# Embroyology -4-

#### \* The subjects of this lecture:

- The changes that happen in the ovaries from the start (primordial follicle) ----> mature graafian follicle.

-These changes that happen in the ovaries are accompanied with changes in the uterus and with changes in the secretion of the pituitary glands.

- The function of the pituitary gland during the changes in the ovaries and the changes in the uterus.

- Menstrual cycle (what it is and the changes that occur during it)

## \* The ovarian follicles

They are changes in the ovary, these changes depend on the secretion of the hormones from the pituitary gland.

At the start, the pituitary gland secrete the "follicle stimulating hormone", this secretion stimulates the changes of the follicle in the ovary.

{{In the previous lecture we took that it starts as a primordial follicle which is an oocyte surrounded by a simple squamous epithelial cells then it becomes one layer of cuboidal cell (this is called follicular cell), this oocyte was oogonia, and when it becomes primary oocytes that means that it entered meiosis 1 (prophase) in diplotein stage, then growing occurs (growing follicle) by mitotic divisions, and it becomes granulosa cells, after that the antrum will be formed inside the granulosa cells (antral follicle), so that it will have fluid inside it which is nutrient for the oocyte. The fluid and the antrum push the oocyte to one side of the follicle. And then the arrangement of the granulosa cells after that will be regular, there will be one antrum (one cavity) and inside it is the fluid.

Follicular -----> growing (changes occur) -----> maturation (mature graafian follicle – mature ovum)

\*A mature ovum has:

- 1. One antrum
- 2. The granulosa cells which have a basement membrane
- Theca externa and theca interna (from the stromal cell the cells of the ovary ---> mitosis occur and then it accumulate around the basement membrane).
  \*The inner is theca interna and the outer is theca externa.

\* The zona pellucida forms in the unilaminar primary follicle and stays until the implantation. It has an attachment with the basil membrane from the outside (the granulosa from the inside).

\* The part which surrounded the zona pellucida called corona radiata (one layer).

\* The other cells which surrounded the oocyte called cumulus oophorus, (it will secrete hormones like the progesterone).

\*\*\*These cells are really important because when ovulation occurs at the surface of the ovary, the oocyte (secondary oocyte) will be released and it will be surrounded by zona pellucida, corona radiata, cumulus oophorus and some of the granulosa cells.

\*Some of the granulosa cells, theca interna and theca externa will stay in the ovary.

-These cells form the corpus luteum (luteal cells) and it has a yellow pigmentation.

\* NOTE : The oocyte in the primordial follicle is a spherical cell about 25 mm in diameter (maximum)

The secondary or the antral follicle -----> more growing -----> graafian follicle (it has a secondary oocyte which enters meiosis2 three hours before ovulation and also it has a polar body with it).

\* Follicular fluid contains components of the plasma and products secreted by follicular cells. Glycosaminoglycans, several proteins (including steroid-binding proteins), and high concentrations of steroids (progesterone, androgens, and estrogens) are present.

\* Secreting the follicle stimulating hormone (FSH) and the luteinizing hormone (LH) from the anterior pituitary gland depends on the hypothalamus. (note: LH's level is increased by secretion of Thecal cells )

-The hypothalamus secrete a control hormone called "Gonadotropin Releasing Hormone".

- At the beginning of each ovarian cycle, 15 to 20 primary (preantral) stage follicles are stimulated to grow under the influence of FSH.
- Thus, FSH rescues 15 to 20 of these cells from a pool of continuously forming primary follicles

\* Most of ovarian follicles undergo atresia, in which follicular cells and oocytes die and are disposed of by phagocytic cells (engulfing by phagocytic cells).

\*atresia means degeneration, shrinkage and death.

\* Atresia takes place in the ovary.

\* Follicles at any stage of development (primordial, primary, preantral, and antral) may undergo atresia.

\* One mature ovum or the graafian follicle which has a secondary oocyte undergo ovulation and it will continue, and then you will realize that it will move towards the surface of the ovary and it makes a bulge of the surface.

\*\*\*\*\*\*\*\*

\* NOTEEE: Sometimes there will not be any ovulation, there will be development and there will be a mature ovum but it doesn't reach the surface, and the reason is that the LH hormone must reach the maximum level of it (in the day 14 of the menstrual cycle).

- Didn't reach the high level -----> no ovulation

\* The treatment is simple -----> we should increase the level of the LH hormone by giving her hormones or stimulation stuff.

\*\*\*\*\*\*\*\*\*

\* Although follicular atresia takes place from before birth until a few years after menopause, there are times at which it is particularly intense

\* Although granulosa cells and the oocytes undergo degeneration during follicular atresia, the theca interna cells frequently persist in isolation or in small groups throughout the cortical stroma and are called interstitial cells

Present from childhood through menopause, interstitial cells are active steroid secretors, stimulated by LH.

## \*the ovarian cycle

-Take a look at this pic :



\* Take a look at the pic in the slide number 7.

\* Under the influence of LH, Granulosa and thecal cells develop a yellowish pigment and change into lutean cells, which form the corpus luteum and secrete the hormone progesterone

\* Corpus luteum will secrete Progesterone.

\* Corpus luteum of pregnancy will keep secreting Progesterone for preparation of the endometrium uterus for the implantation until the 4<sup>th</sup> month of pregnancy. And also its size will increase approximately half of the ovary's size.

\* In the 5<sup>th</sup> month of pregnancy Placenta is formed and starts secreting Progesterone

-No fertilization ----> corpus albicans (shrinkage - degeneration – disintegration)----> no pregnancy -----> the uterus will be prepared for the next menstrual cycle and there will be changes in the hormones.

\*\* Fertilization: progesterone-----> high estrogen----> low

\*\* No fertilization: progesterone-----> low

estrogen---->high

\*In the next cycle, another group of primary follicles is recruited, and again, only one follicle reaches maturity \* In cooperation, granulosa and thecal cells produce estrogens that (a) cause the uterine endometrium to enter the follicular or proliferative phase; (b) cause thinning of the cervical mucus to allow passage of sperm to the ampulla tube (c) stimulate the pituitary gland to secrete LH. At mid-cycle, there is an LH surge that a) elevates concentrations of maturation-promoting factor, causing oocytes to complete meiosis I and initiate meiosis II; (arrested in metaphase 3 hours before ovulation- called dormant stage) b) stimulates production of progesterone by follicular stromal cells (luteinization) (c) causes follicular rupture and ovulation.

\*Ovulation:

\* In the meantime, the surface of the ovary begins to bulge locally, and at the apex, an avascular spot, the stigma, appears.

\* On the surface of the ovary at the site of ovulation you may find a clot of blood called stigma. (there will be a little blood but then it will disappear)

\* The high concentration of LH increases collagenase activity, resulting in digestion of collagen fibers surrounding the follicle

\* In the day 14: ovulation happens-----> in the next 48 hours fertilization occurs----> during the next ten days corpus luteum of pregnancy will form (before the 28 days of the menstrual cycle the corpus will form)

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arteries and the glands will constrict and slough (there will be bleeding). And this is the menstrual cycle which is bleeding and shedding of the endometrium in the functional layer only. (the basil layer is for regeneration).

\*Functional layer = compact layer + spongy layer

#### The menstrual cycle: 28 days (normal)

3 Phases:

- The menstrual phase or bleeding phase (3 -4 days)

- Proliferative phase, Pre-ovulatory (from the 4<sup>th</sup> day to the 14<sup>th</sup> day)

- Secretory Phase, Luteal Phase, Post-ovulatory phase (from the 14<sup>th</sup> day to the 28<sup>th</sup> day): 2 stages either Pregnancy or degeneration of the mature ovum .

# **\*SUMMARY:**

\*Pituitary glands: follicle stimulating hormone (FSH) & luteinizing hormones (LH)

-The word follicle means that it depends on the development of graafian follicle (one mature graafian follicle)

\*ovary: in the day 14 of the menstrual cycle, there will be ovulation for ONE mature ovum

-endometrium had two phases (menstrual phase and the proliferative phase) and is going to enter the secretory phase.

\*\* if there's fertilization---->the endometrium prepare itself and will stay in the secretory phase and it will be under the effect of progesterone. The corpus luteum ------> to corpus luteum of pregnancy and also it will secret the progesterone

\*\* if there's NO fertilization-----> the mature ovum dies-----> the endometrium will be prepared for the next menstrual cycle. (on the day 28, there will be a new bleeding and a new menstrual cycle) -----> the progesterone will drop and the estrogen will be high. In Ovary The corpus luteum -----> corpus albicans (disintegration).

\*\* Good luck

\*\* Done by: Hiba Hudali =D