Female Reproductive Anatomy:

Structure	Definition	Function
Germinal Epithelium	Surface epithelium covering the tunica albuginea, continuous with peritoneal lining	- Does NOT produce germ cells - Breaks at ovulation
Tunica Albuginea	Dense connective tissue layers	Provides structure to the ovary
Cortex	Outer inside portion of the ovary	Contains germ cells, oocyte population, follicles, CL
Medulla	Central part of the ovary	Contains connective tissue, houses blood and lymphatic vessels as well as nerves
Hilus	Where vessels, nerves, and ducts enter an organ	---

What's the difference between the mare's ovary and any other species' ovary?

Regular:

- Ovulation can occur at any point of the cortex layer
- CL can be palpated
- Cortex= outer layer, medulla= inner layer

Mare:

- Ovulation can ONLY occur at the ovulation fossa
- CL cannot be palpated
- Cortex= inner layer, medulla= outer layer

What is the difference in cervical mucus under estrogen and progesterone?

Estrogen- thin and watery, SIALOMUCIN "privileged pathway"

Progesterone- thick and viscous, SULFOMUCIN

Lumen	Inner open cavity of tubular organ
Mucosa	Epithelium (continuous with the lumen) - Layer of loose CT - Band of smooth muscle - No blood supply
Submucosa	- Consists of moderately dense CT - Contains blood lymph and nerves
Circular Smooth Muscle	Contraction results in constriction of lumen
Longitudinal Smooth Muscle	Contraction results in the shortening of tube and propels contents - peristalsis
Serosa	- Thin layer of cells enclosing body cavities - Prevents adhesions

What are the three areas of the broad ligament and what do they do?

- Mesovarium: supports ovaries
- Mesosalpinx: supports oviducts
- Mesometrium: supports uterus

Ovarian Follicles:

Primordial Follicle	- Primary oocyte surrounded by a single layer of squamous cells - Immature and smallest follicle in ovarian cortex
Primary Follicle	- Primary oocyte surrounded by a single layer of cuboidal cells - Stage of majority of follicles
Secondary Follicle	- Primary oocyte surrounded by several layers of cuboidal cells - No antrum - Zona Pellucida present
Tertiary/Graafian/ Antral Follicle	- Primary oocyte present - Differentiation of several distinct cell layers - Antrum present - Actively secreting hormones

Estrous Cycle:

Types of Estrous Cyclicity	Definition	Species
Polyestrus	Female displays estrous cycles uniformly distributed throughout the year without any seasonal influence	Cow, sow, queen
Seasonally Polyestrus	A period of anestrus induced by length of day	- Mare(long days) - ewe(short days)
Monoestrus	Female displays only one period of sexual receptivity	Bitch
Anestrus	When a female does not display estrus (standing heat)	(pregnancy, poor nutrition, lactation)

What are the different phases of the estrous cycle?

Follicular Phase: 20% of the cycle

Luteal Phase: 80% of the cycle

What causes ovulation?

LH surge

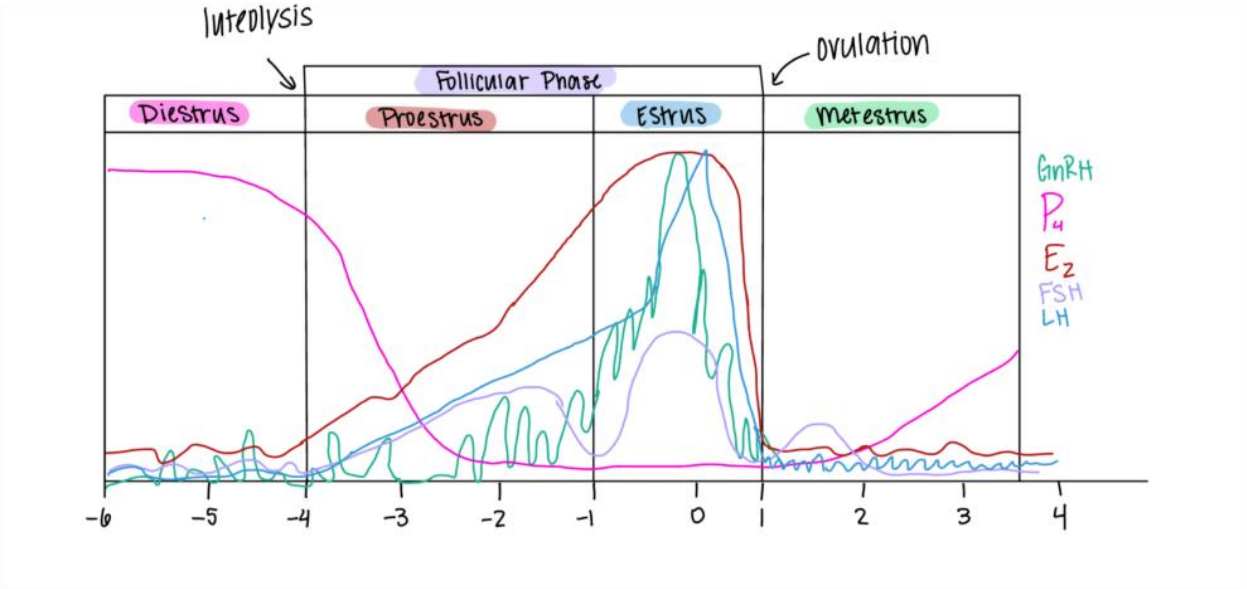
What is Luteolysis?

Destruction of the CL

How are the menstrual and estrous cycles the same? What are the differences between the two cycles?

- Menstrual Cycle
    - 50% Luteal Phase
    - 50% Follicular Phase
    - Endometrial sloughing
- Estrous Cycle
    - 20% Follicular Phase
    - 80% Luteal Phase
- They are both reproductive cycles containing follicular phase and luteal phase controlled by hormones.

What is the hormonal pattern of the estrous cycle?



Follicular Phase:

What are the major events of the follicular phase?

- Luteolysis
- Reduction in progesterone
- GnRH released at higher amplitudes and frequencies
- FSH and LH at higher concentrations
- Promotes follicular development
- Production of estrogen
- Preovulatory surge of LH

What are the two stages that comprise the follicular phase?

Proestrus & Estrus

What is the dominant structure and hormone of the Follicular Phase?

Follicle & Estrogen

What are the 5 events of folliculogenesis?

Primordial-

1. Initiation and progression of pre-antral follicles
    a. Development of primordial follicles

All tertiary follicles-

2. Recruitment of small antral follicles
3. Selection of growing cohort of recruited antral follicles
4. Dominance of 1 or more follicles
5. Follicular atresia occurring continuously throughout folliculogenesis

What's the difference between pre-antral follicle growth and antral follicle growth?

Pre-Antral Follicle Growth:

- Continuous process
- Gonadotropin independent
- Growth factors produced by the granulosa cells and oocyte have a proactive role in development
- Bulk of follicle's life is spent in the pre-antral stage

Antral Follicle Growth:

- Gonadotropin dependent
- Antral follicles develop in response to tonic levels of FSH and LH released from the Anterior Pituitary

What is the 2-cell/2-gonadotropin model?

- LH & FSH are released from the anterior pituitary and travel through the blood to the ovarian follicle
- **This is necessary for ovulation**

THECA INTERNA

1. LH binds to receptor on theca interna cell
2. CAMP activates PKA
3. Cholesterol -> testosterone

GRANULOSA

1. FSH binds to receptor on granulosa cell (needed for testosterone to enter)
2. CAMP activates PKA which then activates Aromatase
3. Testosterone crosses basement membrane
4. Aromatase converts Testosterone -> estrogen

What are the follicular dynamics of antral follicles?

- Recruitment
    - FSH is increased prompting antral follicle growth
    - Gonadotropin dependent

- Selection
    - 1st to acquire LH receptors, increased dependency on LH
        - Inhibin reduces FSH at AP level
    - Changes in hormonal profile
    - Monotocous species (non-litter bearing) have a single follicle selected
    - Polytocous species have many follicles selected
- Dominance
    - Produce increasing estrogen and inhibin
    - Increase blood flow
        - Increase LH received
    - Granulosa cells acquire LH receptor and shifts from E2 production to P4 production right before ovulation
- Atresia
    - All follicles that are unable to survive each dynamic undergo atresia

Luteal Phase:

What are the two stages that comprise the luteal phase?

Metestrus & Diestrus

What is the dominant structure and hormone of the Luteal Phase?

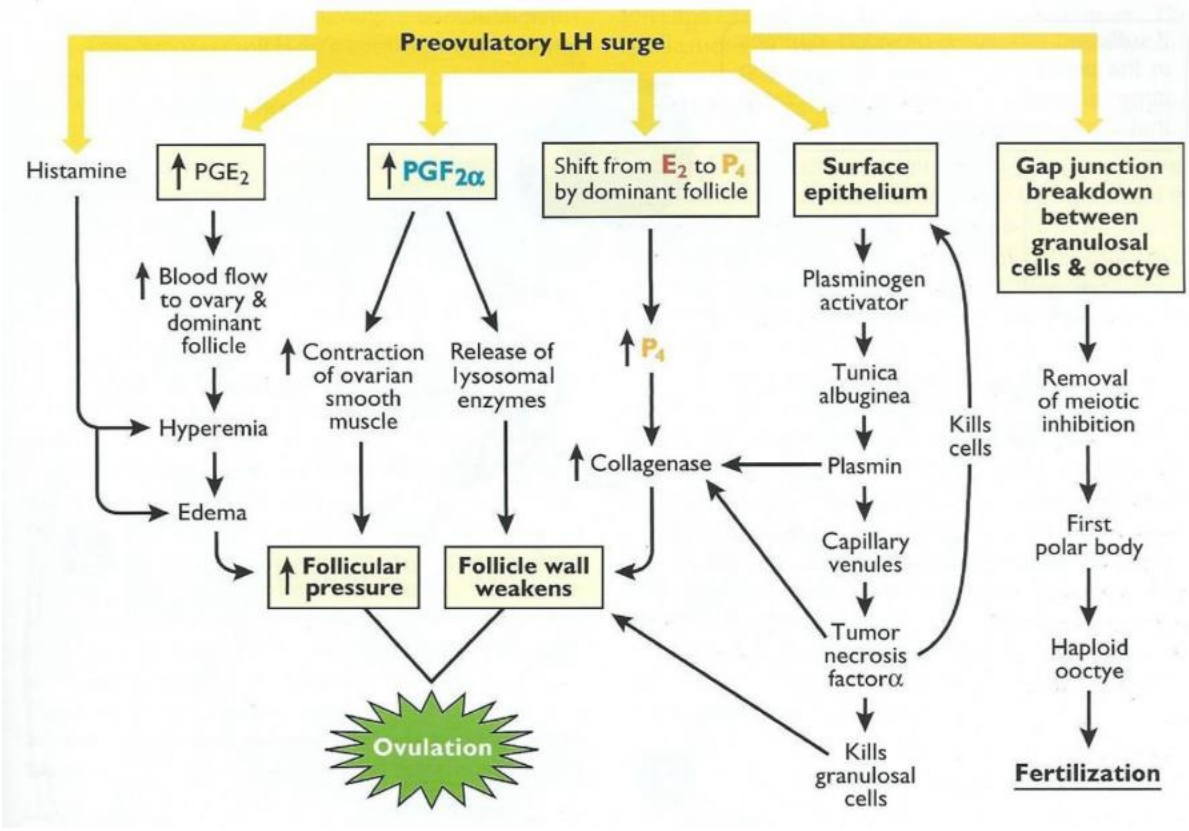
CL & progesterone

Explain the difference between small and large luteal cells:

Type of Luteal Cell	**Original Cells**	**Hormones Produced**	**Receptors**	**Development**
Large Luteal Cells	Granulosa	85% of progesterone Oxytocin Relaxin	PGF2a	Hypertrophy (increase in cell size)
Small Luteal Cells	Theca cells	Progesterone	Oxytocin	Hyperplasia (increase in cell #)

What are two ways luteolysis occurs?

- Functional Luteolysis
    - Oxytocin is released from the posterior pituitary to the uterus which stimulates production of PGF2a from the uterus. PGF2a then binds to its receptor on Large Luteal Cells, and inhibits progesterone synthesis.
- Structural Luteolysis
    - Luteal cells die (apoptosis)
    - Small luteal cells die 1st, large luteal cells die 2nd, immune cells “clean up” after death of luteal cells


Preovulatory LH surge
Histamine
↑ PGE2
↑ PGF2α
Shift from E2 to P4 by dominant follicle
Surface epithelium
Gap junction breakdown between granulosal cells & ooctye
↑ Blood flow to ovary & dominant follicle
Hyperemia
Edema
↑ Contraction of ovarian smooth muscle
Release of lysosomal enzymes
↑ P4
↑ Collagenase
Plasminogen activator
Tunica albuginea
Plasmin
Capillary venules
Tumor necrosis factorα
Kills granulosal cells
Kills cells
Removal of meiotic inhibition
First polar body
Haploid ooctye
Fertilization
↑ Follicular pressure
Follicle wall weakens
Ovulation