

# Female reproductive system

**Female reproductive system** (*organa genitalia feminina*) consists of paired organs ovaries (**ovaria**) a fallopian tubes (**uterine tube**), uterus (**uterus**), vagina (**vagina**) and external genitalia.

The fallopian tubes, the uterus attached to them and the vagina connected to them, create a cavity system that leads to the outside of the body. The fallopian tubes, which widen at the end like a funnel, communicate with the abdominal cavity and are connected to the ovaries. Eggs mature in the ovary during sexual maturity, and after subsequent ovulation are released into the fallopian tube, where fertilization can occur. The ovary also produces most of the female sex hormones that affect the menstrual and ovarian cycles, and in turn participate in the secretion of gonadotropic hormones from the pituitary gland. The uterus is used to nestle the fertilized egg, where it travels through the fallopian tube from the ovary.

## Ovary

The ovary has a flattened, ovoid shape, weight: 6–10 g.

In the hilum, the mesovarium is connected to the lig. latum uteri, the surface is covered by a **single-layered flat to cubic "germinal" epithelium**, in the hilum it passes into the **mesothelium**. The germinal epithelium contains microvilli, sometimes **kinocilia**, numerous **pinocytotic vesicles** are present apically, and **mitochondria** are found basally. In the hilum is the entry of bundles of smooth muscle cells from the mesovary. Interstitial hilar cells have the character of steroid-**androgen**-producing cells (large GER, GK, many tubular-type mitochondria, lipid inclusions, Reineke's crystalloids). Beneath the epithelium is the **tunica albuginea**, which has a whitish color and is made up of dense collagen fibers.

Ovarian hyperplasia leads to **virilization**.

We distinguish **cortex** (zona corticalis) and **medulla** (zona medularis, zona vasculosa).

### Cortex

The cortex of the ovary consists of **sparse collagen tissue**, ovarian follicles, fibroblasts, rare smooth muscle cells, a network of collagen and reticular fibers. It also contains special *fibroblasts* that have fat droplets and react with hormones to change from protein-producing cells to *steroid*-producing cells (**thecal cells**).

During the fertile period, many fibroblasts are present, after menopause they decrease (reticular and collagen fibers increase relatively).

### Medulla

The pulp is formed by a **denser collagenous tissue**. It contains fewer cells, more *collagen and reticular fibers*. It is richly vascularized and innervated.

## Fallopian tube

The fallopian tube is a movable muscular tube measuring 6-8 × 100-150 mm, connecting the uterus to the abdominal cavity. It creates a suitable environment for fertilization of the egg (cilia oscillating in the opposite direction). The secretion of the glands contributes to the nutrition of the **oocyte**. At the time of ovulation, the fimbriae get closer to the ovary, this triggers the mechanism of **blood vessel congestion** and the fallopian tube becomes more rigid.

Its main function is to transport the oocyte to the uterus using cilia and smooth muscle peristalsis.

The fallopian tube has 4 parts:

- **pars uterina** (developed t. muscularis),
- **isthmus**,
- **ampulla**,
- **infundibulum** (numerous cilia) with fimbriae.

### Tunica mucosa

It contains long, segmented, **longitudinally arranged cilia**, which are highest in the ampullary region and decrease towards the uterus. Algae anastomose with each other and form a complex labyrinth.

We divide algae into:

- secondary,
- tertiary.

**Lamina epithelialis** is lined by a single-layered columnar epithelium, which contains ciliated and secretory cells.

**Ciliary cells** are very numerous in the infundibulum. They contain **glycogen granules**, **ciliary apparatus** and **kinocilia** oscillating towards the uterus. Their nuclei are large **oval**, GER and GK, on the other hand, are small, numerous mitochondria are gathered around the **basal bodies**, lysosomes are rarely found here. **Secretory cells** only have microvilli apically. In the cytoplasm, there is a very developed GER, a large GK and an **electron-dense serous large secretory granule**.

The **lamina propria mucosae** is made up of sparse collagenous tissue.

### Tunica muscularis

The tunic muscularis **gets thinner** towards the infundibulum. It contains two layers of smooth muscle cells:

- inner circular,
- external longitudinal.

### Tunica serosa

The tunica serosa consists of **sparse collagenous tissue** with a single-layer flat mesothelium. It is richly supplied with blood vessels.

## Uterus

The uterus consists of 4 parts:

- corpus
- fund,
- isthmus,
- cervix.

## Corpus et fundus uteri

## Tunica mucosa (endometrium)

**Lamina epithelialis** consists of a single-layered cylindrical epithelium with ciliated cells.

**Lamina propria mucosae** contains a special collagen fiber with a higher number of fibroblasts. These are changed by hormonal stimulation into **decidual cells**, which serve for the initial nutrition of the fetus. The intercellular mass is amorphous, has fewer fibers, where **reticular fibers** predominate. This layer is rich in **glandulae uterinae**. They are simple **tubular glands** (in myometrium and branching) formed from a 1-layered cylindrical epithelium without ciliated cells.

It has two layers:

- **The zona functionalis** is the superficial, thicker layer that is washed away. Contains rare col. ligament., dilated lymph. vessels and spiral arterioles (arteriae arcuatae),
- **The zona basalis** is located near the myometrium and is only 0.5 – 1.5 mm high. Here we find bases of glands, more bb. and a network of reticular fibers. Direct arterioles (arteriae arcuatae) run here.

## Tunica muscularis (myometrium)

The myometrium is the thickest layer with a thickness of 15 mm. It contains layers of smooth muscle cells, few collagen fibers and no elastic fibers.

It has 4 layers:

- longitudinal,
- spirals,
- spirals,
- longitudinal.

During pregnancy, it hypertrophies up to 500 mm, hyperplasia (cell division), the secretory activity of protein-secreting cells increases and collagen is formed. After pregnancy, the collagen dies off, shrinks, and is enzymatically degraded, and the tunica muscularis thus regains almost its original shape.

## Tunica serosa (perimetrium)

The main part of the perimetrium is a thin layer of **sparse collagenous tissue** and the **mesothelium** (peritoneal lining). The tunica serosa forms the spaces that separate the uterus from the abdominal cavity. Ventrally we find "excavatio vesicouterina", dorsally **excavatio rectouterina** (Douglas space), which reaches up to the vagina (fornix posterior). It passes laterally into the ligamentum latum uteri. At the edges, they form parametrial ligaments (lig. cardinale uteri, lig. vesicouterine, lig. sacrouterine), which are composed of **dense** collagenous tissue.

## Isthmus uteri

### Tunica mucosa (endometrium)

The muscle layer is 0.5 – 1 mm thick, contains short glands that produce little **mucinous** secretion. During the cycle they remain narrow, almost unchanged, the uppermost layers are washed away.

### Tunica muscularis (myometrium)

Muscle fibers are predominantly **circular** in orientation.

### Tunica serosa (perimetrium)

## Cervix uteri

It is divided into two sections:

- portion of supravaginalis,
- portion of vaginalis.

### Tunica mucosa (endometrium at portion of supravaginalis)

It contains special algae, **plicae palmatae**, which are not washed away. The secretion of the glands depends on the phase of the cycle.

**The lamina epithelialis** is lined by a single-layered columnar epithelium that produces mucus. During ovulation, the secretion is thinner so as not to prevent the penetration of sperm, on the contrary, in the secretory phase and during pregnancy, it is thicker and thus prevents infection.

**The lamina propria mucosae** contains tubular glands (*glandulae cervicales*) that branch. They are lined with a single-layered cylindrical epithelium and secrete mucus.

### Tunica mucosa (endometrium u portio vaginalis)

**The lamina epithelialis** is made up of a multilayered non-keratinizing squamous epithelium with glycogen-rich cells. We can see the transition between columnar and squamous epithelium.

**The lamina propria mucosae** extends into the epithelium through numerous papillae.

### Tunica muscularis (myometrium)

Fibrous cells predominate over muscle cells in the myometrium. Muscle fibers are oriented mainly **circularly**.

### Tunica serosa (perimetrium)

## Sheath

The vagina is a flattened hollow organ 8 cm long and 3 cm wide. The front wall is 2 cm shorter than the back, i.e. the fornix anterior is more caudal than the fornix posterior.

### Tunica mucosa

It is formed by transverse ridges (**rugae vaginales**), longitudinal ridges (**columna rugarum anterior et posterior**). The mucous membrane undergoes changes during menstrual cycle.

1. menstrual phase: maximum desquamation
2. proliferative phase: most glycogen, significant desquamation of bb; lactobacillus acidophilus splits glucose into lactic acid (disinfection)
3. secretory phase: increasing mucosa (vaginal cytology)

**Lamina epithelialis** lined by a multi-layered squamous epithelium. The cells contain glycogen granules, which cleave bacteria after desquamation, keratohyalin gran. and tonofibrils.

**Lamina propria mucosae** does not contain glands, is moistened by transudation from blood vessels and has few sensitive nerve endings. It has two layers:

- **externally** from medium-dense collagen tissue,
- **internally** of thin tissue with numerous elastic fibers, abundantly supplied thanks to thin-walled vessels, during menstruation, the number of otherwise rarely occurring lymph nodes and in general lymph cells (mainly leukocytes) that migrate to the epithelium increases.

### Tunica muscularis

It forms bundles of smooth muscle cells in two layers:

- **inner** circular
- **outer** longitudinal

### Tunica adventitia

It is made of denser collagen tissue, has numerous elastic fibers and **nerve and venous plexuses** , contains nerve ganglia.

## External genitalia

### Labia majora pudendi

**Labia majora** is made of sparse collagenous tissue, contains lobules of adipose tissue and a thin layer of smooth muscle cells called the **tunica dartos**. They are covered with skin in two layers:

- **the outer one** is thicker, hairy, contains sebaceous and sweat glands, eccrine and apocrine,
- **the inner one** is thinner with sebaceous and sweat glands.

### Labia minora pudendi

**Labia minora** are made of thin collagen fibers, elastic fibers, and contain sebaceous and sweat glands.

### Clitoris

It includes two small erectile bodies that end in the **glans clitoridis**. The clitoris is formed by a multi-layered squamous keratinized epithelium.

### Greater vestibular glands (Bartholini)

They are the same glands as the bulbourethral glands in males. They have an ovoid shape, measure 1-2 cm. The type is tuboalveolar glands, which contain mucinous cells. It opens into the *vestibulum vaginae*.

### Smaller vestibular glands

They are **mucinous glands** that open into the *vestibulum vaginae* around the urethra.

## Links

### Related articles

- Menstrual cycle
- Cyclical changes in the female body
- Gametogenesis
- Hyperplastic endometrium (preparate)

### External links

- [https://cs.wikipedia.org/wiki/Pohlavn%C3%AD\\_soustava](https://cs.wikipedia.org/wiki/Pohlavn%C3%AD_soustava)

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