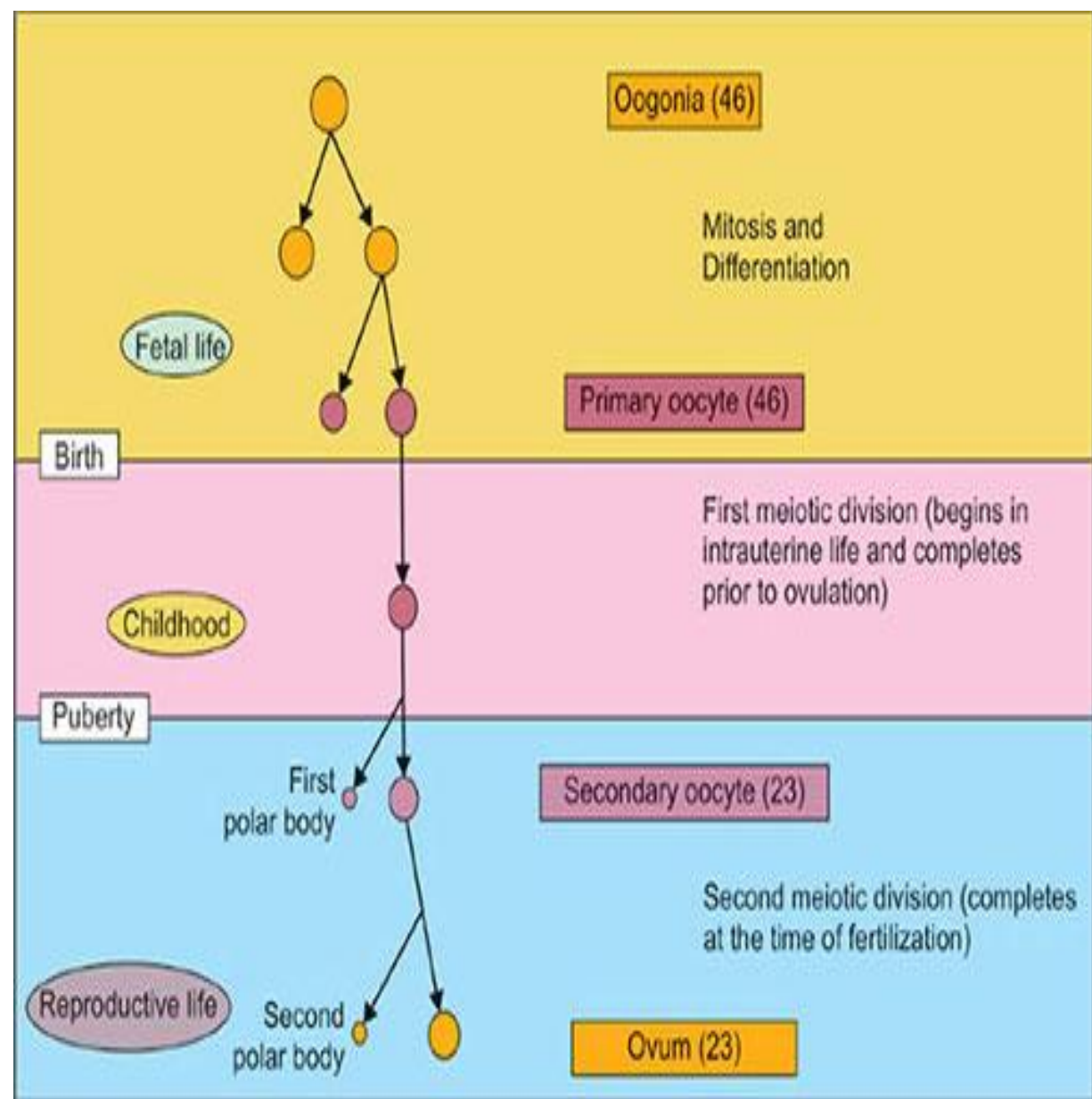
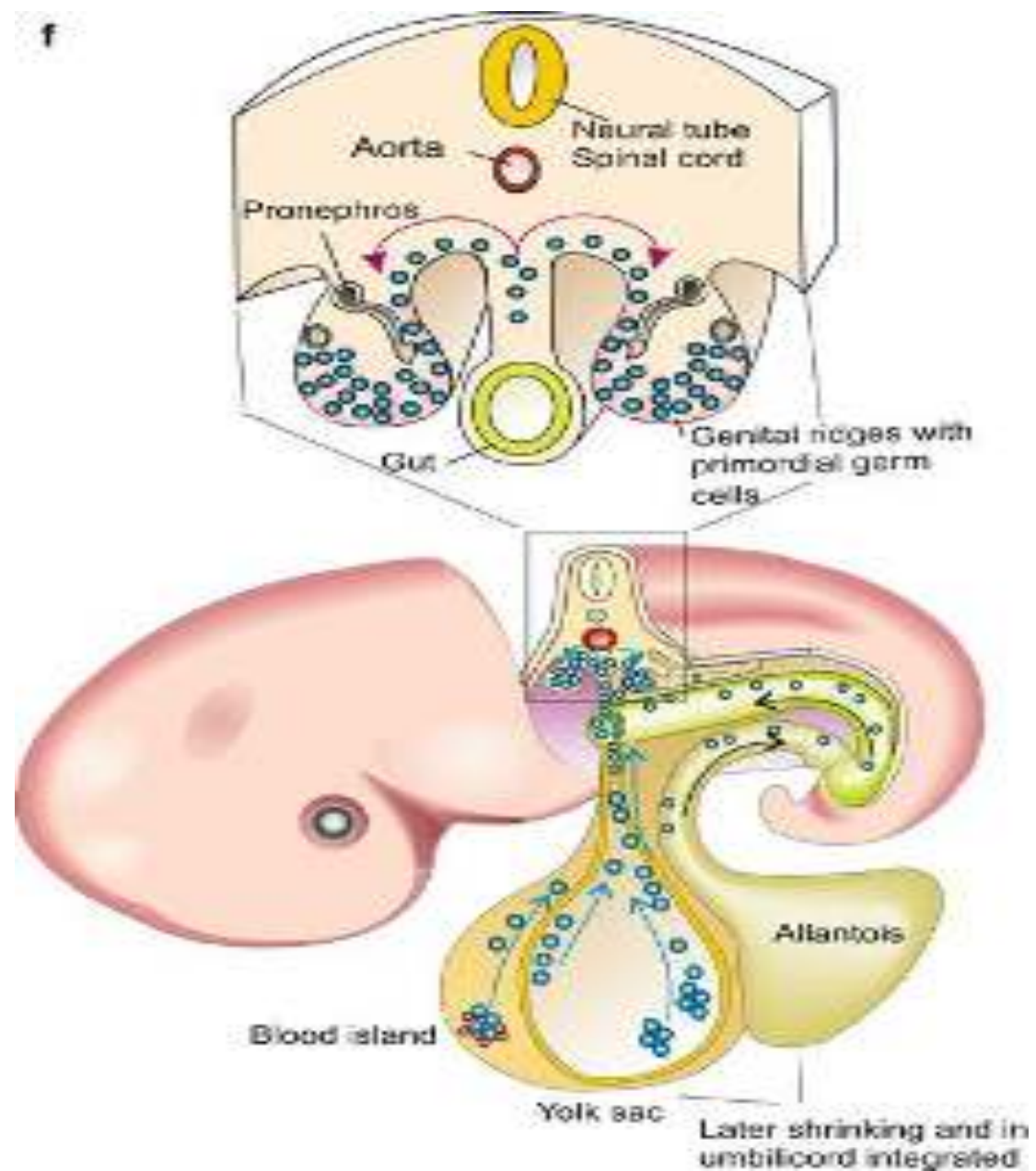


Stages of Oogenesis and its Regulation

Prof. (Dr.) Sanhita Mukherjee

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Foetus

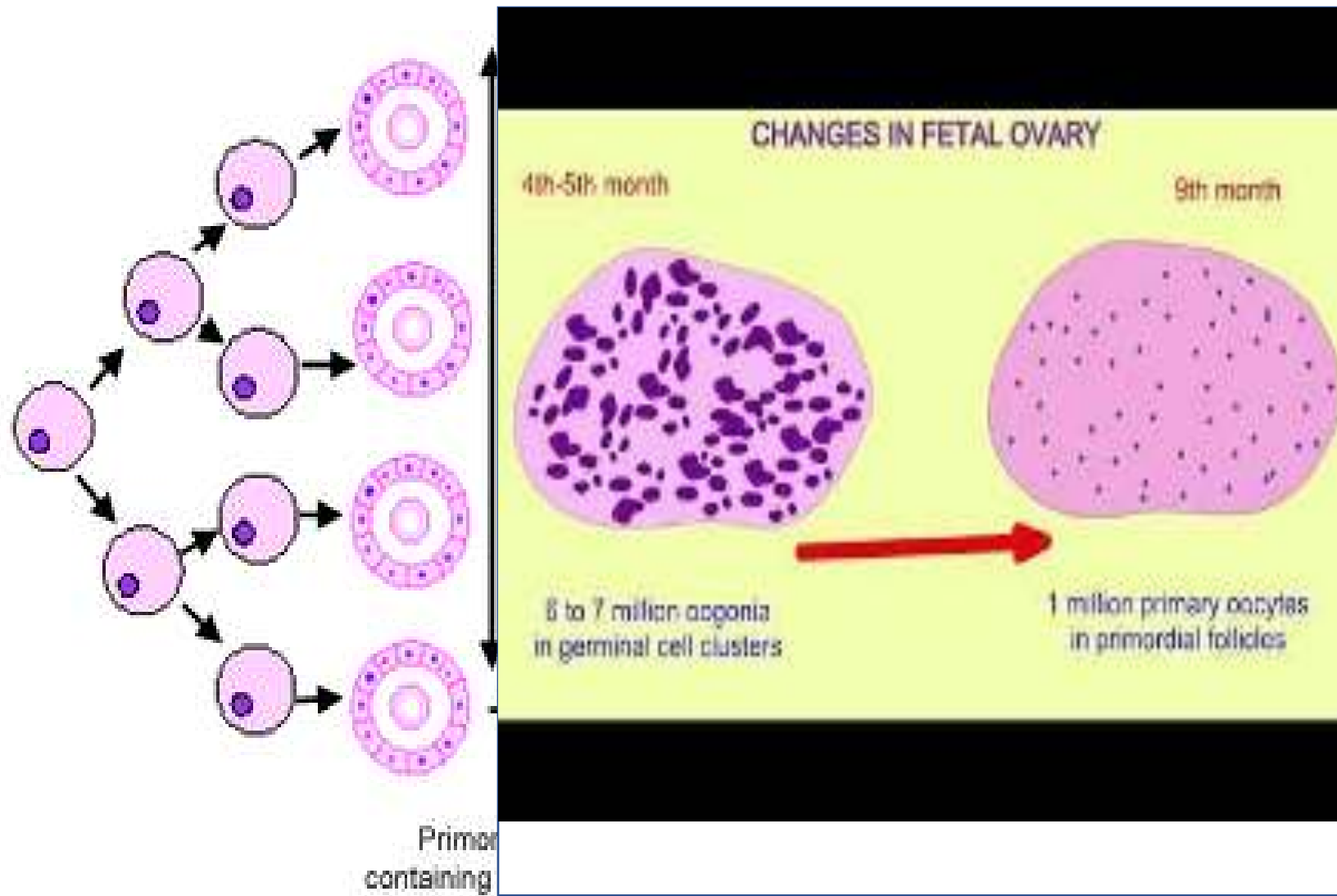


At Birth

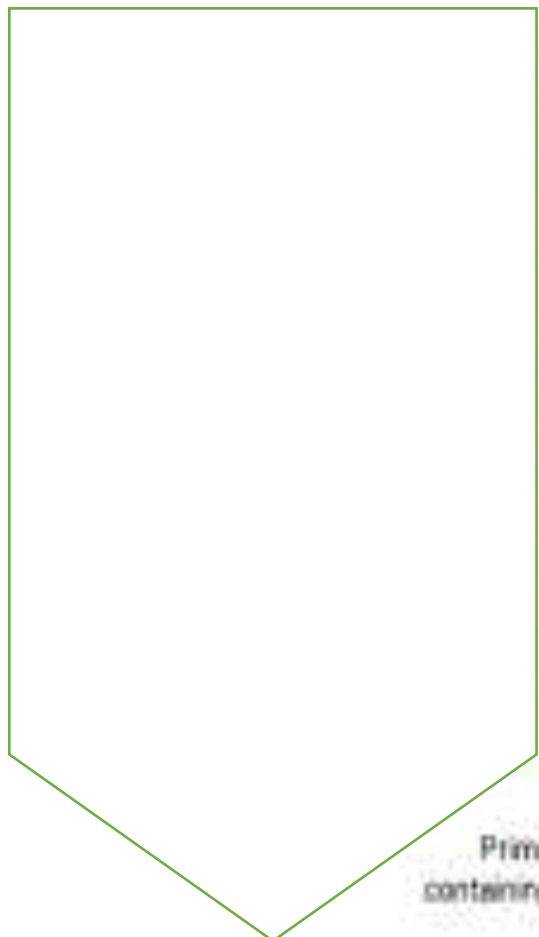


Puberty

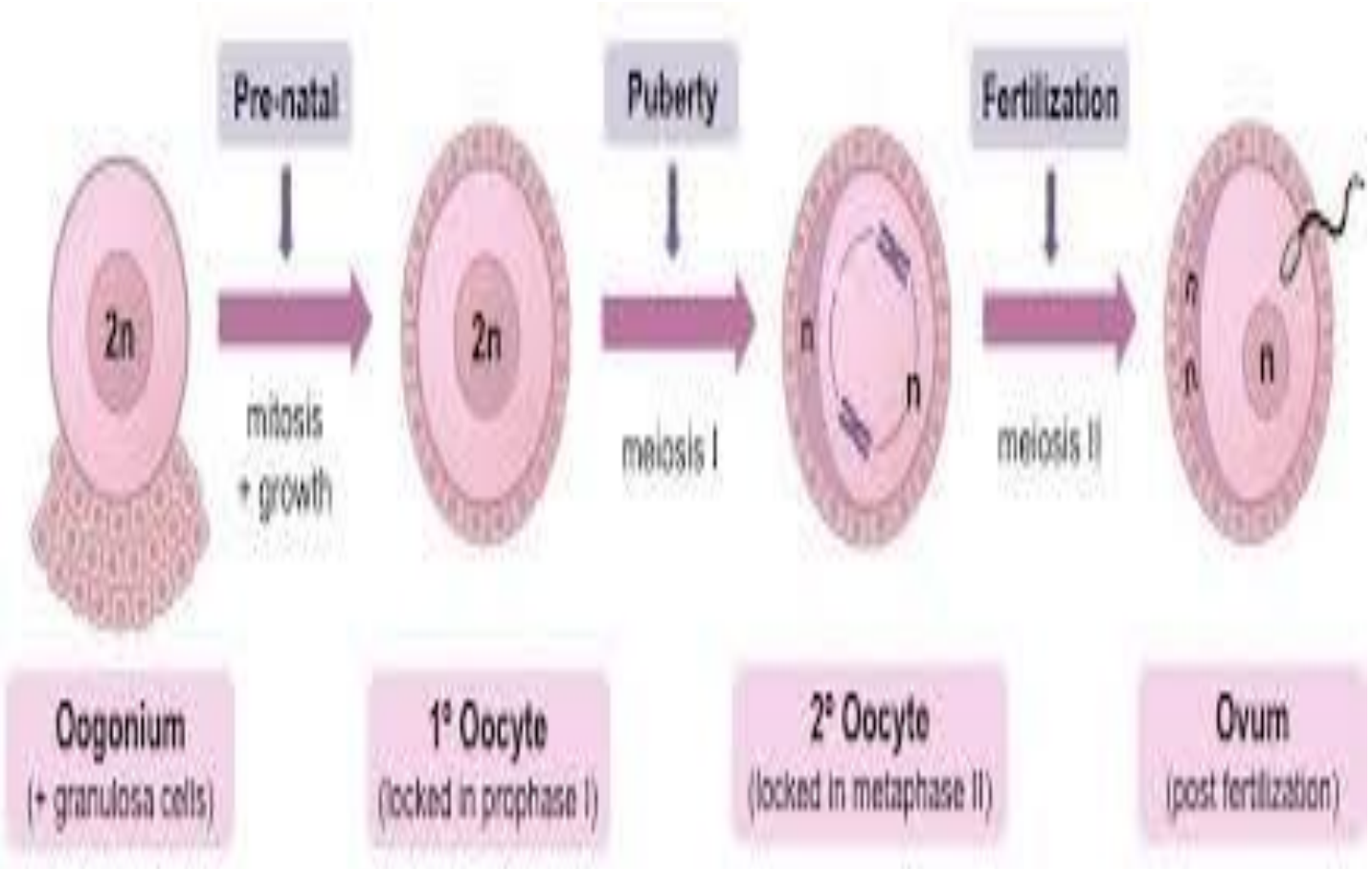


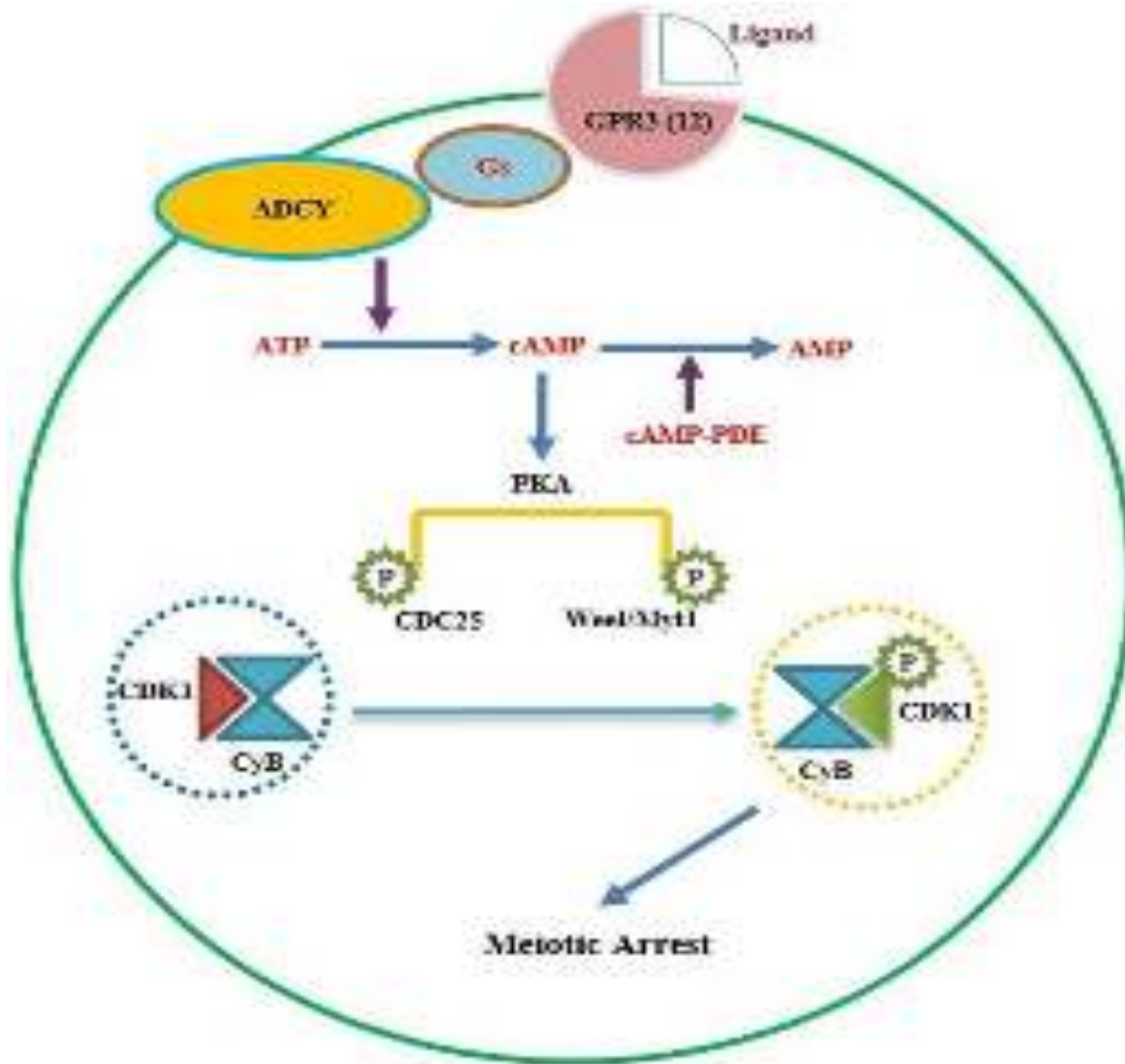


- No new Ova are formed after birth
- During foetal development the ovaries contain over 7 million Primordial Follicles
- Many undergo ATRESIA (involution) before birth and others are lost after birth.
- AT THE time of BIRTH, there are 2million ova, but 50% atretic



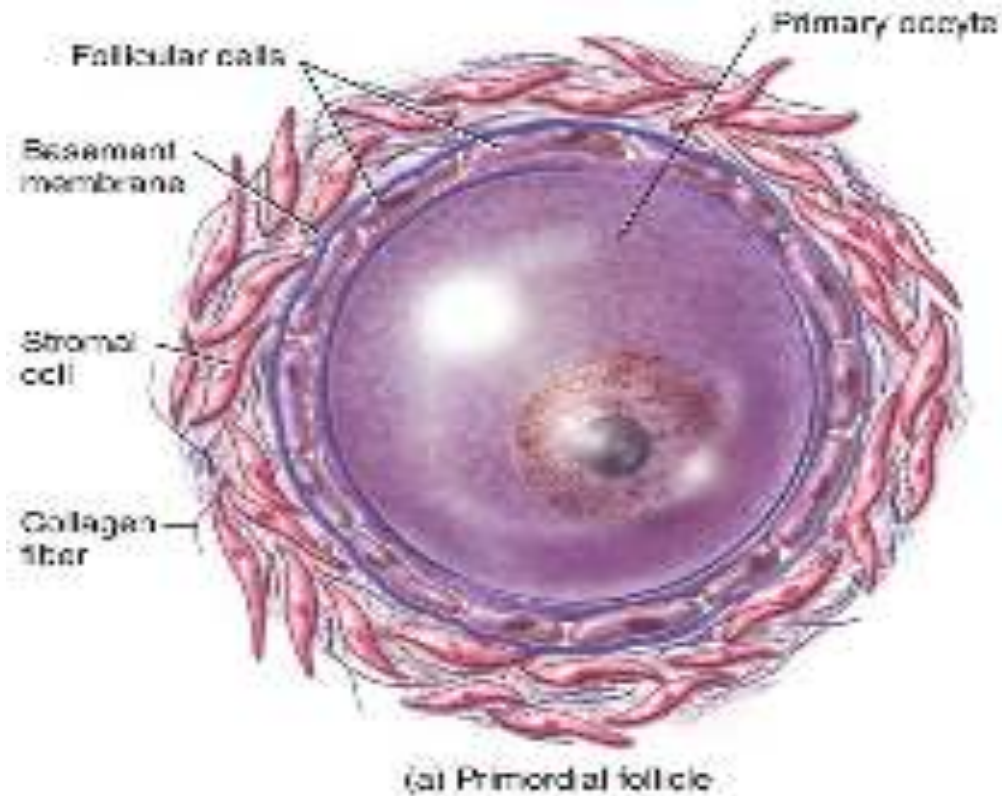
Primordial follicle containing





- Schematic depiction of coordination between GPR-Gs-ADCY and cAMP-PDE maintain high level of cAMP in the oocyte.
- This process is accompanied by the inhibition of cAMP-PDE from unknown signalling preventing the hydrolysis of cAMP, resulting the accumulation of cAMP in the oocyte.
- The increase of cAMP in the oocyte activates the PKA, causing the phosphorylation of CDC25B and Weel/Myt1, which in return inactivate MPF, ultimately inducing meiotic arrest at the diplotene stage

Intra-oocyte elevated cAMP maintains meiotic arrest



The diplotene-arrested oocyte, together with the surrounding of a single layer of flattened granulosa cells, forms a basic unit of the ovary, the **PRIMORDIAL FOLLICLE**.

HOW LONG?

The number of Ova in both of the ovaries at the time of puberty is less than 300,000



Foetus

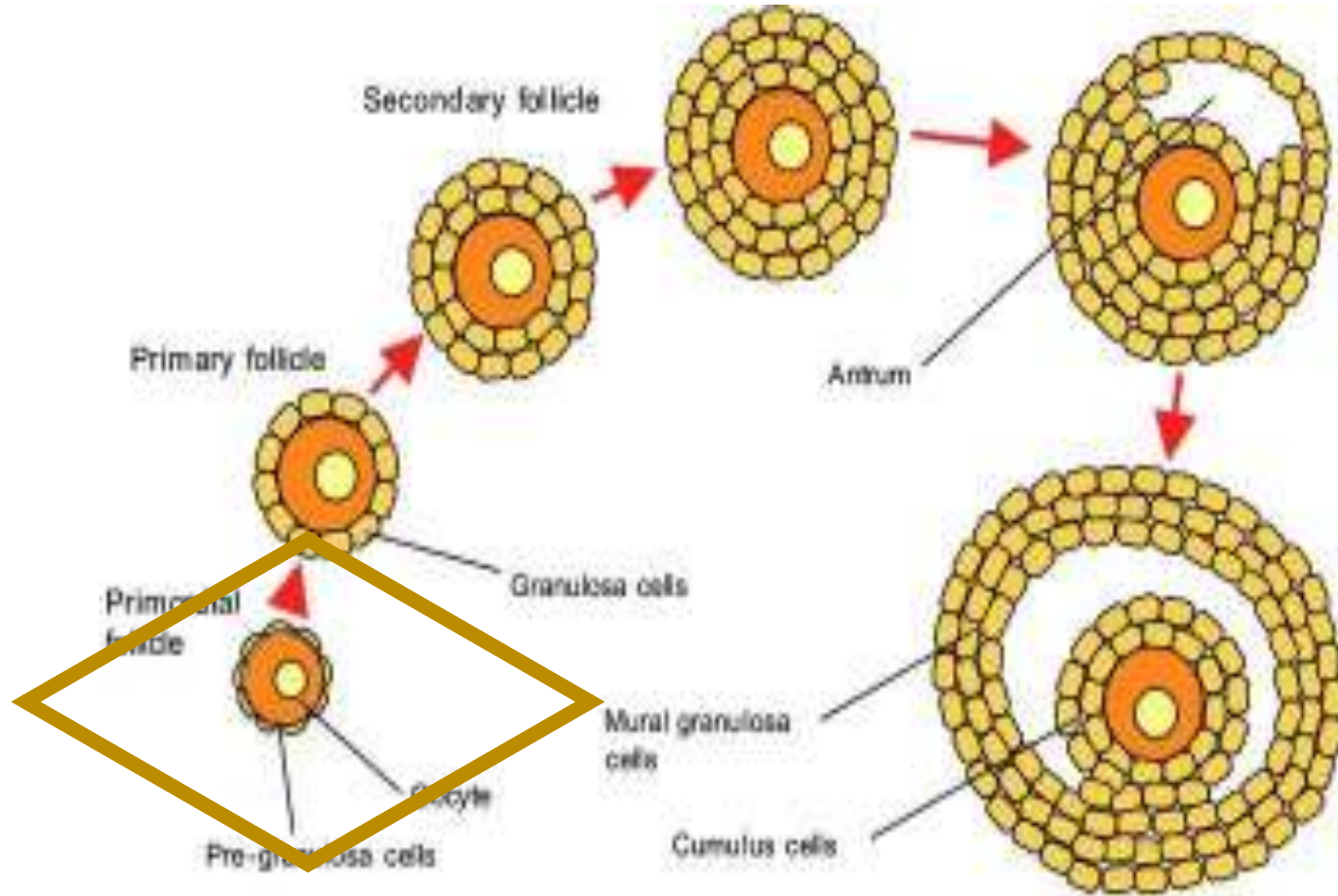


At Birth



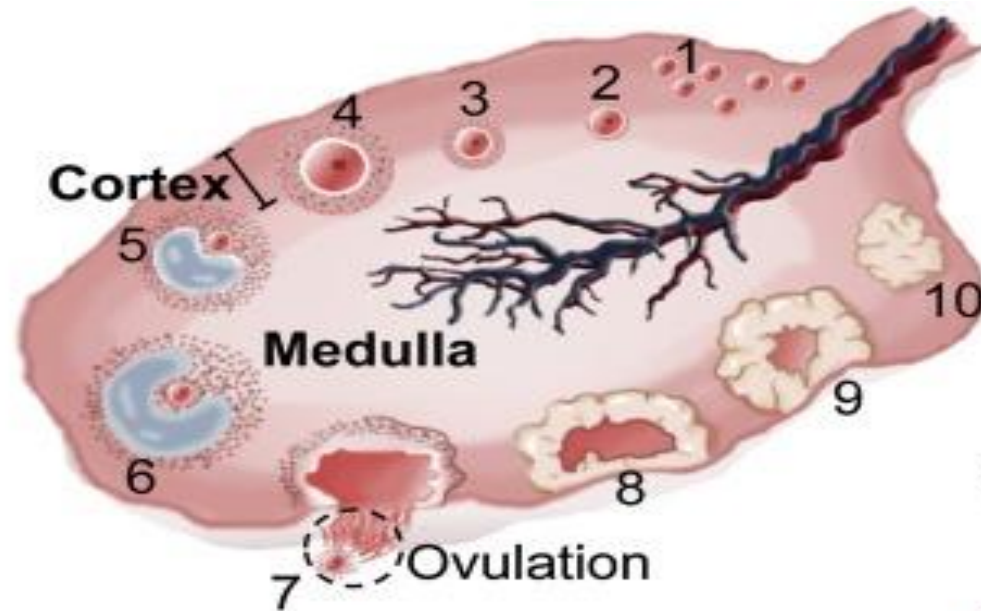
Puberty





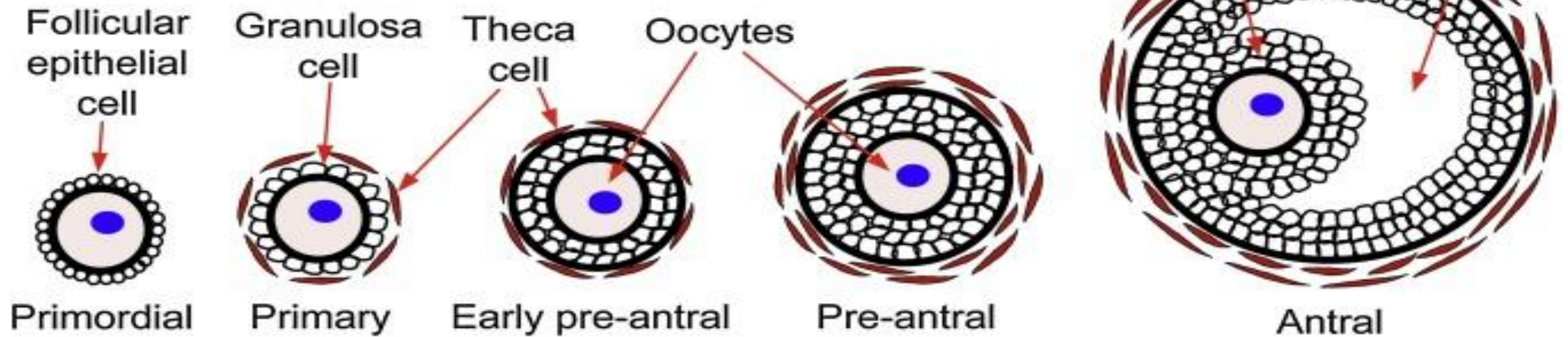
**ONLY FOLLICLE PRESENT
BEFORE PUBERTY**

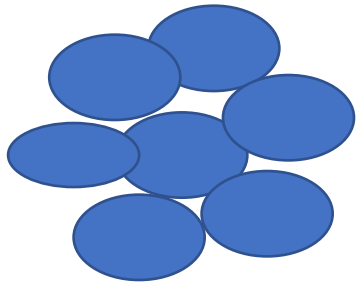
1. Primordial follicle
2. Primary follicle
- 3-4. Pre-antral follicle
- 5-6. Antral follicle
7. Cumulus-oocyte complex (COC)
- 8-10. Corpus luteum



Relative stiffness

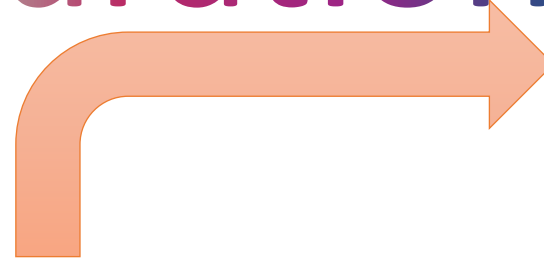
 High Low





Primordial
Follicle

Maturation



Primary
Follicle

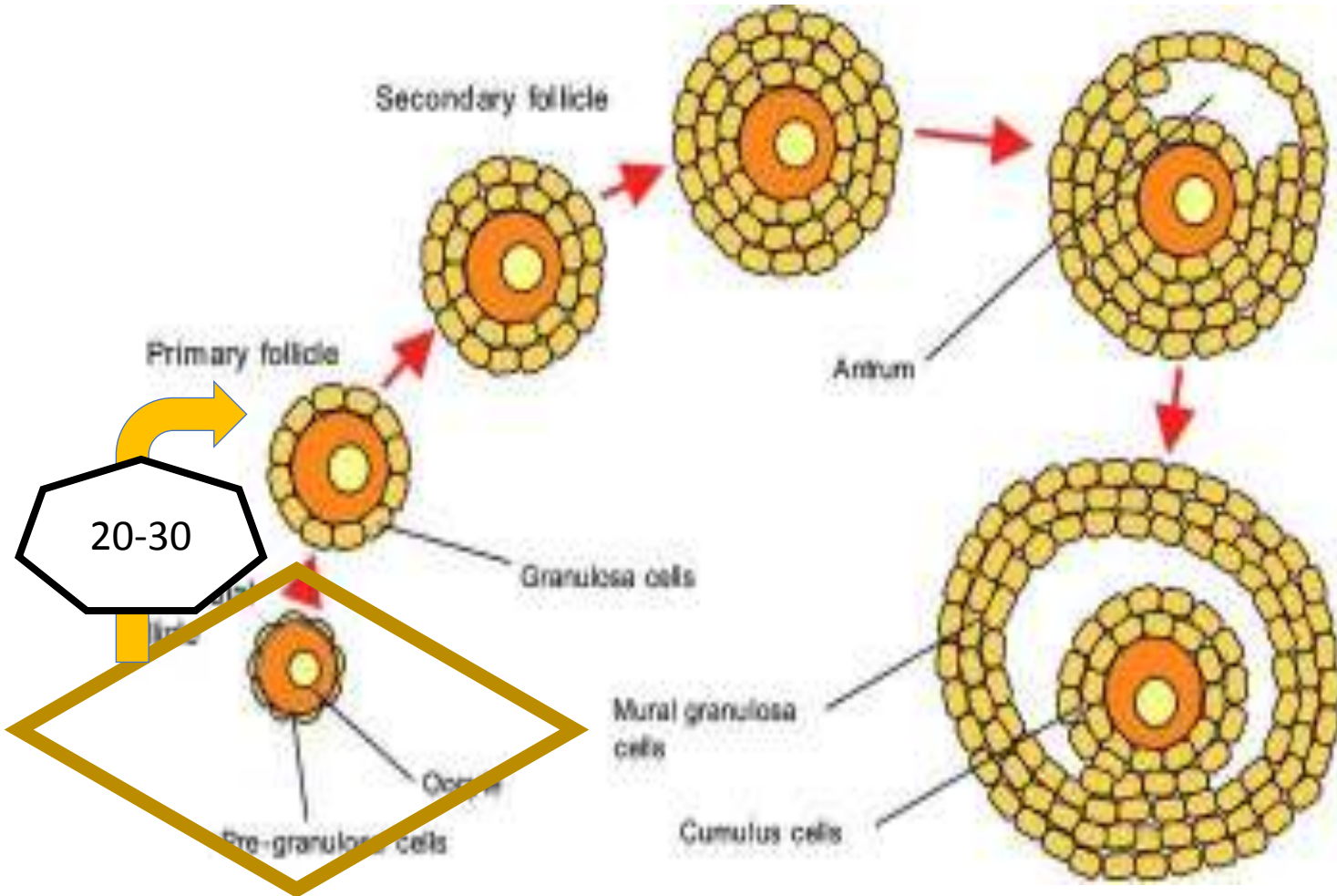


Ova



Release

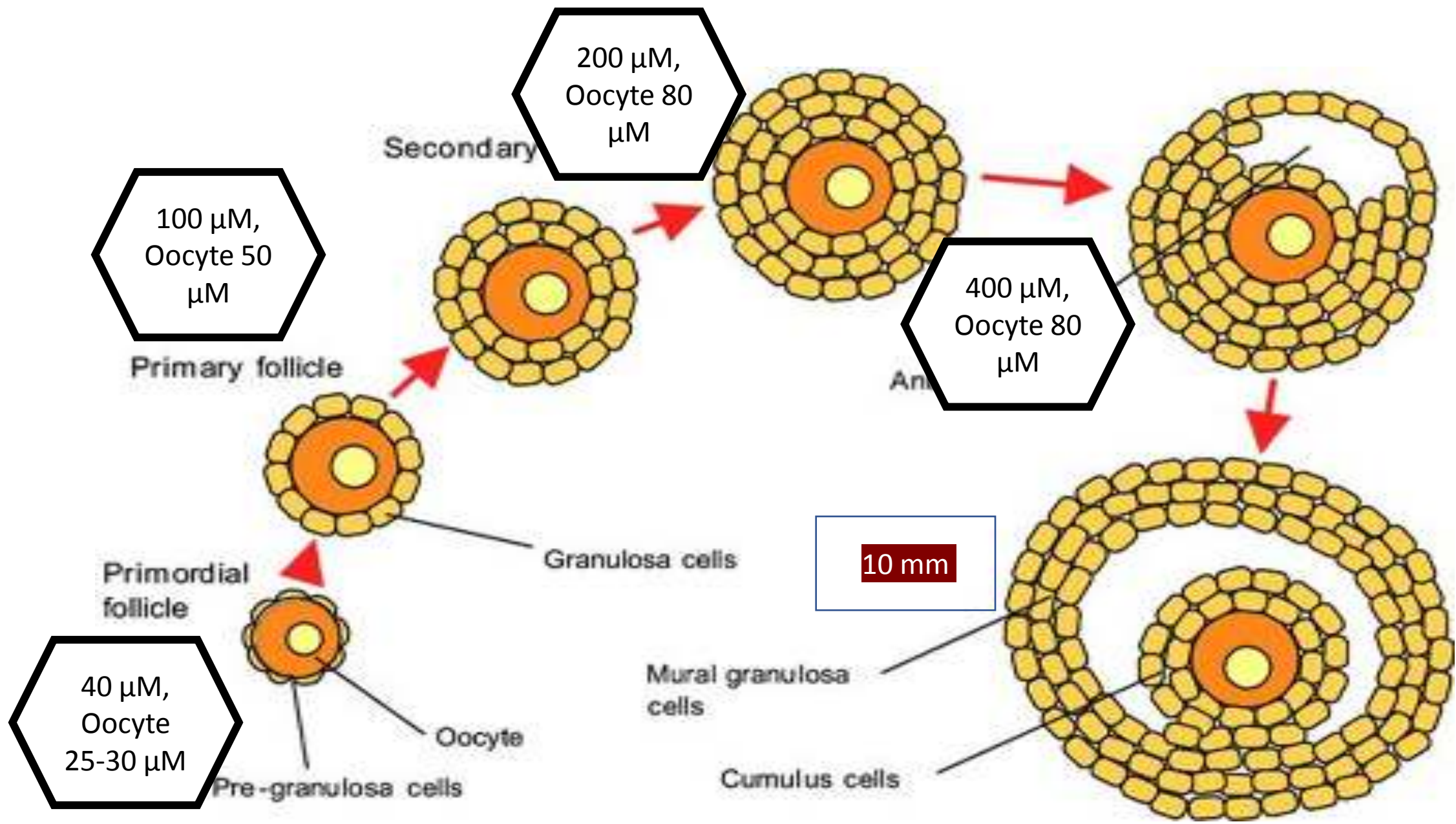
Only one of these ova per cycle is released in OVULATION. About 500 in the course of normal reproduction life



As follicles start growing 3 things change:

1. Oocyte
2. Follicular Cell
3. Surrounding Stroma

ONLY FOLLICLE PRESENT BEFORE PUBERTY



Primary (Multilaminar) Follicle

Oocyte – cortical granules, Balbiani body disperses

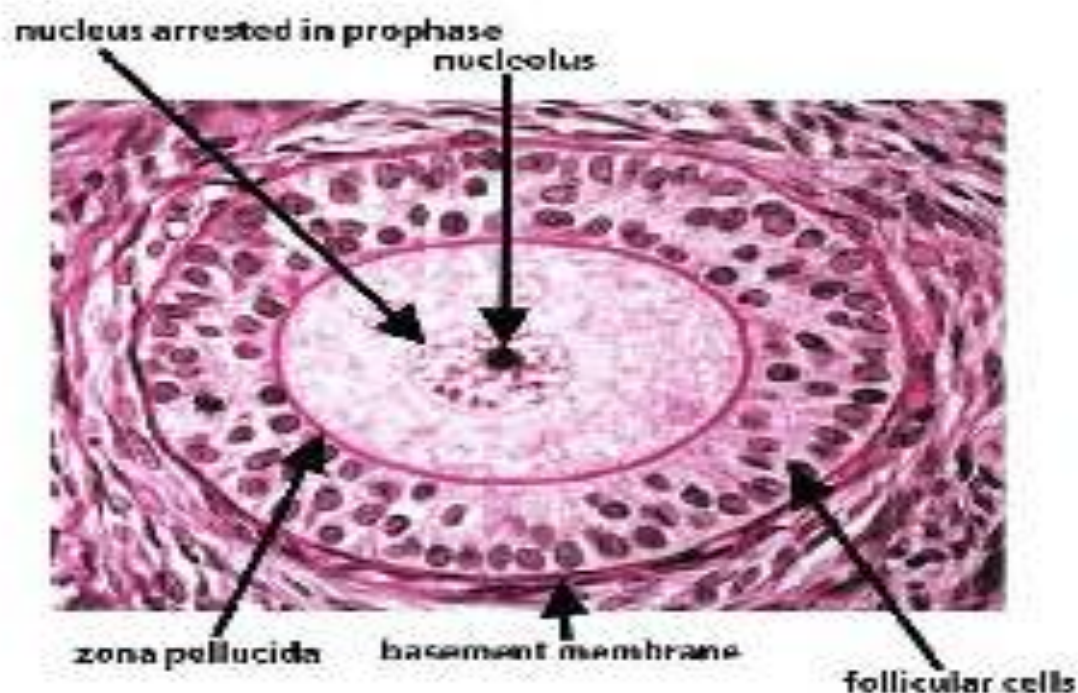
Zona Pellucida – secreted by oocytes; between oocyte and granulosa cells

Granulosa Layer – avascular; separated from surrounding cells by a basal lamina

Follicular/Granulosa cells – have FSH receptors; convert androgens to estrogens

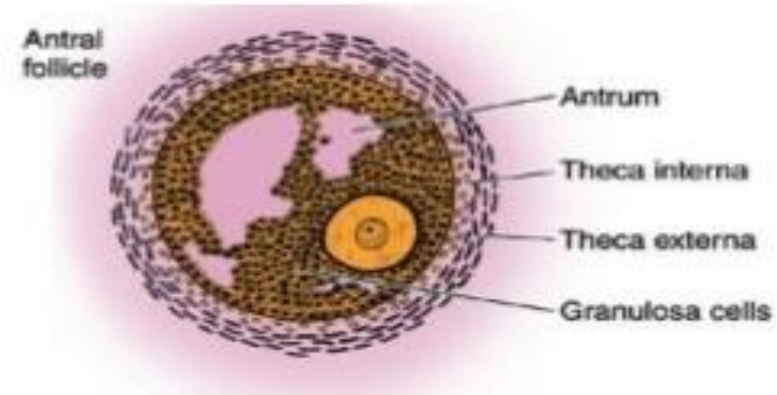
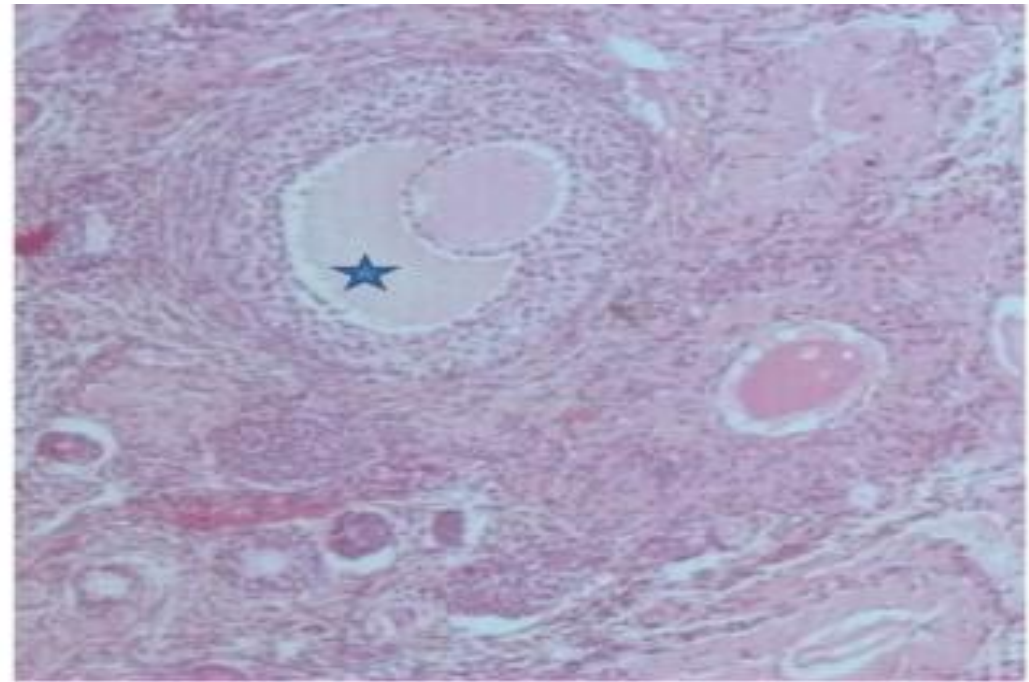
Theca interna – inner, highly vascular layer of cuboidal secretory cells (respond to LH)

Theca externa – outer CT layer, smooth muscle & collagen bundles



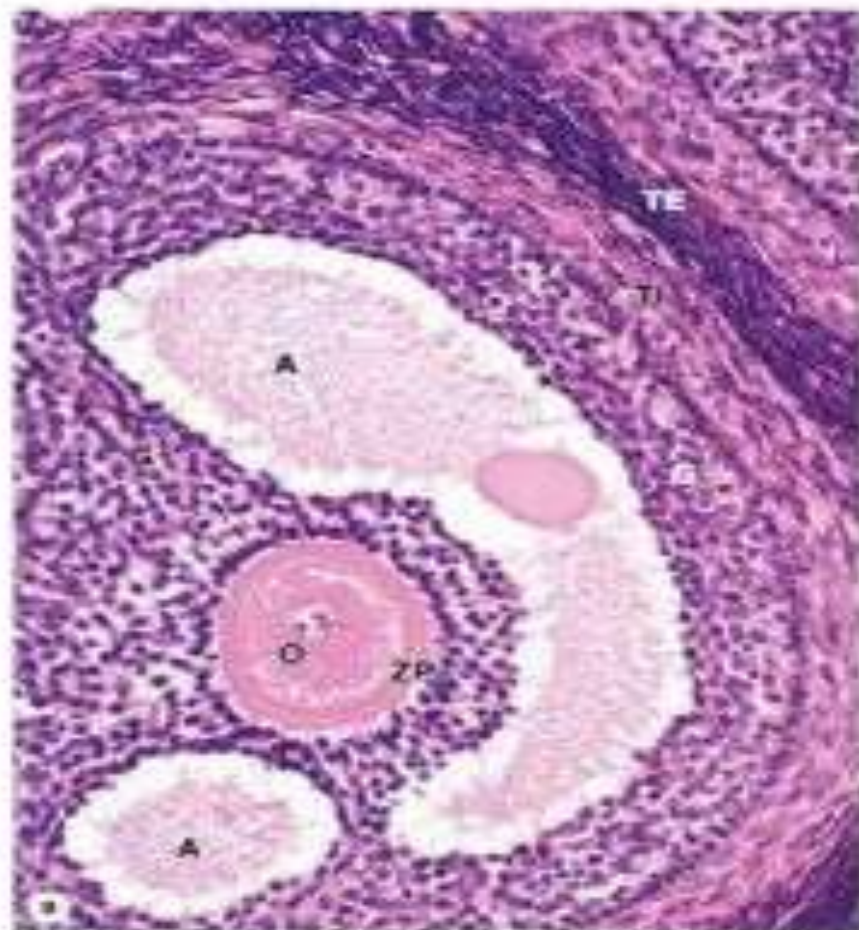
Antral follicle

- Appearance of spaces between granulosa cells
- Fluid accumulation
- Few cell adhere to ovum-
– cumulus oophorus



Antral Follicle

- An antral follicle with large, fluid-filled antral cavities or vesicles (A) forming within granulosa layer by the follicular cells.
- The oocyte (O) is surrounded by the zona pellucida (ZP) and granulosa cells (G).

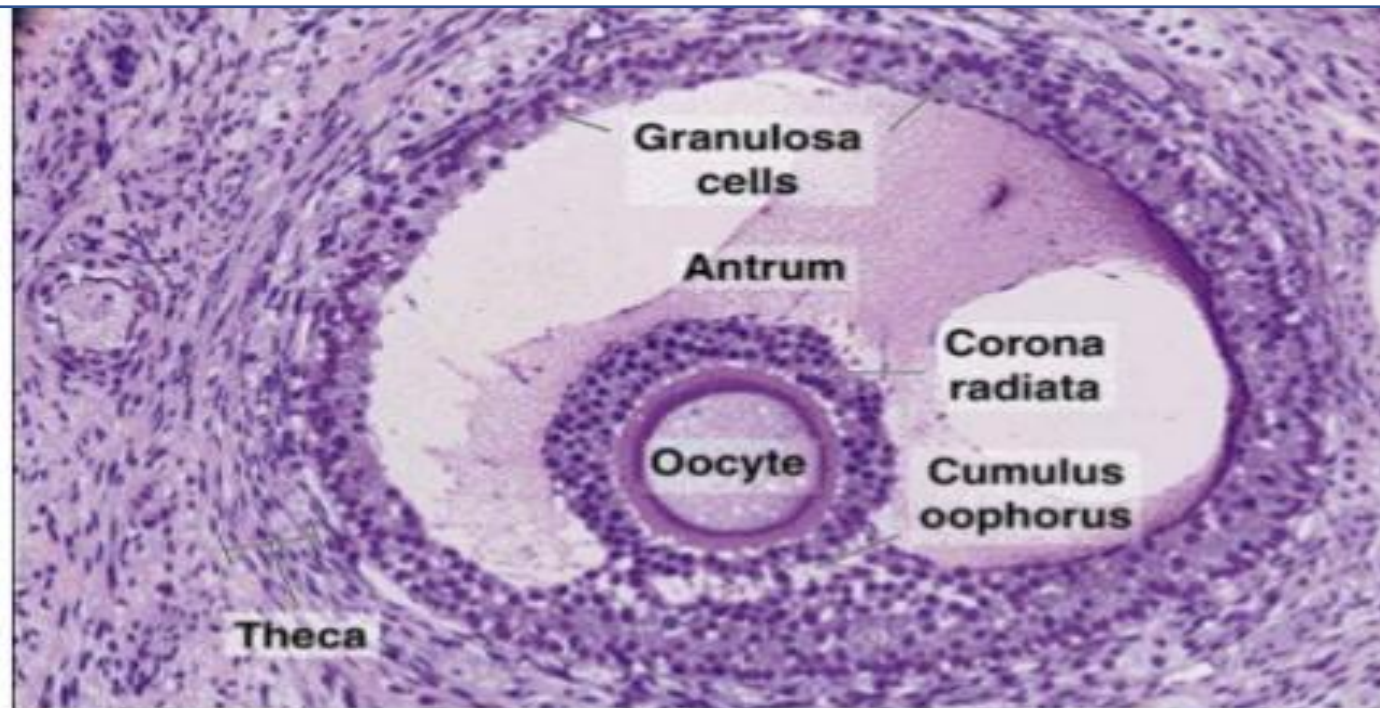


Antral Follicle

- Granulosa cells also line wall of follicle.
- Granulosa cells make up the **corona radiata**.
- The corona radiata and oocyte are attached to the side of the follicle within a larger mass of granulosa cells called the **cumulus oophorus**

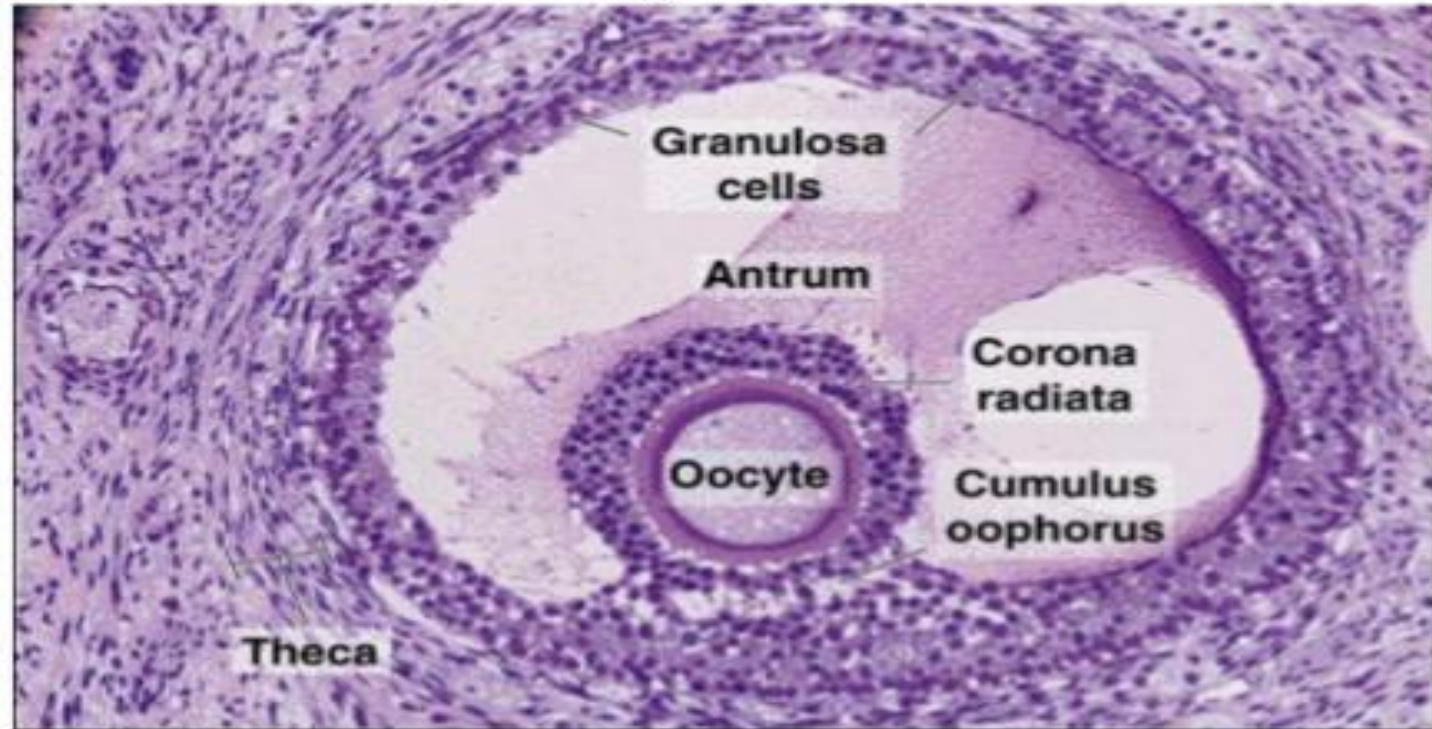


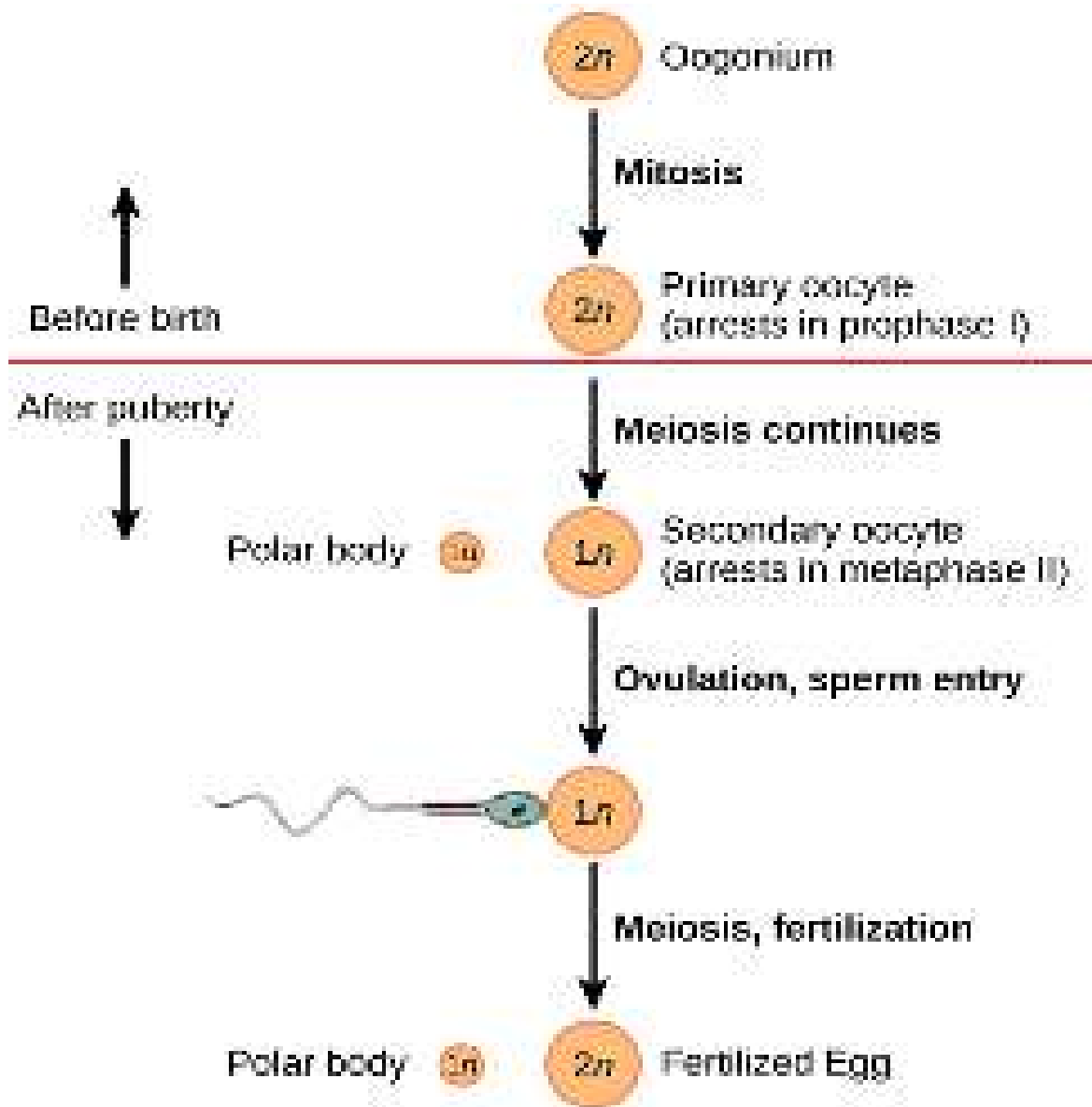
Antral Follicle



Mature Follicle (Graafian follicle)

- Primary oocyte completes its 1st meiotic division and becomes a secondary oocyte.
- Follicular antrum enlarges.
- Oocyte lies eccentrically in the follicle.

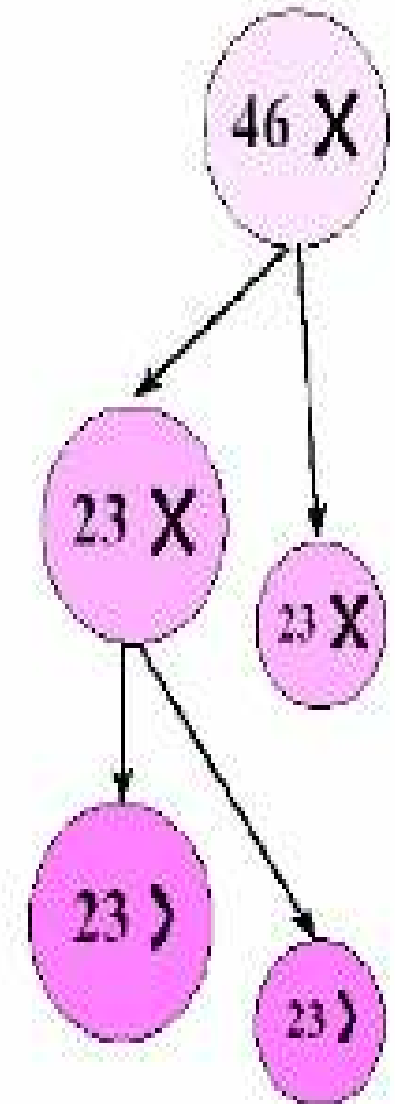


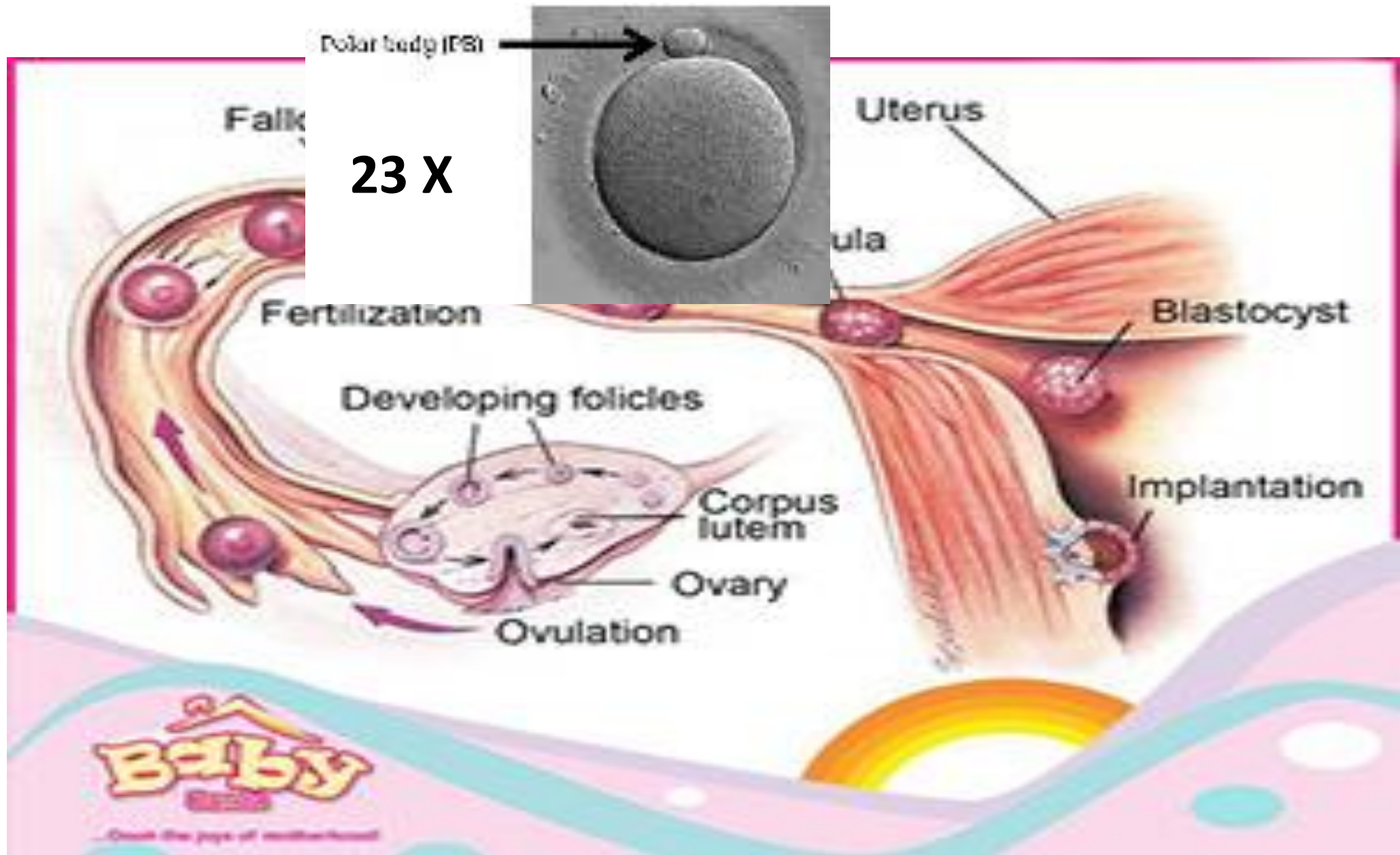


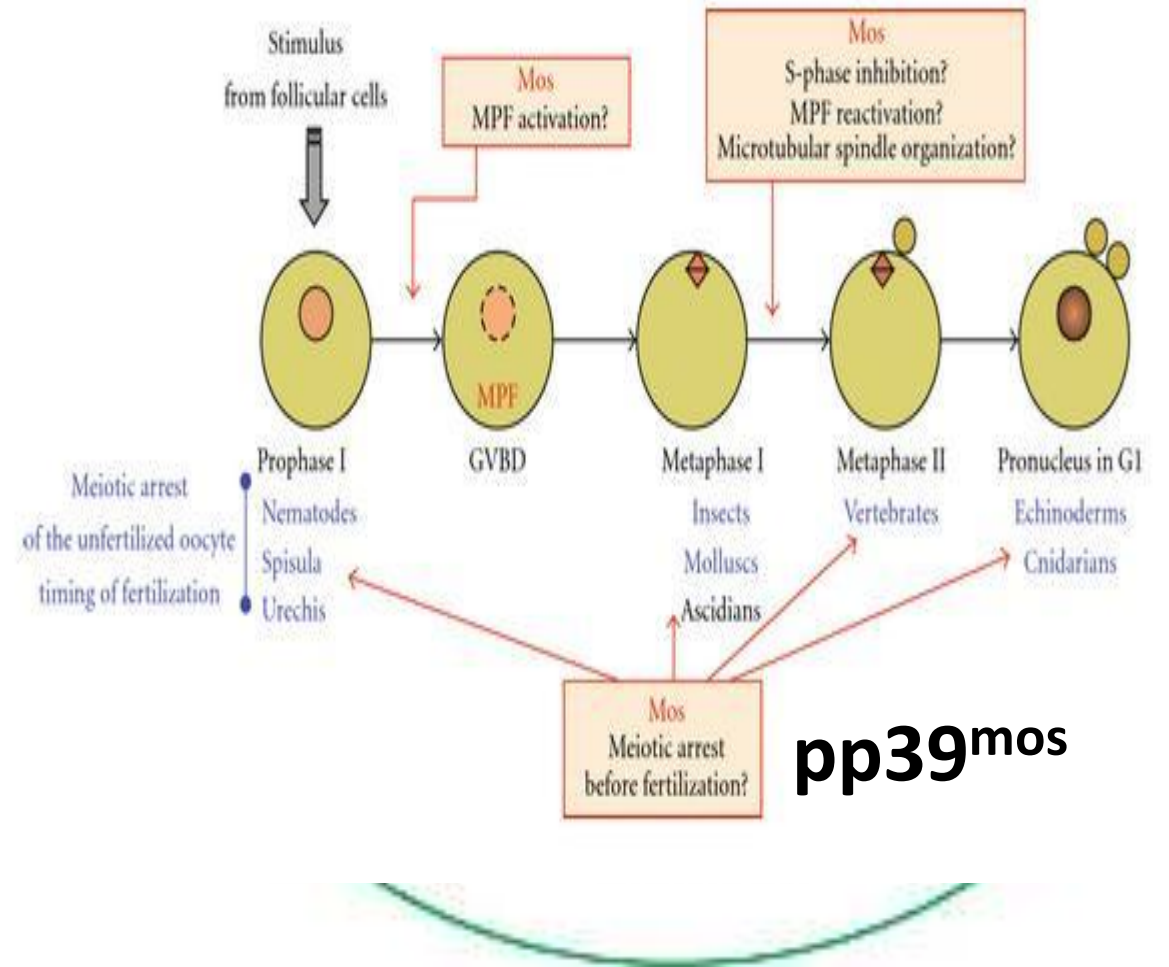
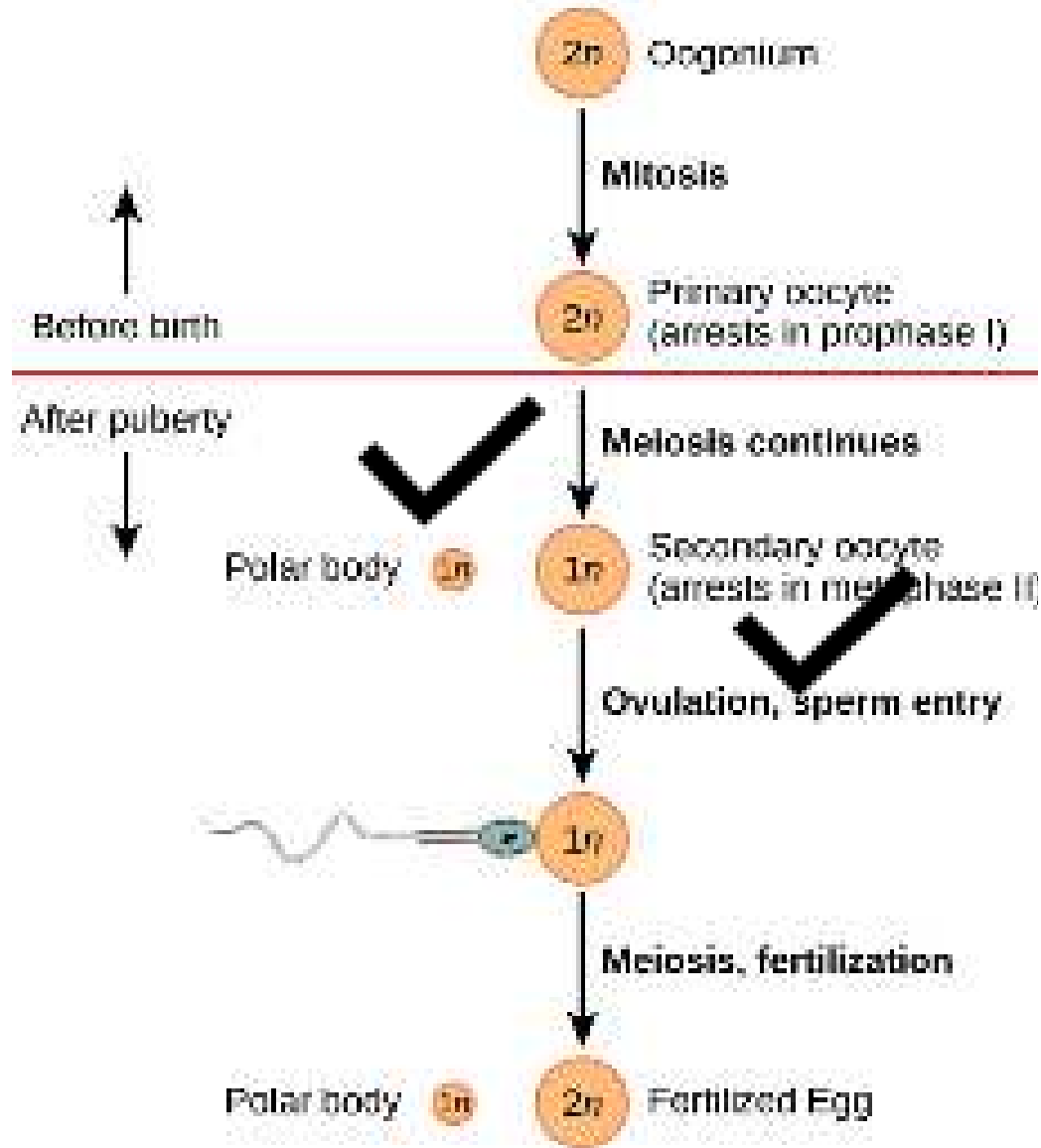
Primary oocyte, 46 chromosomes, each with two chromatids.

Secondary oocyte, left, and first polar body, right; 23 chromosomes each with two chromatids.

Mature oocyte, left, and second polar body, right; 23 chromatids apiece







Intra-oocyte elevated cAMP maintains meiotic arrest

Participation of FSH/FSHR, Estrogen/ER, NPPC/NPR2, Oocyte in maintaining mammalian oocyte meiotic arrest via cGMP

