The Luteal Phase of the Estrous and Menstrual Cycle

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- steroid synthesis
  - progesterone
  - collagenase
- theca interna

**Preovulatory Follicle**

- increases in size
  - papilla forms
- composed of cells from the granulosa and theca interna
- progesterone production increases
- a small cavity may be present where the follicular antrum was present

**Luteal Tissue**

- Large cells from granulosa
- Small cells from the theca interna
Functional Capability of CL

- the number of luteal cells
  - large cells undergo hypertrophy (3 fold)
  - small cells undergo hyperplasia (5 fold) and hypertrophy
- vascularization of CL
  - Initiated by angiogenic factors from follicle
  - Vascularity effects CL steroid synthesis and delivery of hormones
- Insufficient CL function
  - Failure to maintain pregnancy
  - Important in domestic animals
**LH receptor location**

- Small luteal cells
  - LH receptors
  - Progesterone production driven by LH
- Large luteal cells
  - Very few LH receptors
  - Progesterone production mostly independent of LH

**Luteolysis**

- Uterus
- \(\text{PGF}_{2\alpha}\)
- Oxytocin

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**Prostaglandin F2\(\alpha\) Control of Luteolysis**

Prostaglandin synthesis by uterine endometrium is released into the uterine vein. Progesterone from CL stimulates production of uterine PGF2\(\alpha\) after day 15 in cow. PGF2\(\alpha\) is picked up by ovarian artery through counter current exchange and delivered back to the ovary where it causes lysis of the CL.
Blood Supply to Uterus and Ovary in the Mare

Luteolysis

• Uterus
• PGF$_{2\alpha}$
• Oxytocin

Relationship of Oxytocin and PGF2$\alpha$
**Luteolysis**

- decreased blood flow
- cellular response
  - apoptosis
  - progesterone synthesis
- Immune response
  - Lymphocytes
  - Macrophages

**PGF action in CL**

- Small luteal cells
  - PGF receptors few
- Large luteal cells
  - PGF receptors numerous
  - Unsure what molecules come from large luteal cells but they do trigger regression of small luteal cells

**Menstrual Cycle**
Luteolysis in the Primate

- Does not require the uterus
- CL lifespan in the human is 12-14 days unless pregnancy occurs
  - In the absence of pregnancy, CL self destructs
  - Primate CL dependent on LH
  - Luteal cells start to die in absence of LH, then produce intra-ovarian PGF$_{2\alpha}$ (oxytocin?) and luteal regression.

Luteolysis in the Primate (cont.)

- Menstruation
  - Drop in P$_4$ and E$_2$
  - Endometrial PGF$_{2\alpha}$ vasoconstriction, necrosis
  - Endometrial inflammation and tissue degeneration