The human female reproductive system consists of **two gonads (ovaries)**, **two uterine tubes (fallopian tubes)**, the **uterus**, the **vagina**, and the **external genitalia**. (The **mammary glands**, sometimes considered with the female reproductive organs, were studied in the integument lab). The structure of these organs undergo important modifications in the various stages of reproductive life (puberty, pregnancy, menopause), and also shows cyclic variations depending on hormonal relationships between the hypothalamus-hypophysis and ovary during the period of reproductive activity.

**OVARY**

_A. Ovary._

*Longitudinal section of a mature ovary.*
The ovary has a surface ("germinal") epithelium, comprised of cuboidal cells. This is a misnomer in that it has nothing to do with production of gametes instead it is continuous with the mesothelium of the mesovarium. The epithelium sits on a dense connective tissue capsule, the tunica albuginea. The site of entry and exit of blood vessels is termed the hilum, with the blood vessels extending into the medulla. The medullary stroma is comprised of loose fibroelastic connective tissue with some smooth muscles cells. The cortex is between the medulla and the tunica albuginia. The cortical stroma consists of whorls of densely packed fibroblast-like cells.

In the cortex, the most prominent feature are the ovarian follicles. These take several types: primordial, unilaminar primary, multilaminar primary, secondary, mature (Graafian) (see the figure above). During pregnancy, the follicle will become a corpus luteum. This is comprised of granulosa lutein cells with surrounding theca lutein cells.

UTERINE TUBE (oviduct, Fallopian tube).

The wall of the oviduct consists of highly folded mucosa, a muscularis (inner circular, outer longitudinal layers of smooth muscle and a serosal layer. The epithelial layer varies between simple columnar and pseudostratified columnar and is composed mostly of ciliated cells with some interspersed non-ciliated secretory (peg) cells. The lamina propria consists of loose fibroelastic connective tissue.

Schematic representation of a section of the fallopian (uterine) tube.

UTERUS

The uterus is an organ with three basic layers: the endometrium, myometrium and a serosa (over most of the organ). Additionally, the cervix is somewhat distinct histologically. The endometrium is covered by a single layer of tall columnar epithelium that extends down to line the tubular glands that are surrounded by endometrial stroma.
In the **proliferative stage** the glands are relatively straight and lined by an epithelium that is uniform and shows no cytoplasmic signs of secretion. Numerous mitotic figures can be seen in the glandular epithelium because it is developing rapidly. The cuboidal cells are supported by a loose connective tissue that is also considered to be part of the endometrium, mainly consisting of fibroblasts, and blood vessels. The endometrial zone adjacent to the myometrium has a greater density of cells and constitutes the **stratum basale**. This stratum is not sloughed off during menstruation and serves to regenerate the endometrium. The stroma adjacent to the myometrium contains small arteries or arterioles that extend towards the uterine lumen. These are the **spiral arteries**. The superficial stroma of the endometrium is rich in and capillaries and venous sinusoids.

The **myometrium** consists of interlacing bundles of smooth muscle cells plus blood vessels and relatively sparse collagenous tissue. There are no distinct layers of smooth muscle.

In the latter (secretory; luteal) stage of the menstrual cycle (days 14-28) the endometrial glands of the stratum functionalis become coiled, irregular in diameter, and lined by columnar cells that show signs of secretion. The columnar cells lining the glands become larger and taller. It is this functional layer that will be sloughed during menses.

The uterine mucosa during the menstrual cycle (×30).
CERVIX & VAGINA

The cervix represents a transition from the body of the uterus to the vagina. The myometrium has many more connective tissue fibers and fewer smooth muscle cells. There is nonkeratinized stratified squamous epithelium covering the vaginal portion of the cervix (“ectocervix”). The endocervix surrounds the cervical canal and is lined by simple columnar epithelium continuous with the endometrium. There are well-developed cervical mucus glands in this region. Also, there is an abrupt change of stratified squamous to simple columnar epithelium near the external os of the cervical canal, the junction between endocervix and ectocervix. This region of epithelial transition is clinically important since it is here that many carcinomas of the cervix develop.

The vaginal wall consists of three principle layers: mucosa, muscle and adventitia. The vaginal mucosa, may be thrown into folds (rugae), lined by a stratified squamous, nonkeratinizing epithelium. The thickness of the epithelium varies with the stage of the reproductive cycle. The epithelial cells are rich in glycogen (thus, the “empty” appearance of these cells in routine histological preps), which serves as a metabolic substrate for the commensal bacteria of the vagina. The epithelium is supported by a loose to moderately dense fibroelastic connective tissue stroma with abundant venous and lymphatic vessels. Note the absence of mucous glands in the vaginal wall. The muscle layer consists predominantly of smooth muscle fibers, which run in spiral-like and longitudinal fashion through the wall. Skeletal muscle fibers from the perineal musculature may also blend with the wall in the region of the vaginal introitus.
Placental villi are attached to the chorionic plate and extend into the intervillous space, surrounded by maternal blood that is entering from the decidua basalis, which is derived from maternal tissue along with placental septae.

The chorionic plate proper consists of rather dense vascular and connective tissue. In places on the fetal (non-villous) side of the plate there are amniotic cells.

The villi are initially covered by two layers, an inner one from cytotrophoblast and an outer one from syncytiotrophoblast (see the figure below). Later in pregnancy the cytotrophoblast layer is almost completely lost; only a few scattered cells or nests of cells remain in the term placenta. In these cases, the syncytiotrophoblast may be the only thing (other than a basement membrane) separating maternal blood from the endothelium of the fetal blood vessels in the core of the villi. Surrounding the blood vessels is irregular loose connective tissue. The CT within the villi contains a population of macrophages called Hofbauer cells. In addition to their customary role as part of the immune system, these cells may help to maintain villous homeostasis by affecting water regulation and nutrient/waste transport.

Mature villi are highly branched. The stem that is attached to the chorionic plate is the stem villus the branches include terminal villi and anchoring villus.

villi to this layer. Where does detachment of the placenta from the uterine wall usually occur at parturition?
Cross section of placental villus, early pregnancy
(≈ 300x)

1. CT stroma with fetal b.v. & nucleated RBCs
2. Hofbauer cell
3. Cytotrophoblast
CHECK LIST

Understand the general architecture of the ovary, uterus, cervix, uterine tube, vagina and placental villi.

OVARY: Understand the contents of the hilum, cortex and medulla. Know the cycle of maturation of follicles, including the ploidy of each stage. Know the location and secretory patterns of hormones affecting the ovary and secreted by the ovary. Identify:

- germinal epithelium
- tunica albuginea
- primordial follicle
- unilaminar primary follicle
- multilaminar primary follicle
- secondary (antral) follicle
- mature (Graafian) follicle
- corpus luteum
- corpus albicans
- granulosa lutein cells

- oocyte
- zona pellucida
- granulosa cells
- cumulus oophorus
- corona radiata
- granulosa thecal cells
- basal lamina
- theca interna
- theca externa

UTERINE TUBE: Know the anatomical segments of the uterine tube. Identify:

- mesosalpinx
- lamina propria
- ciliated cells

- muscularis layer
- columnar/pseudocolumnar epithelium
- secretory (peg) cells

UTERUS: Know the structure and function of the layers of the wall. Understand the morphology and endocrinology of the uterine (menstrual) cycle. Identify:

- myometrium
- endometrium

- stratum functionalis
- epithelium
- uterine glands

- stratum basalis
- lamina propria (stroma)
- spiral arteries

- identify the progressive changes in endometrial structures during proliferative, secretory and menstrual stages.

CERVIX AND VAGINA: Know the epithelial transition region at the endocervix/ectocervix junction. Know the three layers of the vagina. Identify:

- cervical mucous glands
- epithelial transition zone
- epithelium of vagina

- syncytiotrophoblast cells
- cytotrophoblast cells
- Hofbauer cells

PLACENTA: Describe the basalis, capsularis, parietalis, chorionic plate. Identify: