PRACTICAL ROADMAP

FEMALE REPRODUCTIVE SYSTEM

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Anatomical
Sciences
Ovary

**Primordial follicles**
- Primary oocyte
- Follicle cells

**Primary follicle**
- Primary oocyte
- Follicle cells

**Secondary follicle**
- Primary oocyte
- Coronal radiata
- Follicle cells

**Graafian follicle**
- Oocyte
- Stromal cells
- Follicular cells
- Basal lamina
- Zona pellucida forming
- Multilaminar primary follicle
- Zona pellucida granulosa cells
- Theca interna
- Antrum
- Theca externa

**Corpus albicans**
- Developing corpus luteum
- Ovulated secondary oocyte

**Corpus luteum**
- Antrum
- Corona radiata
- Zona pellucida
- Ovulated secondary oocyte

**Corpus albicans**
- Ovulated secondary oocyte

**Mature (graafian) follicle**
- Theca externa
- Theca interna
- Antrum
- Corona radiata

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• Slides 9 and 9.2
Ovary (Baboon)

NOTE: A cross section through the ovary shows two distinct regions: The peripherally situated cortex and central medulla. Cortex is richly cellular connective tissue that surrounds the ovarian follicles at the different stages of development, while medulla (not visible in either section) contains loose connective tissue with numerous blood vessels, nerves and lymphatic vessels.

An OVARIAN FOLLICLE is a roughly spheroid cellular aggregation that contains a single oocyte (immature ovum or egg cell). As they develop, ovarian follicles secrete hormones and thus influence different stages of the menstrual cycle. At the same time, under the influence of pituitary hormones, follicles grow and develop, culminating in ovulation of usually a single oocyte.

Study the development of the ovarian follicles in the following slides.
Cortex (consists of connective tissue stroma and follicles at the different stages of development)

Germinal epithelium

Tunica albuginea

Single layer of squamous follicular cells

Single layer of cuboidal follicular cells

Oocyte

Nucleus

PRIMORDIAL FOLLICLE

PRIMARY UNILAMINAR FOLLICLE
PRIMARY MULTILAMINAR FOLLICLE

- Oocyte
- Zona pellucida
- Multiple layers of follicular (granulosa) cells

SECONDARY ANTRAL FOLLICLE

- Basement membrane
- Antrum filled with follicular fluid that forms between the granulosa cells
- Theca interna
- Theca externa
MATURE GRAAFIAN FOLLICLE

NOTE: During the period of follicular maturation, the theca interna cells become steroid producing cells. Under the influence of pituitary LH hormone, these cells secrete the precursors of oestrogens (androgens) which are transported to the granulosa cells. In response to pituitary FSH hormone, androgens are converted to oestrogens, which in turn stimulate the granulosa cells to proliferate and enlarge thus increasing the size of the follicle.
NOTE: Ovulation results in the release of the secondary oocyte from the mature - graafian follicle. Subsequently, the remains of the collapsed graafian follicle undertakes reorganisation into the corpus luteum and contains the centrally located granulosa lutein cells (derived from granulosa cells), peripherally located theca lutein cells (derived from theca interna cells) and the cells of theca externa that now forms the septa of this transient endocrine organ.

This slide shows a cross section of the entire ovary with a very large corpus luteum (encircled) containing a central clot (CL). Study the granulosa lutein cells and the theca lutein cells using the two photomicrographs on the following slide.
The granulosa lutein cells contain large spherical nucleus and a large amount of cytoplasm, whereas the theca lutein cells are smaller with spherical nucleus and thus generally appear to be closer to each other in comparison to granulosa lutein cells. These two types of steroid producing cells secrete progesterone and oestrogen into the rich vascular network and in that way stimulate the growth and differentiation of the uterine endometrium in preparation for the possible implantation of the fertilized ovum.
NOTE: The uterine wall is composed of three layers (from the lumen outward): Endometrium (consists of luminal epithelium, glands, connective tissue – stroma and spiral arteries), myometrium the thick smooth muscle layer (with numerous large blood vessels and lymphatic vessels) and perimetrium the outer serous layer. We will concentrate mostly on the endometrial layer, since this layer undergoes cyclical changes each month throughout the reproductive lifespan of a female. Study the cyclical changes (phases) happening within the endometrium in the following slides. **Remember to correlate the three phases of the menstrual cycle taking place within the endometrium with the events happening simultaneously within the ovary!**
NOTE: During the proliferative phase (Day 4 to day 14 of the 28 day menstrual cycle) the endometrium is recovering after it has been slough off. Epithelial cells (from the basal parts of the glands situated in the stratum basale), reconstitute the glands and migrate to cover endometrial surface. Fibroblast looking stromal cells proliferate, spiral arteries lengthen, while simple tubular glands appear relatively straight, with narrow lumina. Observe each of these changes in the following slide.
Lumen

Endometrium

Myometrium

Stratum functionale

Stratum basale

Luminal (simple cuboidal to columnar) epithelium

Uterine (simple tubular) glands

Spiral arteries

Connective tissue - stroma, with fibroblast looking stromal cells
NOTE: During the secretory phase (Day 14 to Day 28 of the menstrual cycle) endometrium becomes edematous, glands enlarge and become corkscrew, their lumina filled with secretory products (glycogen), spiral arteries lengthen and coil, while stromal cells decidualise (become large and rounded), providing a favorable environment for possible embryo implantation. Observe each of these changes in the following slide.
Uterine glands
Spiral arteries
Decidualised stromal cells
Lumen
Luminal epithelium
Uterine glands
Decidualised stromal cells
Endometrium
Myometrium
Slide 60
Placenta

- Amnion
- Amniontotic Sac
- Chorionic plate
- Chorionic villi
- Intervillous space
- Maternal side of the placenta - Decidua basalis
- Chorionic villi
NOTE: The inlet from the first photomicrograph and the bottom photomicrograph show the anchoring villous attaching to the maternal part of placenta called decidua basalis.
NOTE: Tertiary villus surrounded with the maternal blood lake within the intervillous space. Its core is made of the mesenchymal tissue which cushions numerous foetal blood vessels. The outside layer of the villous is made of the syncytiotrophoblast cells, while the cytotrophoblast cells are relatively sparse, found immediately under the former.

NOTE: This photomicrograph shows the point of attachment of the anchoring villus (outlined in red) onto the maternal part of placenta (decidua basalis). Large decidualised stromal cells are easily identified (arrows) and maternal spiral arteries frequently seen.
NOTE: This photomicrograph represents a section of the tertiary villous with noticeable Hofbauer cells (uterine macrophages).
Slide 122
Non lactating mammary gland

NOTE: The inactive non lactating mammary gland is composed of 15-25 secretory lobes, embedded in adipose tissue. This gland is a modified sweat gland where each lobe represents a compound tubular alveolar gland. The alveoli empties into ducts lined by cuboidal or low columnar epithelial cells and surrounded by myoepithelial cells. The ducts from each lobule empty into a lactiferous duct that empties onto the surface of the nipple. These ducts are surrounded by smooth muscle in the region of the nipple which assists with the erection of the nipple. Abundant adipose tissue is present within the dense irregular connective tissue of the interlobular spaces.
NOTE: The mammary glands undergo dramatic proliferation and development during pregnancy. The changes in the glandular tissue of the lobes are characterised by a decrease in the connective as well as adipose tissue. The ducts branch and alveoli develop. In the later stages of pregnancy, there is a hypertrophy of the secretory cells and accumulation of the secretory product in the alveoli. The secretory cells produce two distinct products that are released by merocrine (protein component) and apocrine (fatty or lipid component of the milk) mode of secretion.