Histology of Female Reproductive System
Female genital system

- Internal reproductive organs
  - paired ovaries
  - oviducts,
  - Uterus
  - vagina
- External genitalia (vulva)
  - Mons pubis
  - Labia majora
  - Labia minora
  - Vestibule
  - clitoris
Ovaries

- Surface epithelium covering the ovaries is called the **germinal epithelium** (simple squamous low cuboidal epith), is a modified peritoneum.
- Directly beneath this epithelium is the **tunica albuginea**, the connective tissue capsule whose collagen fibers are oriented parallel to the ovary surface.
- Each ovary is subdivided into the highly cellular **cortex** and a **medulla**.
- **Ovarian cortex** is composed of a connective tissue framework, the **stroma**, housing fibroblast-like **stromal cells**, **ovarian follicles** in various stages of development.
- **Medulla** contains interstitial cells, large blood vessels, lymph vessels, and nerve fibers embedded in a connective tissue stroma.
Ovaries

- Ovarian follicles
- Medullary region
- Cortical region
Uterine (Fallopian) tubes

- İnfundibulum with fimbria,
- ampulla,
- isthmus,
- uterine (intramural) part
Uterine (Fallopian) tube wall is composed of three layers:

- **Serosa (or peritoneum):** outermost layer composing of mesothelium and a thin layer of connective tissue

- **Muscularis:** throughout most of its length is made of an inner, relatively thick circular and an outer thinner longitudinal layer. The boundary between these layers is often indistinct

- **Mucosa:** inner lining consisting of thin longitudinal folds that project into the lumen of the uterine tube. Folds are most numerous and complete in ampulla, become smaller in isthmus. Epith is simple columnar composing of ciliated and nonciliated (peg) cells.
Uterus

- body,
- fundus,
- cervix.

- The uterine wall of the body and the fundus is composed of
  - endometrium
  - myometrium
  - adventitia or serosa.
Endometrium

- Mucosal lining of the uterus,
- is composed of a simple columnar epithelium and a lamina propria.
- Epithelium is composed of nonciliated secretory columnar cells and ciliated cells,
- Lamina propria houses simple branched tubular glands that extend as far as the myometrium
- Morphological/physiological alterations in the endometrium during the phases of the menstrual cycle are controlled by hormones.
Endometrium

- Consists of two layers,
  - the **E. functionalis**, a thick, superficial layer that is sloughed at menstruation
  - the **E. basalis**, a deep, narrow layer whose glands and connective tissue elements proliferate and regenerate the functionalis during each menstrual cycle.

- E.functionalis is vascularized by numerous **coiled helical** arteries that supply the glands and connective tissue.

- The **straight arteries** are much shorter and supply only the E. basalis.
Myometrium-serosa

- **Myometrium** is composed of inner longitudinal, middle circular, and outer longitudinal layers of smooth muscle.
- Much of the anterior portion of the uterus is covered by **adventitia**, 
- Fundus and posterior portion of the body are covered by a **serosa**.
Cervix

- Endometrium of the cervix is different from the rest of uterus
- Mucosa measures 2-3 mm thick; contains large branched glands, lacks spiral arteries
- Mucosa undergoes little change in thickness during menstrual cycle, is not sloughed during menstruation.
- Cervical glands undergo functional changes related to the transport of the spermatozoa
- Amount and properties of the mucus secreted by the gland cells vary during the menstrual cycle.
- At midcycle the amount of mucus increases 10-fold.
- Blockage of openings of mucosal glands results in the formation of nabothian cysts.
• The transformation zone is the site of transition between vaginal stratified squamous epith and cervical simple columnar epithelium.
Vagina

- Hymen consists of folds of mucous membrane extending into the vaginal lumen
Vagina

Vaginal wall consists of

**Inner mucosal layer:**
- with numerous transverse folds or rugae and is lined by **startified squamous nonkeratinized epithelium**.
- CT papillae from the underlying lamina propria project into the epithelium, lacking glands. LP has two regions: outer cellular loose CT and deeper dense CT that may be considered as submucosa
- Keratohyalin granules may be present in the epithelial cells, but keratinization does not occur
Vagina

Intermediate muscular layer
- An outer longitudinal and inner circular smooth muscle layer
- The outer sm layer is continuous with corresponding layer in the uterus
- Striated muscle fibers of the bulbospongiosus muscle are present at the vaginal opening

Outer adventitial layer
- organized into inner dense connective tissue layer adjacent to the muscularis
- and an outer loose connective tissue
External genitalia (vulva)

- Mons pubis
- Labia majora
- Labia minora
- Vestibule
- Clitoris
Mons pubis and Labia majora

- Is the rounded prominence over the pubic symphysis
- Formed by subcutaneous adipose tissue
- Covered with pubic hair

- 2 folds of skin heavily endowed with adipose tissue and a thin layer of smooth muscle; extending from mons pubis
- Homologue to scrotum
- Smooth muscle corresponds to dartos muscle of the scrotum
- Outer surface covered by pubic hair; devoid of hair on the inner surface
- Numerous sweat and sebaceous glands open on both surfaces
Labia majora
Labia minora and Clitoris

- Paired hairless folds of skin bordering the vestibule
- Homologous to the skin of the penis
- Deep epithelial cells have abundant melanin pigment
- The core of CT within each fold is devoid of fat
- CT contains numerous blood vessels, fine elastic fibers, large sebaceous glands

- Erectile structure homologous to the penis
- Its body is composed of 2 small erectile bodies (corpora cavernosa)
- Glans clitoris is a small rounded tubercle of erectile tissue
- The skin over glans is very thin forms the prepuce of the clitoris; contains numerous sensory nerve endings
Male Reproductive System
Anatomy-Histology Correlate

“All this talk of Viagra and penile implants reminds me of a charming story about my own penis.”

By: Michael Lu, Class of 2007
- Review the contents of the **inguinal canal** and **spermatic cord**. Remember the descent of the testes during development, and the various fascial and muscular layers of the scrotum. This process is detailed below.

- Note the testicular artery and vein and the genital branch of the genitofemoral nerve entering the spermatic cord at the deep inguinal ring. The ilioinguinal nerve sends branches to the scrotum (or labia in females) through the inguinal canal, but is not part of the spermatic cord.

- The ductus deferens travels up the spermatic cord in the inguinal canal, exits from the deep inguinal ring and turns towards the prostate gland located below the bladder.
- The **testis** is covered by a dense collagenous coat called the **tunica albuginea**. Septa extend into the testis to separate the lobules. In mature testis, there is a prominent vascular layer immediately beneath the tunica albuginea.

- Most of the testis is occupied by highly coiled **seminiferous tubules**, as seen in most of the bottom panel. The blue arrows point to **Leydig cells** that secrete testosterone.
- The **seminiferous tubules** are composed of **spermatogonia** located at the base of the epithelium with large round nuclei.

- Spermatogonia give rise to **primary spermatocytes**, with larger nuclei midways up in the epithelium. The nuclei are round with distinct bundles of dense chromosomes. These cells are in extended prophase of the first meiotic division.

- The primary spermatocytes further develop into **spermatids** located higher up in the epithelium toward the lumen. The round nuclei become smaller, denser, and change shape into the heads of mature **sperm**, or spermatozoa.

- Also found within the seminiferous tubules are **Sertoli cells**, which are large, relatively pale and irregularly shaped. We can see a prominent nucleolus within the Sertoli cell nucleus. These cells primarily support and nourish the germ cells in the testis with long, apical cytoplasmic folds. They contain testosterone and FSH receptors.

- Within the loose connective tissue of the testis, among seminiferous tubules, we can see **Leydig cells**. They are indicated by the arrow in the bottom panel. These cells secrete the male steroid hormone, testosterone. There may be small capillaries found among the clusters.
As mentioned before, the **ductus (vas) deferens** runs in the spermatic cord. It has a thick smooth muscle coat (bottom left) and the mucosa is highly folded and lined with pseudostratified epithelium.

- Other contents of the spermatic cord include the **testicular artery**, the **pampiniform plexus of veins**, the **genital branch of the genitofemoral nerve**, and the **dartos** (smooth) and **cremaster** (skeletal) muscles.

- The testicular artery surrounded by the pampiniform plexus creates a counter-current heat exchange that cools the blood in the artery as it travels to the testis (bottom right). Continual healthy development of sperm
After the ductus deferens exits the deep inguinal canal, it heads superiorly towards the urinary bladder. After crossing the ureters, the **ampulla** of the ductus deferens joins the **seminal vesicle**.

- The seminal vesicle is located on the posterior side of the bladder and lateral to the ampulla of the ductus deferens. It produces seminal fluid including fructose, absorbic acid, and other components that constitute about 50-80% of semen.

- The duct of the seminal vesicle and the ductus deferens join to form the **ejaculatory duct** that runs through the prostate gland.

- The **prostate gland** is an exocrine gland located inferior to the bladder. It secretes various components of semen including citric acid and acid phosphatase as the ejaculatory duct passes through it. The opening of the ejaculatory duct is found at the **seminal colliculus**, where the contents are emptied into the prostatic portion of the urethra.

- Note the inner surface of the urinary bladder. The openings of the ureters are found at the **ureteric orifices**. In between them is the interureteric crest. Together with the opening to
- The **prostate gland** is shown to the right. The secretory glands, lined with simple columnar epithelium, differ somewhat in morphology as they move progressively from the urethra toward the gland periphery.

- The glands near the urethra tend to enlarge with age and restrict the urethra, known as benign hypertrophy. Glands near the periphery are subject to carcinomatous change.

- The glands have a characteristic folded appearance. There may also be distinct **concretions** that are

- The **seminal vesicle** is shown to the left. Once again, it is a coiled, sacculated tubular structure that is surrounded by a smooth muscle coat (bracket). Generally, this smooth muscle contains inner circular and outer longitudinal layers.

- The highly folded mucosa of the seminal vesicle is illustrated below, lined with high cuboidal to low columnar epithelium. One may also find some variable pseudostratified columnar epithelium.
- The two corpora cavernosa and single corpus spongiosum form the **erectile tissue** of the penis. Note on the top left panel the trabeculae and irregular venous spaces. During an erection, blood flow enters the erectile tissue via arteries, fill the venous spaces, and stay there due to obstructed venous outflow.

- The urethra within the corpus spongiosum, with its erectile tissue filled with blood, is shown in the bottom left.

- The urethral epithelium (bottom right) is lined with pseudostratified or stratified columnar epithelium. There is some variability.