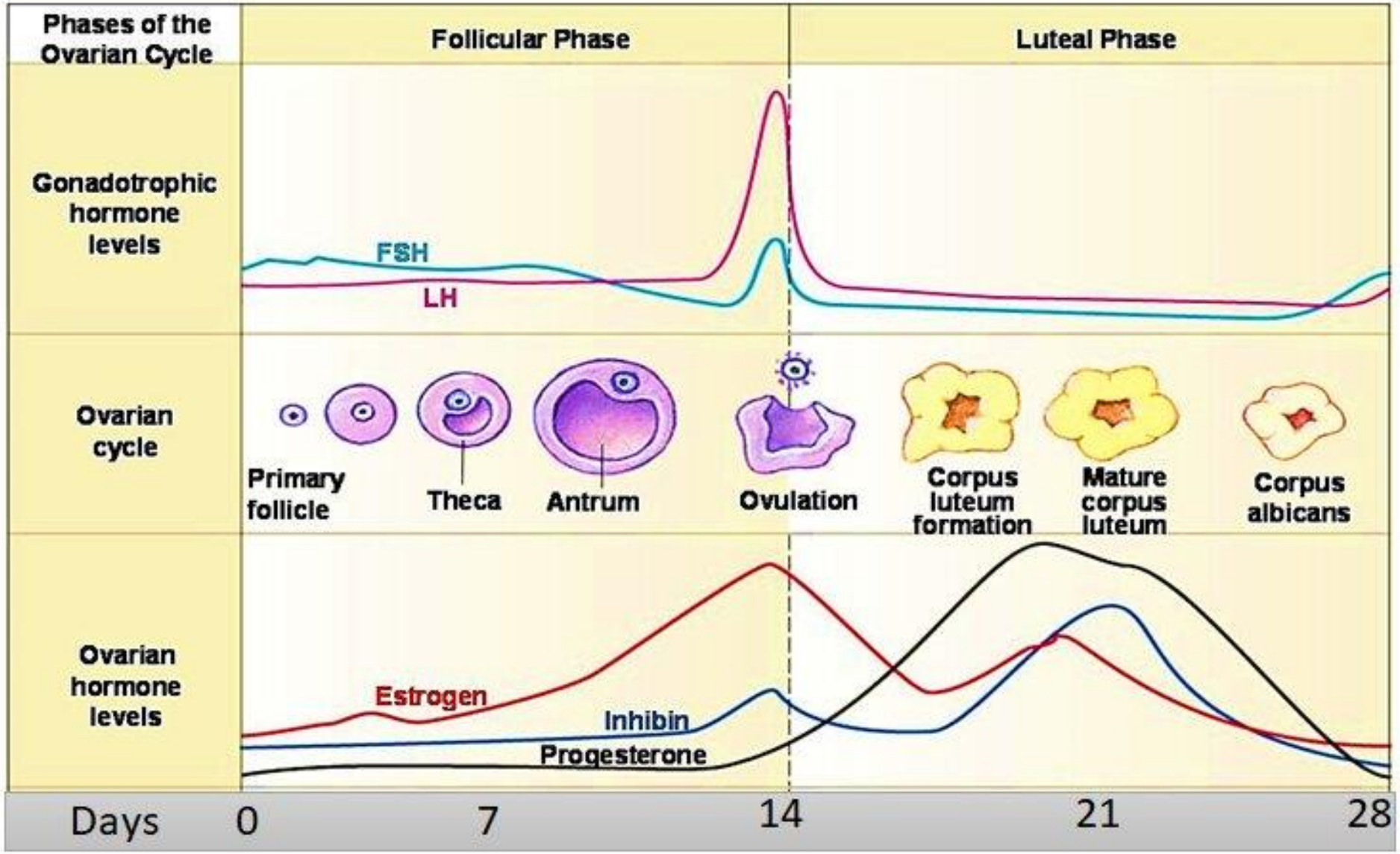
- In a life cycle, a woman's body is vulnerable to a variety of changes.
- The cycle of these changes occur in women every month, positively for pregnancy is called the menstrual cycle.
- When an ovum is unfertilized, the uterus lining sheds and leads to a haemorrhage, called menstruation.
- In a girl, menstruation starts from the age of 10 to 15 when she attains puberty and this beginning is known as menarche.
- The ending of menstruation is known as menopause which takes place at the age range of 50.

Phases of the Menstrual Cycle

- **Menstrual phase:** Day 1, uterus lining which is prepared for implantation starts to shed which lasts 3 to 5 days.
- **Follicular phase**: In this phase, the primary follicle starts developing into a mature Graffian follicle.
  - The endometrium also starts proliferating.
  - The uterus starts preparation for another pregnancy.

- **Ovulatory phase**: Mid-cycle phase, this is the phase in which ovulation takes place i.e., day 13-17.
  - The end of the follicular phase along with the ovulation period defines the fertilisation period.
- **Luteal phase:** It is the post-ovulation phase, where the fate of the corpus luteum is decided.
  - If fertilisation occurs, pregnancy starts.
  - If fertilisation doesn't occur, it marks the onset of another cycle.

Menstrual cycle



Parturition

- The process of childbirth is known as parturition.
- Parturition is initiated by neuroendocrine signals.
- Mild uterine contractions start when the foetus is fully developed.
- This is followed by secretion of oxytocin from the pituitary gland.
- Contractions become stronger and stronger as more oxytocin is secreted resulting in childbirth.
- After the infant, the placenta is also delivered.

- **Lactation:** Increased secretion of prolactin from the pituitary gland induces milk production in the mammary glands.

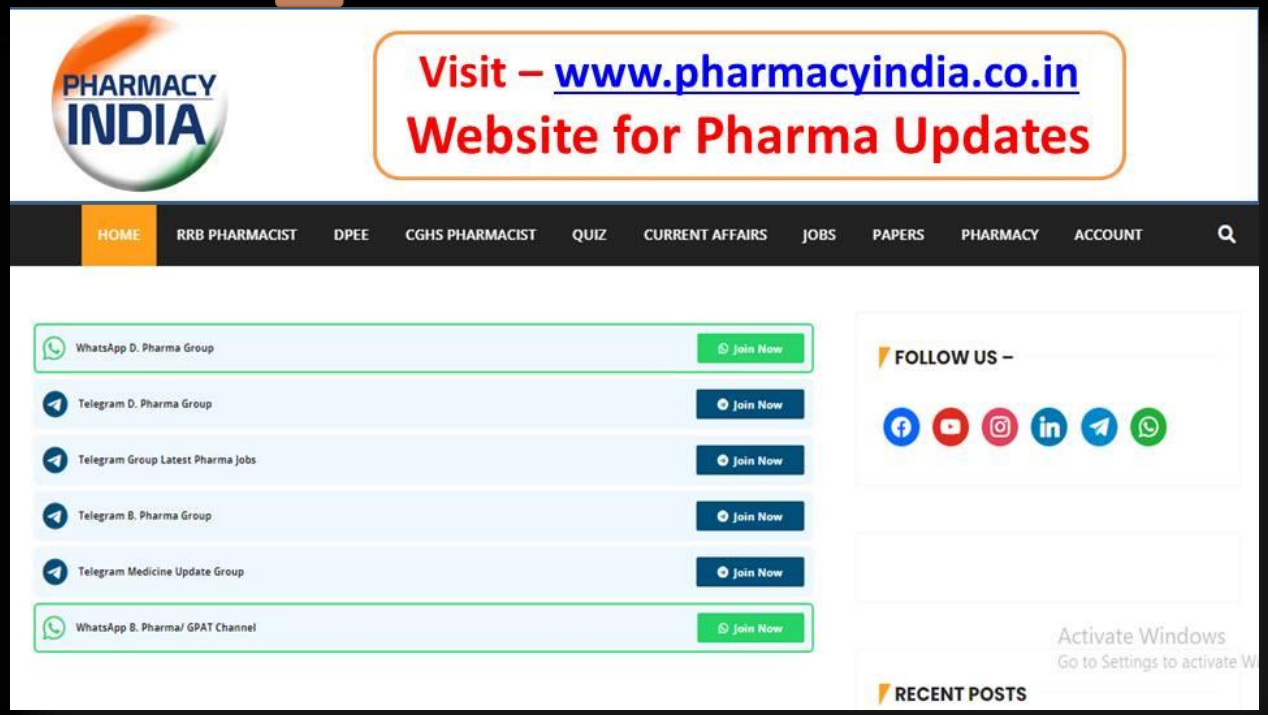
- **Colostrum:** It is the first formed (yellowish) milk from the mammary glands.
  - It is rich in antibodies and proteins and essential for the immunity of infants

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