

LABORATORY 27 - FEMALE REPRODUCTIVE SYSTEM - OVARY (first of three laboratory sessions)

OBJECTIVES: **LIGHT MICROSCOPY:** Recognize the overall structure of the ovary, germinal epithelium, tunica albuginea, cortex and medulla. Distinguish follicles and their components and cell types involved in different stages of development including theca interna and externa, granulosa, cumulus oophorus, oocyte, zona pellucida and corona radiata. Identify the various appearances of atretic follicles. Observe interstitial glands. Recognize corpus luteum and corpus albicans.

ELECTRON MICROSCOPY: Recognize follicles and their components.

ASSIGNMENT FOR TODAY'S LABORATORY

GLASS SLIDES

[SL 136](#) Ovary - cat

[SL 137](#) Ovary - monkey

[SL 13](#) Ovary - human, fetal

[SL 129](#) Ovary - human, mature

[SL 130](#) Ovary - human, mature

[SL 131](#) Ovary - human, 5 months pregnancy

[SL 132](#) Ovary - human, post-menopausal

POSTED ELECTRON MICROGRAPH

S-108 Ovum

[Lab 27 Posted EMs](#)

HISTOLOGY IMAGE REVIEW - available on computers in HSL

Chapter 17, Female Reproductive System, Ovary

Frames: 1125-1143

SUPPLEMENTARY ELECTRON MICROGRAPHS

Rhodin, J. A.G., [An Atlas of Histology](#)

Copies of this text are on reserve in the HSL.

Female reproductive system – ovary pp. 402 - 408

OVARY: FOLLICULAR DEVELOPMENT AND CORPUS LUTEUM

A. **OVARY - CAT.** [SL 136 \(scan\)](#). H & E (J. 22-2 to 22-8; W. 19.3 to 19.6). Observation of this section of cat ovary will familiarize you with excellent examples of the different stages of follicle maturation prior to finding similar follicles in the sections of human. Other regions of the ovary will be considered when examining the later slides.

1. In the periphery of the cortex, note [primordial follicles](#) (oocyte surrounded by flattened follicle cells) and an occasional [primary follicle \(primordial, blue arrows; primary, red arrows\)](#) (follicle cells have a cuboidal shape and may be organized into multiple layers).
2. Deeper in the cortex and into the medulla identify several stages of development of growing and [secondary \(antral\) follicles \(antrum, red arrow\)](#). In the largest of the secondary follicles, observe the following: theca interna (green arrow), granulosa, cumulus oophorus (red arrow), corona radiata (blue arrow), zona pellucida (black arrow) and oocyte ([late secondary follicle](#); - [arrows indicate structures](#)). In some slides, a Graafian follicle ([low](#), [med](#)) may be present.
3. In this same slide note that the stroma of the cortex that is composed primarily of spindle-shaped cells. The small clusters of light-staining ovoid cells interspersed within the stroma are composed of cells of the "[interstitial glands](#)" ([1](#), [2](#), [blue circle](#)). These cells are derived primarily from the theca interna of atretic (degenerated) follicles and persist for a prolonged period in the cortex. The prominence of these cells (interstitial glands) is peculiar to several animals including the cat. They are less evident in sections of human ovaries.
4. Scattered wavy [eosinophilic bands](#) in clear spaces represent remnants of the zona pellucida of atretic follicles.
5. Blood vessels engorged with red blood cells may be evident throughout the section.

B. **OVARY - MONKEY.** [SL 137 \(scan\)](#) - plastic thin section stained with H & E.

1. The main purpose of this slide is to show secondary follicles in early stages of atresia (J. 22-3 to 22-12; W. 19.10). Additionally, this section also shows other characteristics of the ovary as well. On the surface of the organ observe the simple cuboidal epithelium that surrounds the structure and varies in height. Although the epithelium is not related to the forming of oocytes, it is called the germinal epithelium. Find the cortex, the outer dense layer of which is referred to as the tunica albuginea. Distinguish the region of the medulla that contains many blood vessels and find the mesovarium that anchors the ovary in place. In the cortex, locate large secondary follicles. One or more secondary follicles will show signs of atresia as indicated by granulosa cells in various stages of degeneration, i.e., cytoplasmic vacuolization, pyknosis or karyorrhexis of the nuclei (entire nucleus is dense or broken into pieces) and the presence of macrophages. There is little notable effect on the theca interna at this stage.
2. In addition, observe:
 - (a) variable numbers of [primordial blue arrows; primary, red arrow](#), [primary](#) and growing follicles. Within this thin section, scattered or clumped mitochondria are visible in the cytoplasm of the oocytes. (W. 19.4)
 - (b) spindle-shaped cells of the stroma, several late [atretic follicles \(red arrow\)](#) often with remnants of the zona pellucida still in place, blood vessels (blood cells are [highly eosinophilic](#) in this section) and the germinal epithelium.

- C. OVARY - HUMAN. Not all stages of follicular and corpora luteal development will be evident in any one of the following slides. These sections do contain good examples of atretic follicles, corpora lutea and corpora albicantia. In addition to the images in the VLM, your text and atlas have illustrations that may be matched to many of the structures that you will observe:

Corpus Luteum (J. 22-13, 22-14; W. 19.8)

Atretic follicles and glassy membranes (J. 22-12; W. 19.10)

Corpora albicantia (W. 19.11)

1. LATE FETAL OVARY. [SL 13](#) ([scan](#)).
 - a. Cortex. Note surface "germinal" epithelium, primordial and primary follicles (some atretic), and cellular connective tissue stroma.
 - b. Medulla. Note relative extent and contents of medulla as compared to cortex.
 - c. Mesovarium continuous with medulla. Some sections may include uterine tube (oviduct).
2. MATURE OVARY. [SL 129](#) and [SL 130](#).

These slides contain good examples of corpora lutea ([1](#), [2](#)) remains of advanced atresia of large follicles (some of which may have prominent thickened basement membranes ([blue arrows](#)) that are called "glassy membranes") and corpora albicantia (early). You may see, also, normal secondary follicles (most without cumulus oophorus) and large secondary follicles in early atresia. Some slides may have follicular cysts, cavities with little structure other than a thin fibrous connective tissue wall. Note the large amount of connective tissue and the paucity of primordial follicles.

3. OVARY OF PREGNANCY; 5 months [SL 131](#).

This section consists primarily of a large corpus luteum that is visible grossly. Note any other structures present.

4. OVARY, POST-MENOPAUSE. [SL 132](#) ([scan](#)).

This section shows a virtual absence of follicles, ova and functioning corpora lutea. Scars of corpora albicans are evident and remnants of atretic follicles appear as elongated, wavy, eosinophilic structures, called corpora fibrosa (red arrows). The ovary has a prominent medulla and many blood vessels are present.

REVIEW

1. Histologically, what differentiates a primary from a primordial follicle? a primary from a secondary follicle? a corpus luteum from a corpus albicans?
2. What histological changes occur in atresia of small and large follicles?
3. In a secondary follicle, which cells are involved in forming estrogen?
4. What cells form the corpus luteum? What is their role in the formation of hormone?

OBJECTIVES FOR LABORATORY 27: FEMALE REPRODUCTIVE SYSTEM - OVARY

1. Using the light microscope or digital slides, identify:

- Regions and structures
 - Cortex
 - Medulla
 - Germinal epithelium
 - Tunica albuginea
 - Mesovarium
- Cell types and extracellular structures
 - Oocyte
 - Zona pellucida
 - Follicular cells
 - Granulosa cells
 - Cumulus oophorus
 - Corona radiata
 - Theca interna
 - Theca externa
- Follicles
 - Primordial follicle
 - Primary follicle
 - Secondary follicle
 - Antrum
 - Tertiary (Graafian) follicle
- Corpora
 - Corpus luteum
 - Granulosa luteal cells
 - Theca luteal cells
 - Corpus albicans
- Interstitial glands
- Atretic follicles
 - Eosinophilic bands
 - Glass membranes
 - Corpora fibrosa

2. On electron micrographs, identify:

- Oocyte
- Zona pellucida
- Granulosa cells
- Basement membrane
- Theca interna cells