

Odesa National Medical University

Histology, cytology and embryology

«Female reproductive system»

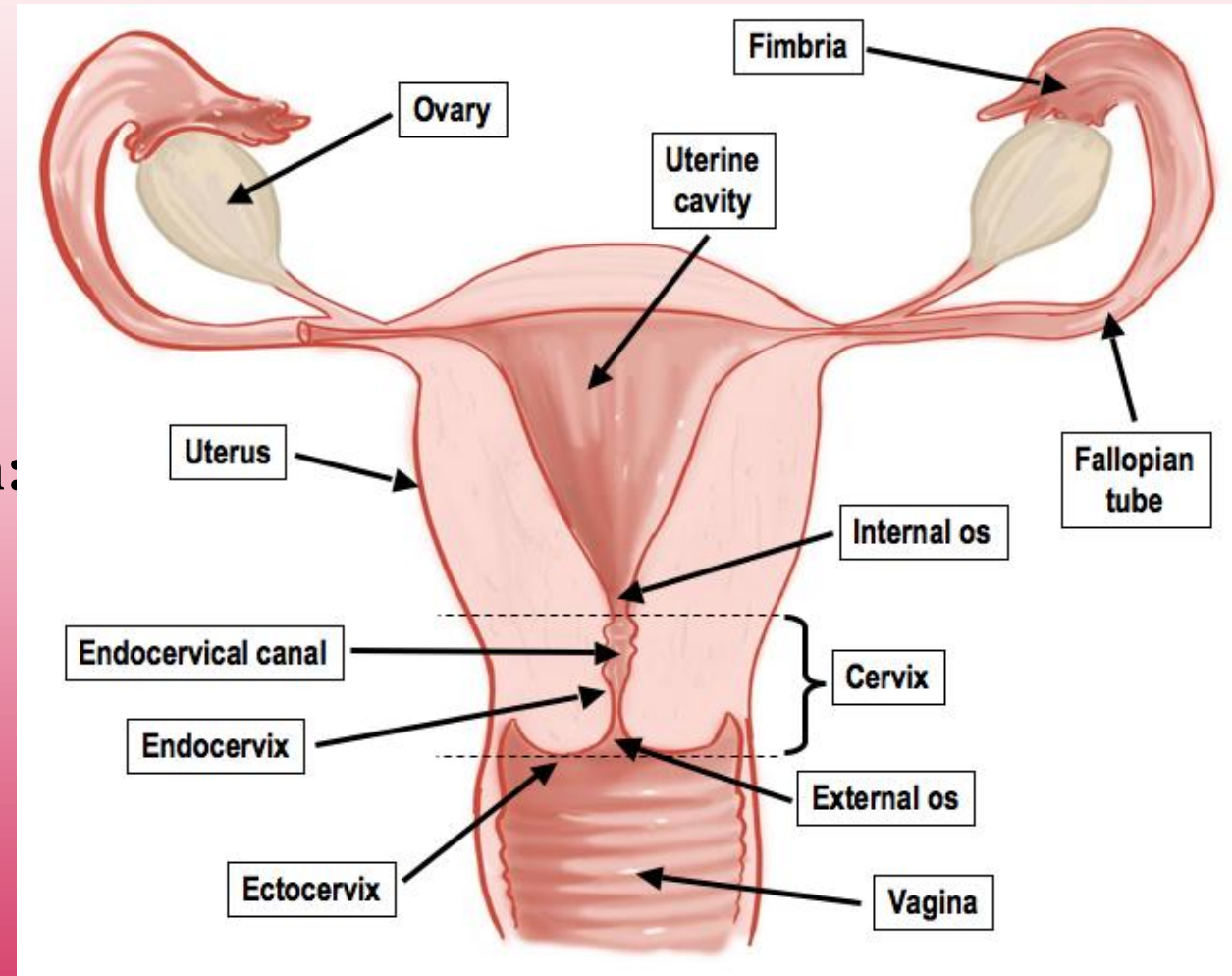
Organs of the female reproductive system:

- Ovaries
- Uterine tubes
- Uterus
- Vagina
- External genitalia

Functions of the female reproductive system:

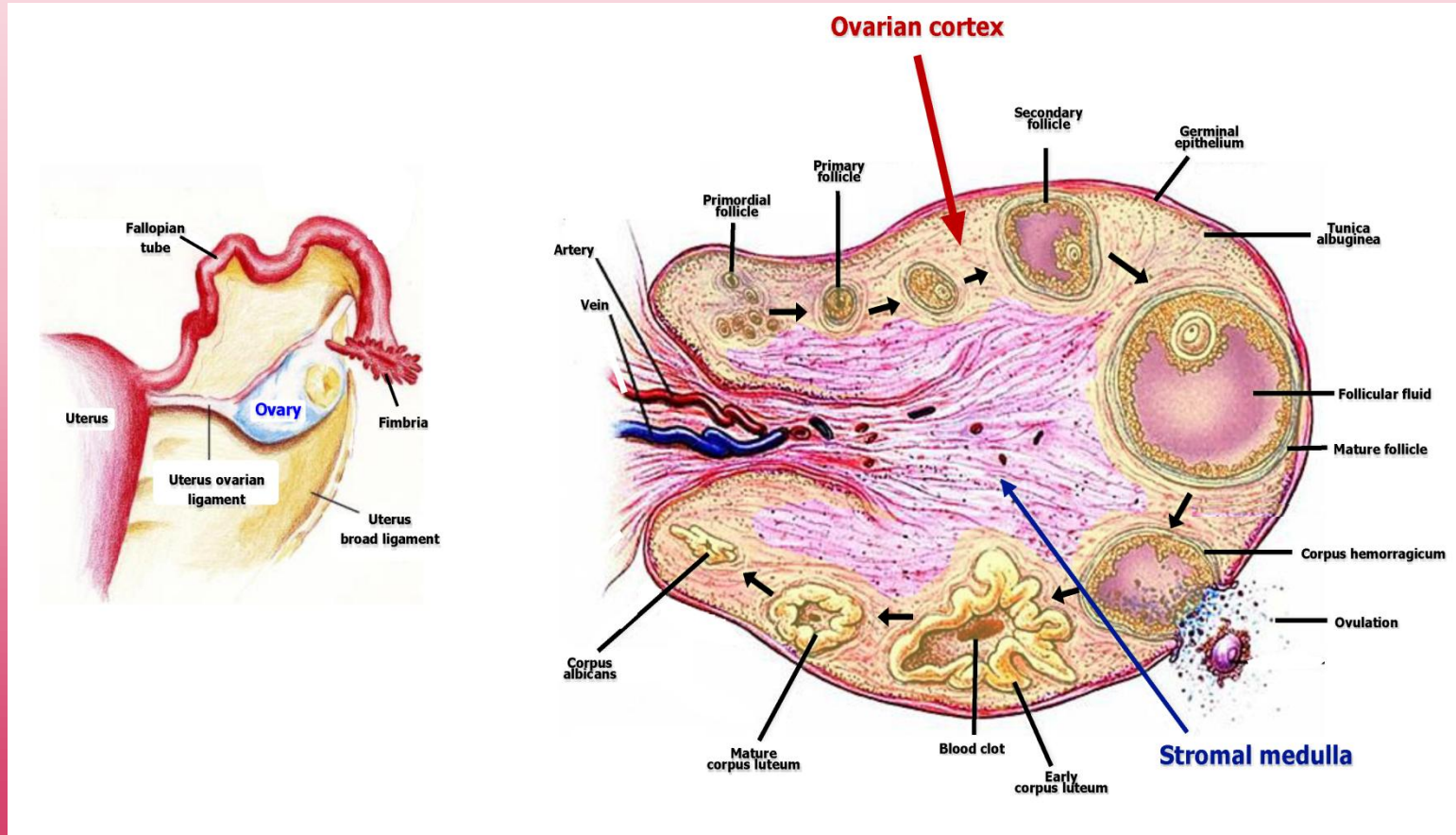
- generative function - the formation of female germ cells - oocytes
- endocrine function - the production of sex hormones - estrogen and progesterone
- provides conditions for fertilization
- provides conditions for fetal development

- An essential feature of FSW is its close relationship with the hypothalamic-pituitary system.



Ovaries

- Externally the ovary is covered by tunica albuginea that is formed by connective tissue and covering mesothelium.
- Under the tunica albuginea the ovarian cortex and medulla are located.



Ovarian cortex

- Consist of stroma and parenchyme

Stroma:

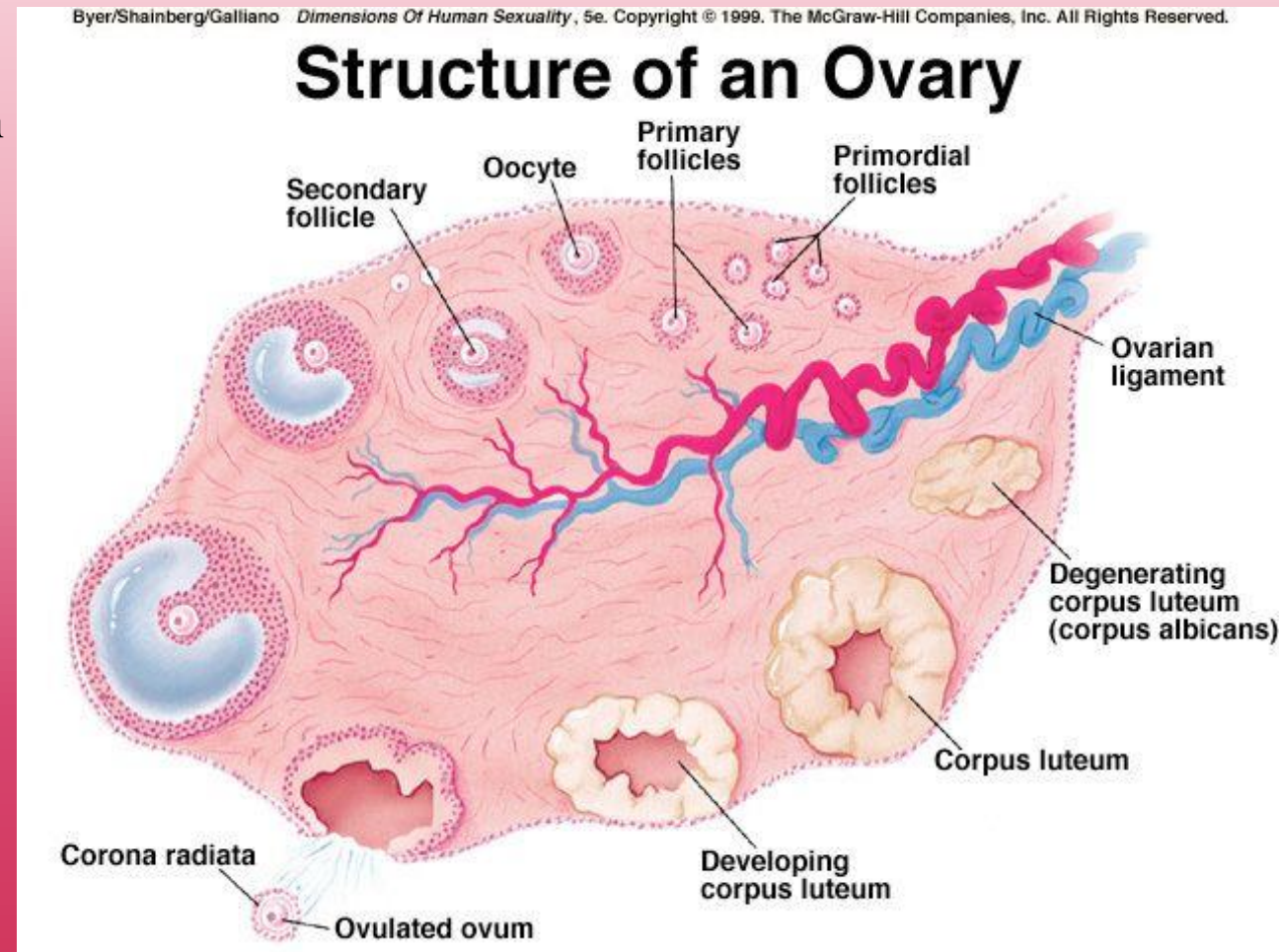
- Loose connective tissue
- Collagen fibers and less elastic
- Numerous fibroblast that are similar to smooth muscle cells (interstitial cells) and are capable for production of hormones.

Parenchyme:

- Primordial follicle
- Primary follicle
- Secondary follicle
- Mature (Graafian) follicle
- Corpus luteum and corpus albicans
- Atretic follicle

Ovarian medulla

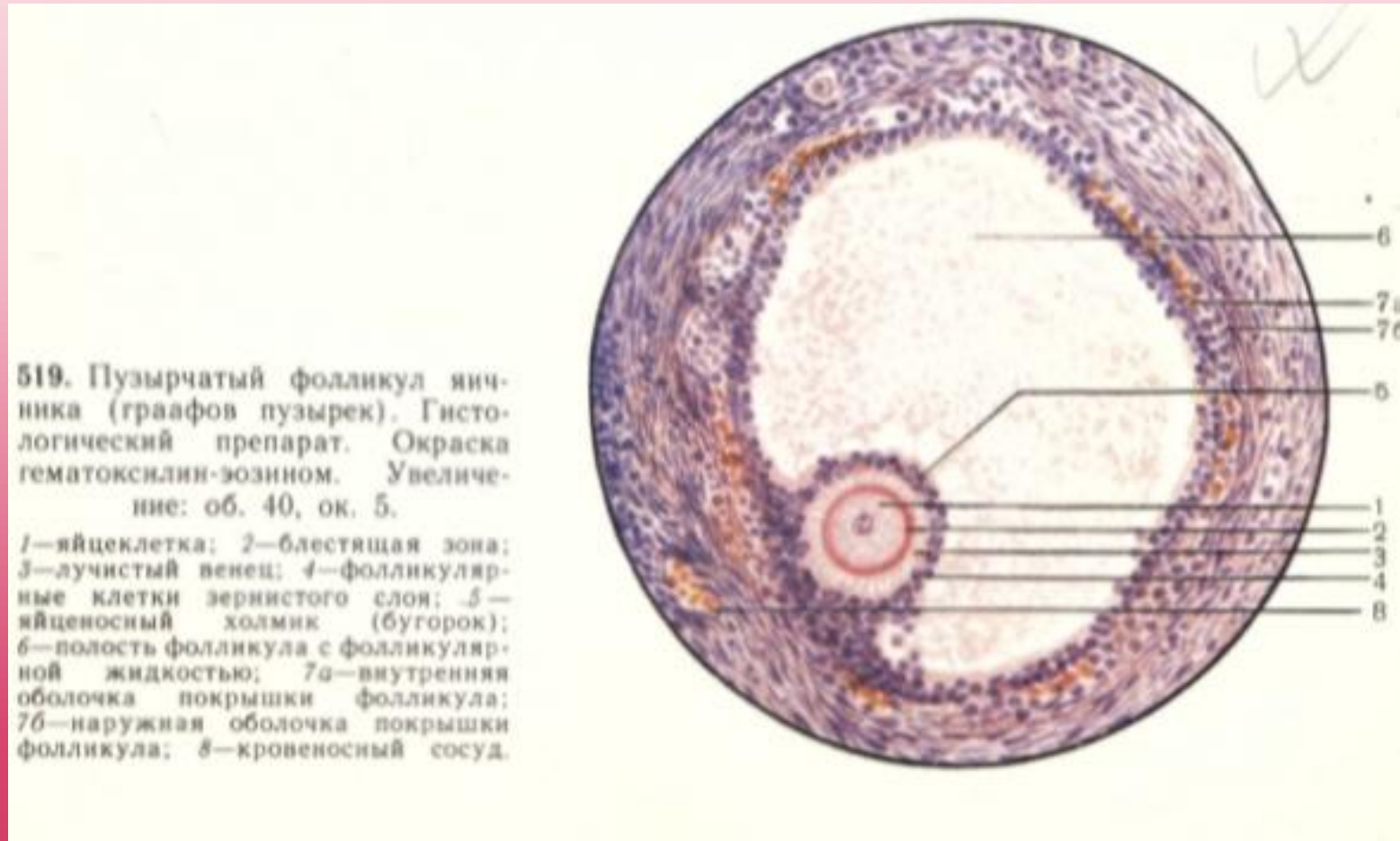
- Loose connective tissue
- Blood vessels and nerve plexuses



Morphofunctional comparison of follicles

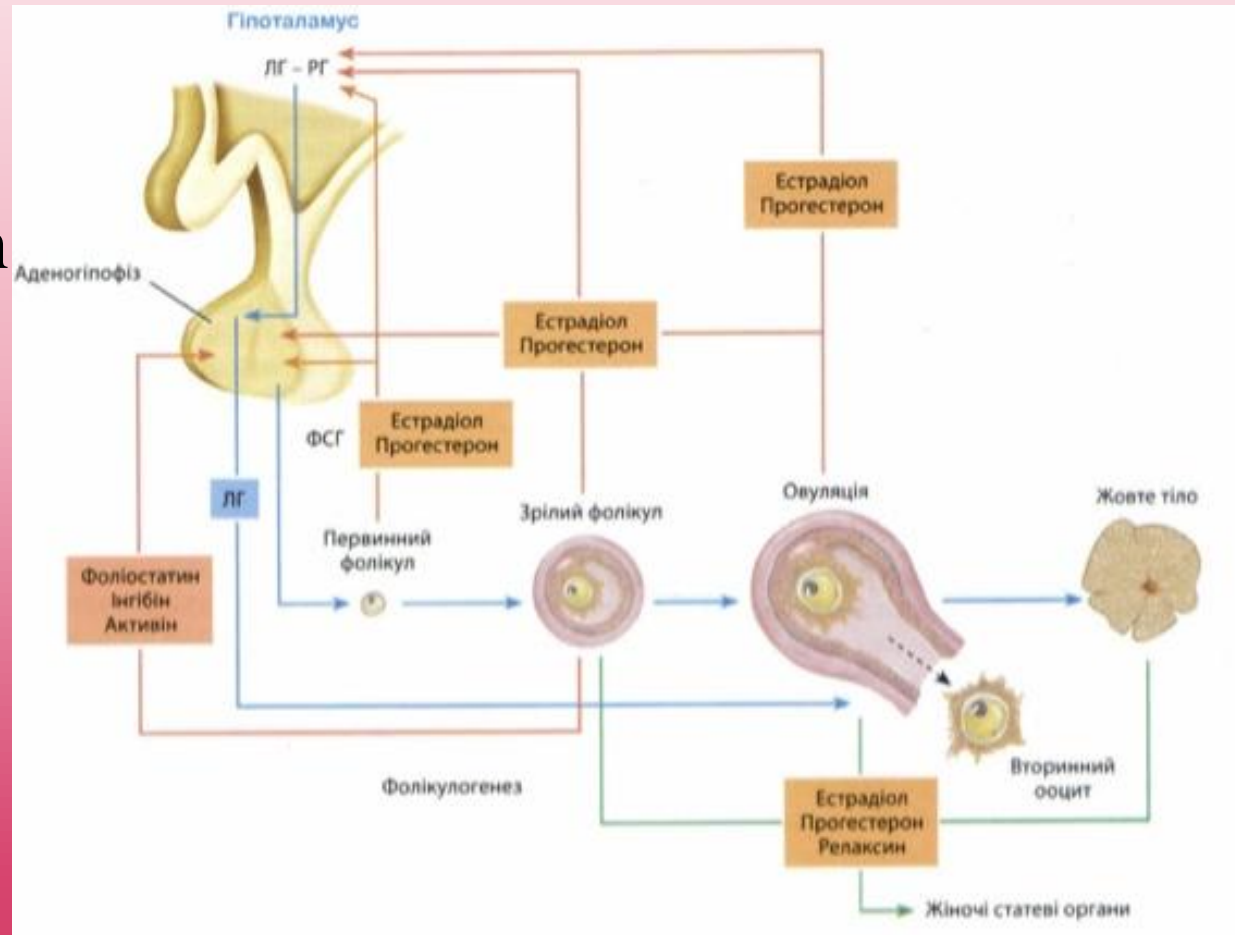
Primordial follicle:	Primary follicle:	Secondary follicle:	Mature follicle:	Atretic follicle:
<ul style="list-style-type: none"> - Primary oocyte in diplotene stage of meiotic prophase - Simple squamous epithelium 	<ul style="list-style-type: none"> - Primary oocyte in dyctiotene stage - Simple columnar epithelium on the basal lamina - Zona pellucida - Size of the follicle is increased 	<ul style="list-style-type: none"> - Stratified epithelium - External theca– dense connective tissue - Internal theca– capillaries, interstitial cells - Cumulus oophorus (primary oocyte, corona radiata, stratum granulosum, zona pellucida) - Corona radiate - 1-2 layers of follicular cells - Antrum - Estrogen- containing antrum 	<ul style="list-style-type: none"> - Big size - Cumulus oophorus (primary oocyte, corona radiata, stratum granulosum, zona pellucida) - Antrum - Estrogen- containing antrum 	<ul style="list-style-type: none"> - do not reach the maturation stage - Oocyte is died by apoptosis - in the center is a hyalinized transparent zone - Internal cells proliferate and produce estrogen - the process of atresia is caused by the hormone inhibin

Mature follicle



Ovulation

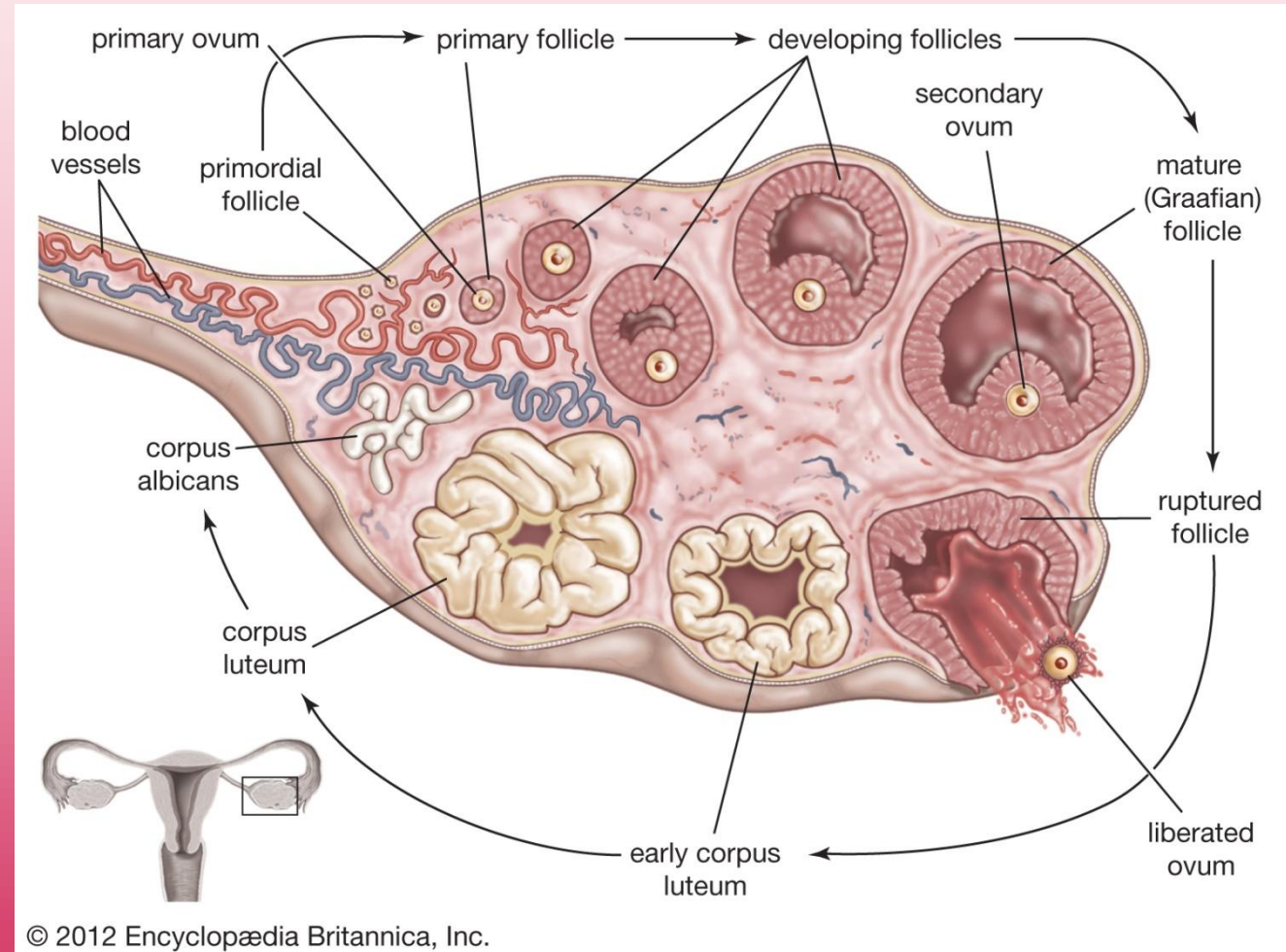
- This is a rupture of the wall of a mature follicle and the release of the primary oocyte to the abdominal cavity under the influence of luteinizing hormone (LH).
- During the exit into the abdominal cavity, the first division of meiosis is completed and in the fallopian tube is a secondary oocyte.
- The oocyte is currently in the metaphase of the second division of meiosis. Oxytocin plays a significant role in ovulation.



Corpus luteum- temporary endocrine gland

Stages of development:

1. Stage of proliferation and vascularization
 - Bleeding from the ruptured capillaries of the theca interna
 - Corpus hemorrhagicum
2. The stage of glandular metamorphosis
 - Differentiation of granulosa cells and theca cells into luteal cells with lipid droplets inside
3. The blossom of corpus luteum
 - The luteal cells produce progesterone
 - Corpus luteum of pregnancy 11-12 weeks
 - Corpus luteum of menstruation- 12-14 days
4. The stage of regression
 - The luteal cells undergo autolysis
 - Formation of corpus albicans



Oogenesis- the process of formation of female germ cells (oocytes)

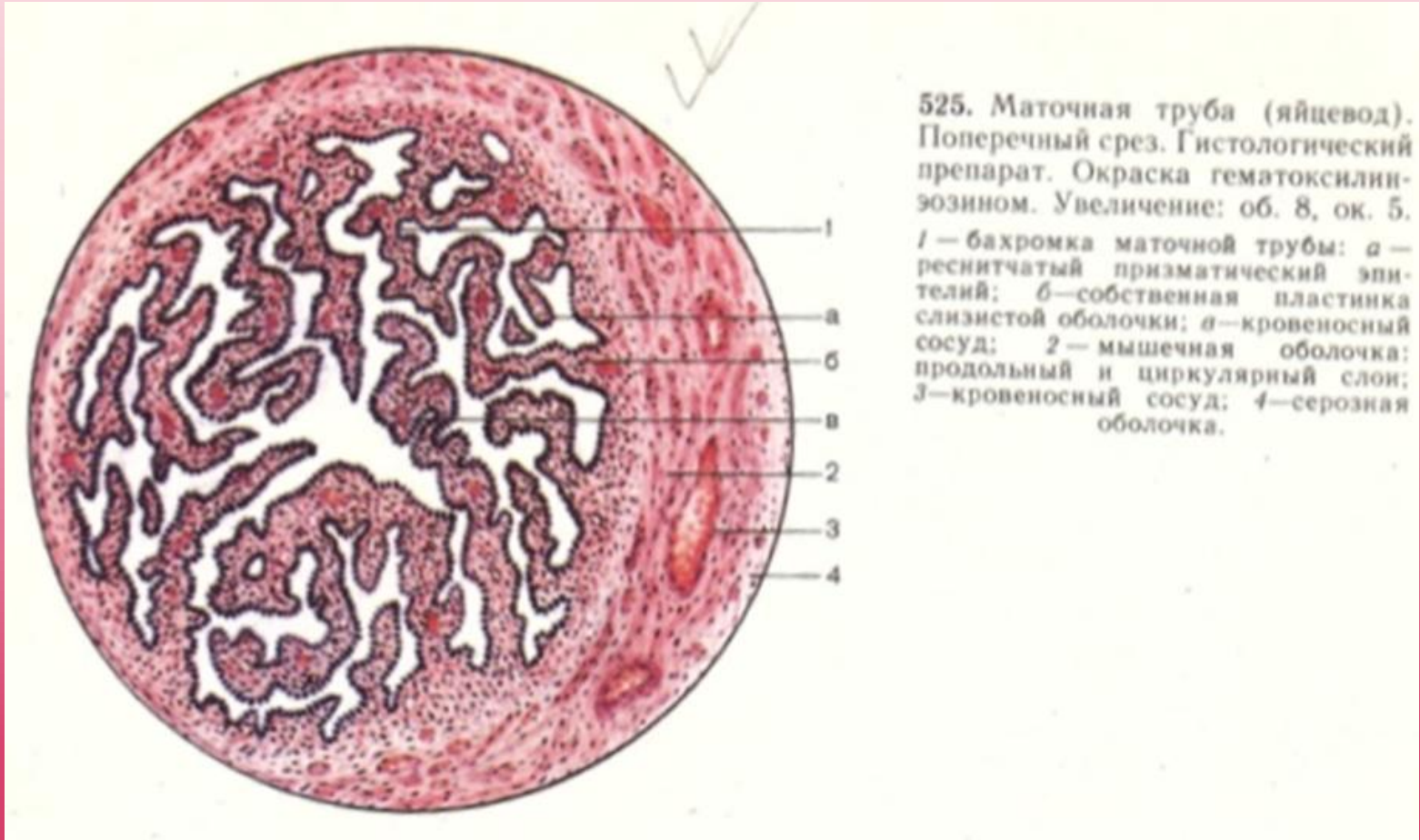
Stages of oogenesis:

1. Proliferation – (lasts from 2-5 month of intrauterine development)
division of oogonia by mitosis
2. Growth – (lasts from the 3 month of intrauterine development)
formation of primary oocyte (small and big growth)
3. Maturation – resuming of the meiosis (prophase 1) and formation of the big cell - secondary oocyte and small cell-polar body. The second meiotic division starts after the 1st one , but its arrested in the metaphase stage and resumes after fertilization.

Uterine tubes (oviducts)- paired tubes that extended from the uterus towards the ovaries

Structure:

- *Mucosa*
 - Epithelium – simple columnar ciliated epithelium
 - Lamina propria- loose connective tissue
- *Muscularis*– inner circular, outer longitudinal.
- *Serosa*– loose connective tissue covered by mesothelium



Uterus- hollow muscular organ for implantation and fetal development

Layers of the uterine wall:

1. Endometrium-internal- *simple columnar epithelium* (secretory cells, ciliated cells, excretory ducts of simple tubular uterine glands)

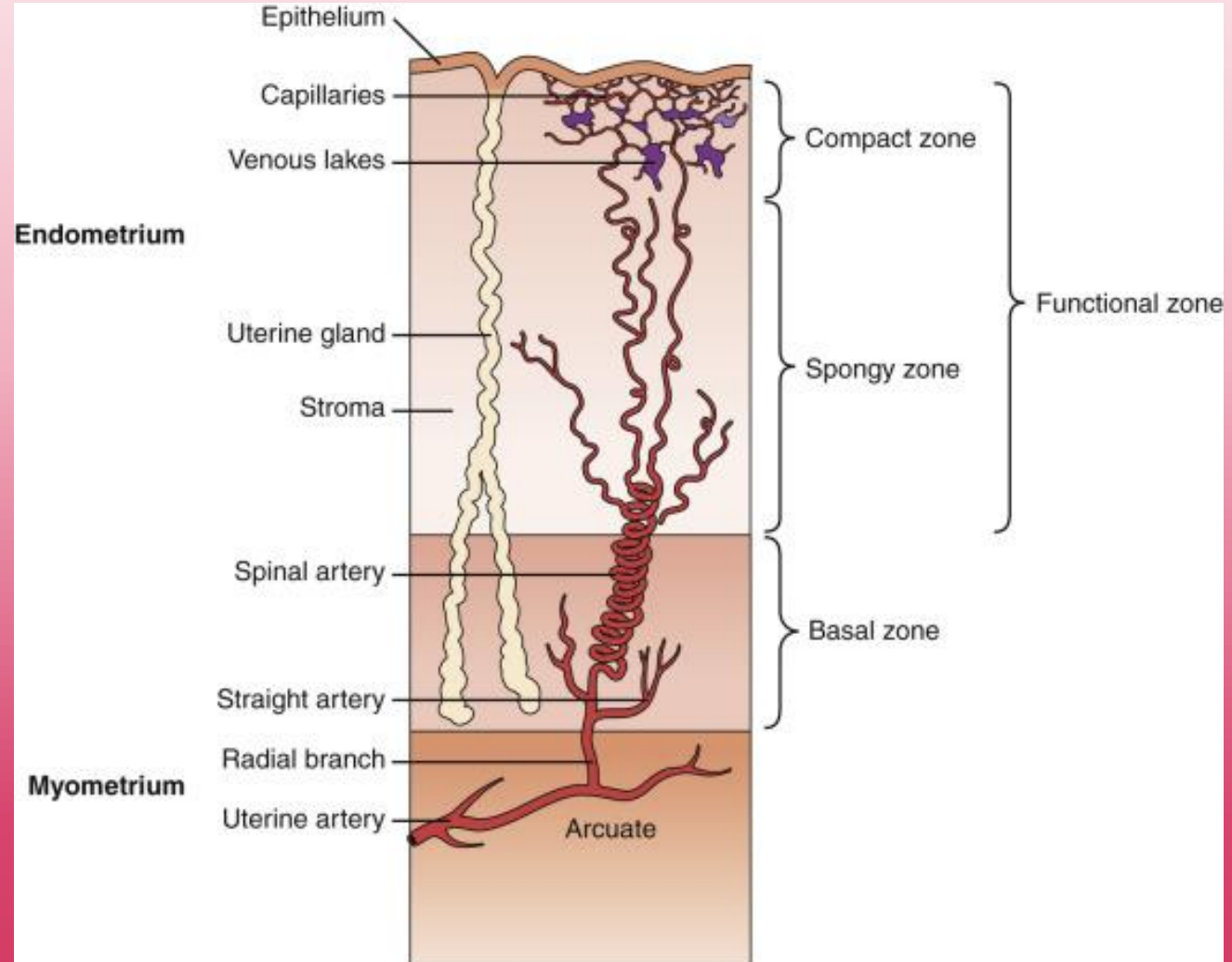
- Basal (20%)-get the nutrition from straight arteries
- Functional (80%) – get the nutrition from spiral arteries

Lamina propria– loose connective tissue, decidual cells

2. Myometrium- middle- smooth muscle tissue:

1. *Inner – submucosal* – fibers oriented parallel to the long axes
2. *Middle - vascular* – oriented circular (numerous blood and lymphatic vessels)
3. *Outer - supravascular* - oriented parallel to the long axes

3. Perimetrium – loose connective tissue covered by mesothelium.



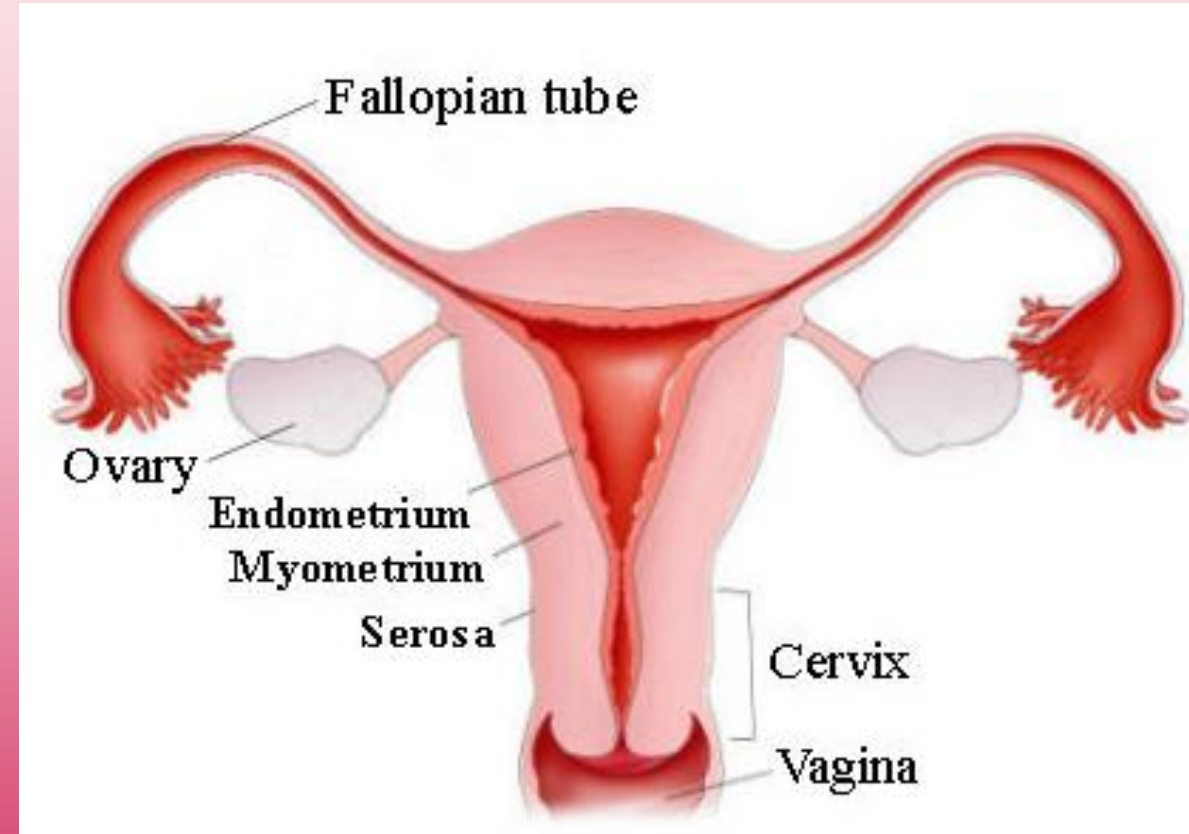
The cervix uteri

1. **Internal layer** - The cervix is covered by simple columnar epithelium, that secretes mucous. The vaginal part (ectocervix) is covered by stratified squamos epithelium.

The mucosa forms folds and longitudinal crests. Contains branched mucous-secreting glands.

2. **Middle layer** – circular layer of smooth muscle cells.

3. **External layer** is surrounded by parametrium.



Ovarian-menstrual cycle

cyclic changes of the functional layer of endometrium under the impact of progesterone and estrogen

1. Menstrual period (1-3 days) – desquamation of the functional layer of endometrium due to contraction of the spiral arteries

2. Postmenstrual period

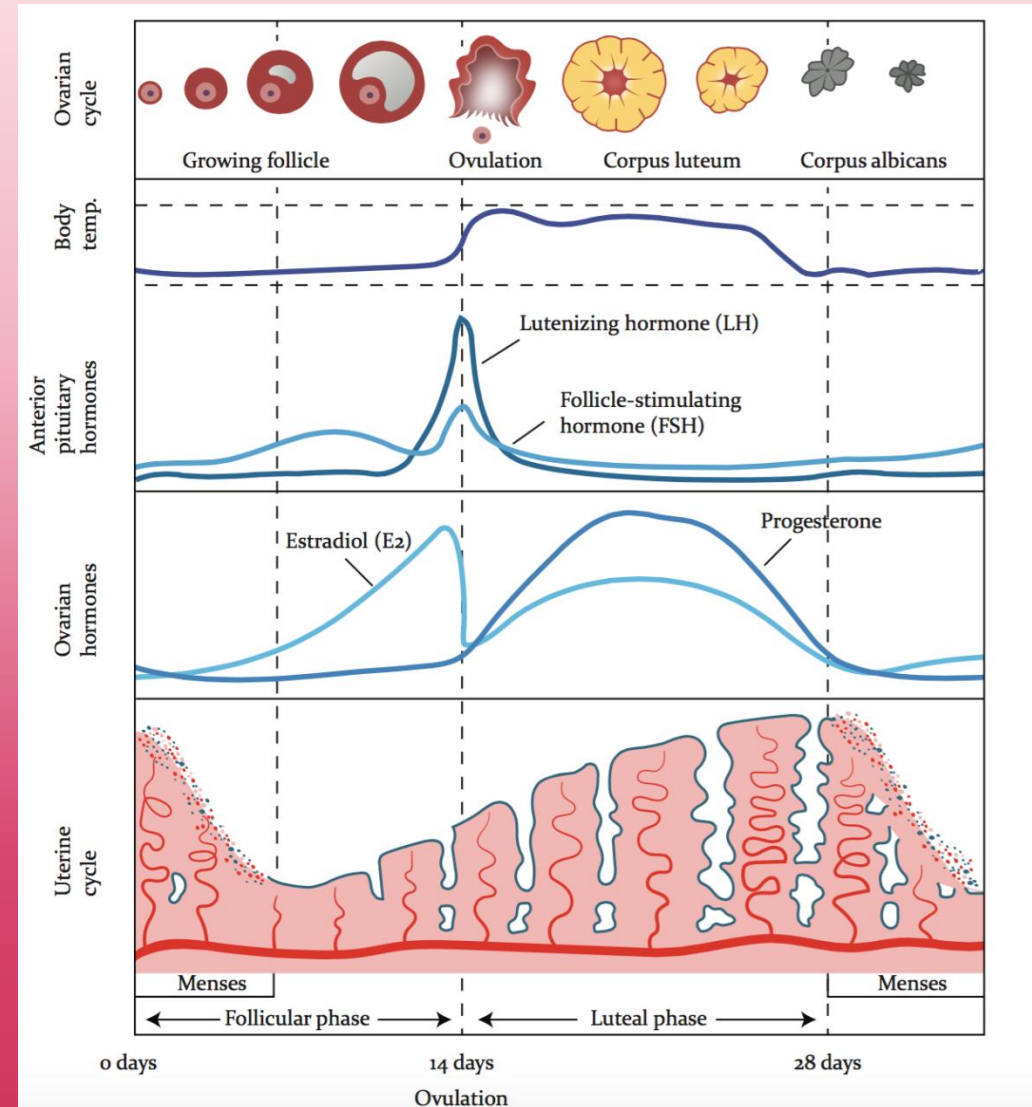
- Regenerative phase (3-5 days) – growth of follicles and production of estrogen by them. Estrogen provides the regeneration of the desquamative functional layer

- Proliferative phase (5-11 days) – hypertrophy of cells. Endometrium becomes thicker in 2-3 times

- Rest phase (11-14 days) – endometrium is completely reestablished

3. Premenstrual period (15-28 days). LG initiate

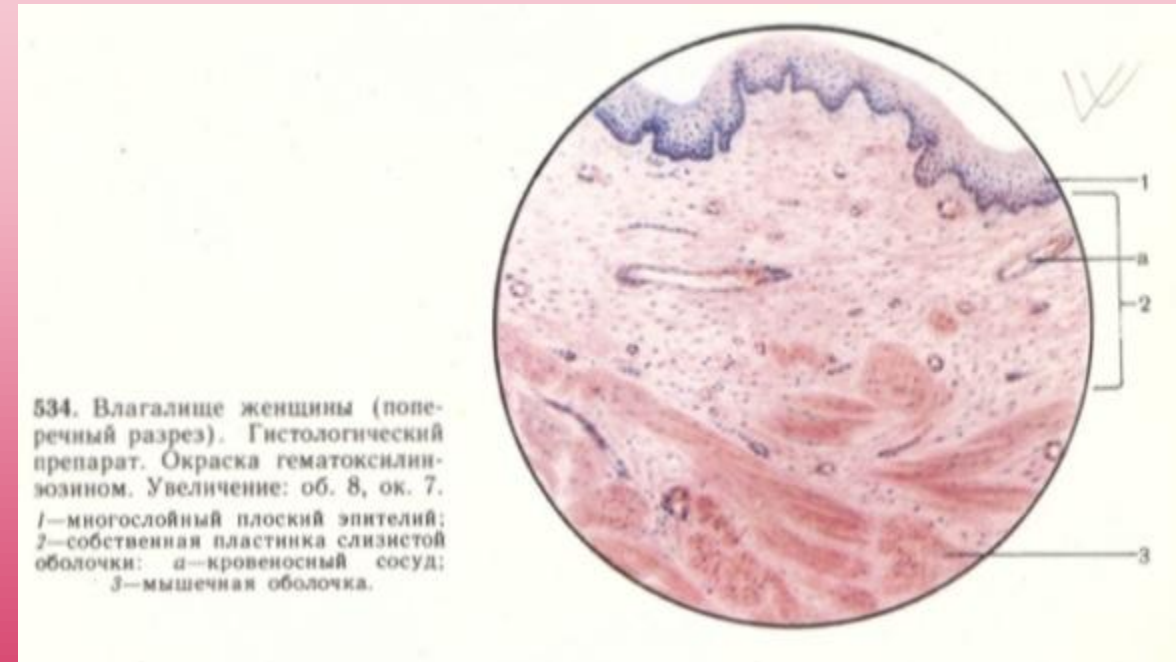
- Edema of endometrium
- Enlarging of the uterine glands and their lumene is filled by secretory products
- Enlarging of mammary glands
- Appearing of the predecidual cells
- In the functional layer appears compact zone and spongy zone.



Vagina- fibromuscular tube

Layers:

- *mucosa* – stratified squamous non-keratinized epithelium (basal, transitional, functional), lamina proper
- *muscular* - bundles of smooth muscle cells
- *adventitia* – loose connective tissue



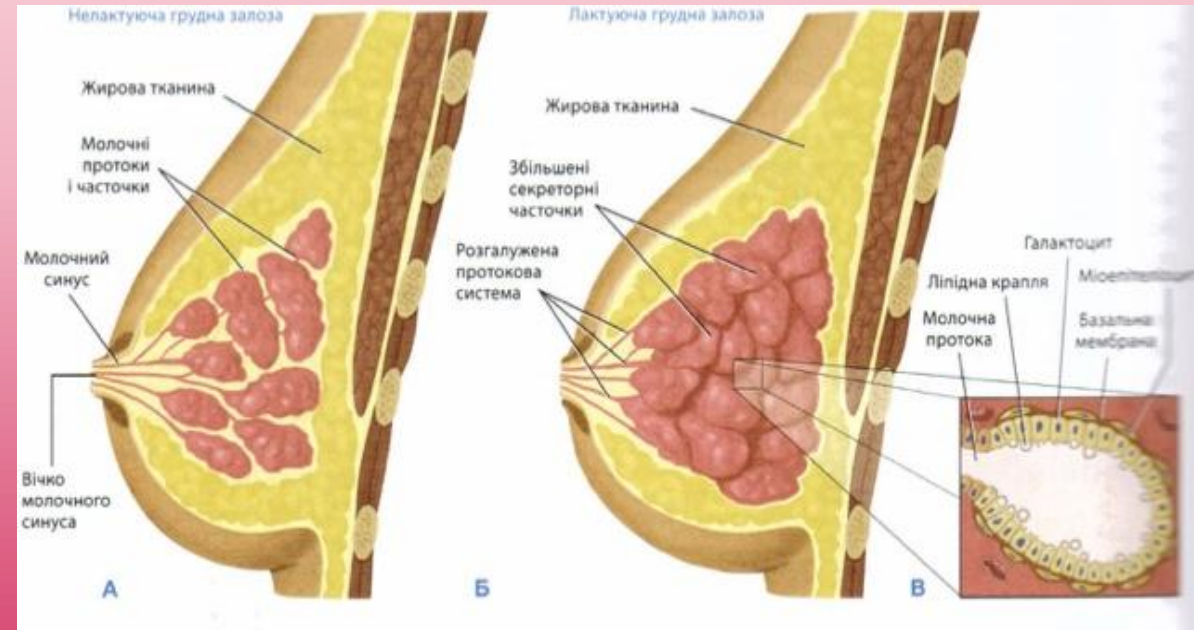
External genitalia

- 1. Labia majora-** covered with hair, a large number of sebaceous and sweat glands, venous plexuses.
- 2. Vestibule** – stratified squamous non-keratinized epithelium with (Bartholin's) glands in the lateral wall, they are alveolar-tubular. Produce a transparent lubricating mucous of the alkaline reaction.
- 3. Labia minor-** hairless folds of the skin with numerous elastic fibers, blood vessels and sebaceous glands
- 4. The clitoris** - erectile structure. The body composed of two small erectile bodies, the corpora cavernosa.

Mammary glands

Consist of:

- *stroma* – connective tissue
- *parenchyme* – alveolar secretory portions and a branched system of excretory ducts.
- Secretory portions have lactocytes (single-layer cubic epithelium) and myoepithelial cells.
- The mammary ducts are a single layer of cuboidal or columnar epithelium and myoepithelial cells.
- The mammary sinuses are stratified squamous epithelium.



Mammary glands

Non-lactating mammary gland



Lactating mammary gland

