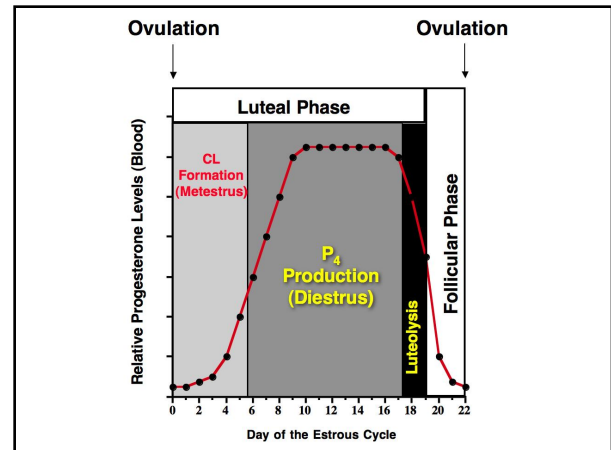


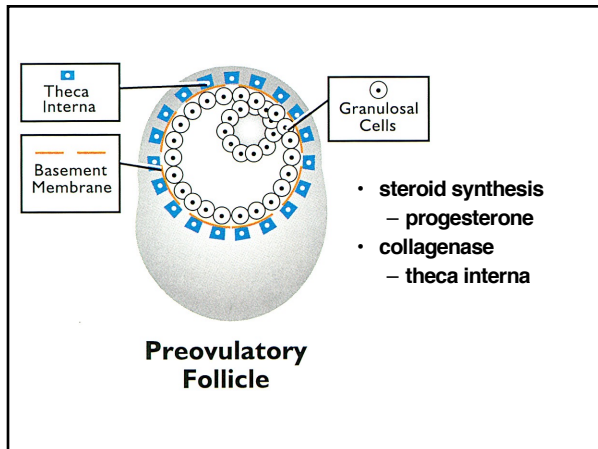
The Luteal Phase of the Estrous and Menstrual Cycle

John Parrish

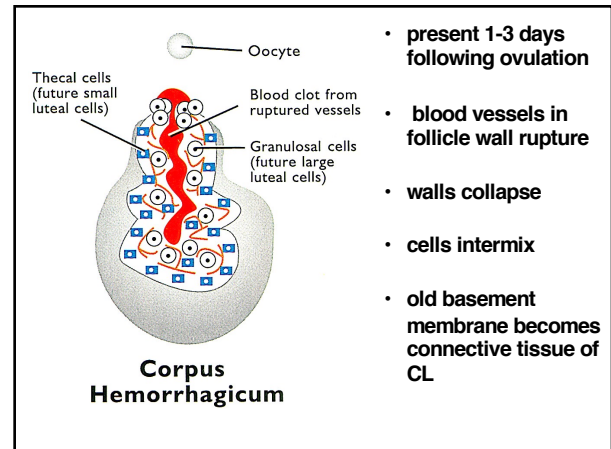
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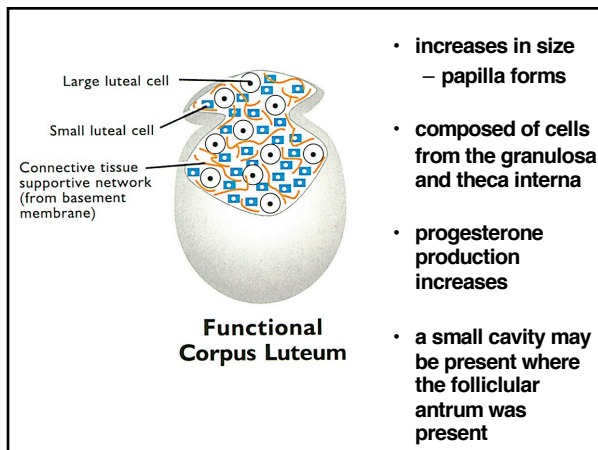
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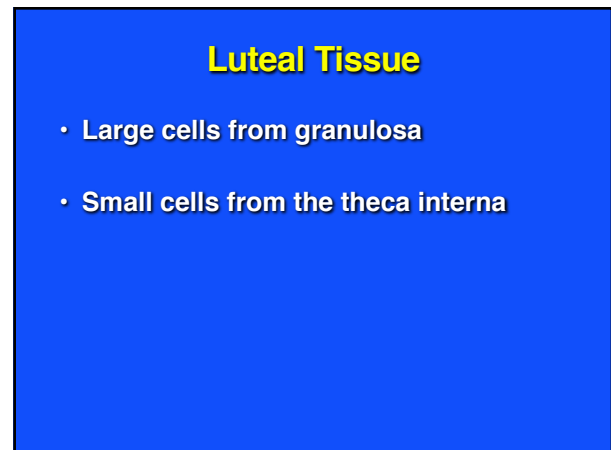
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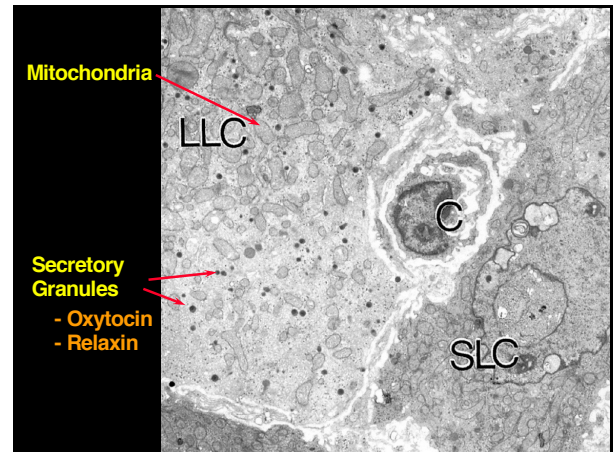
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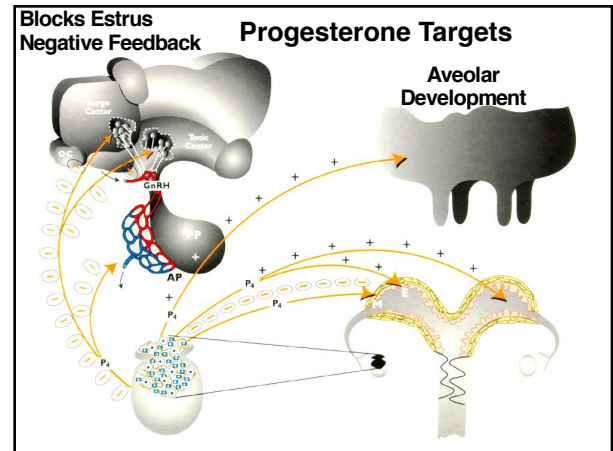


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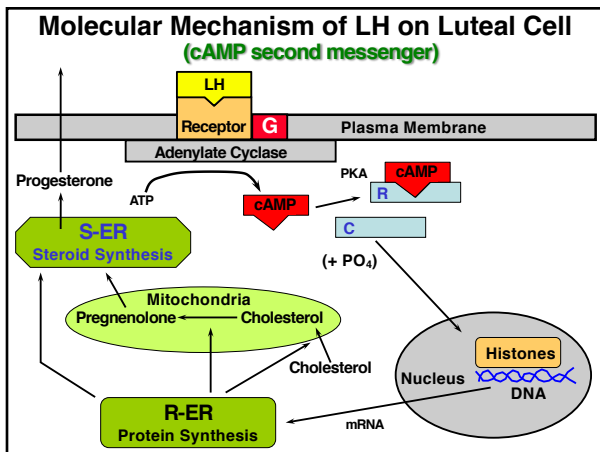
Functional Capability of CL

- 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

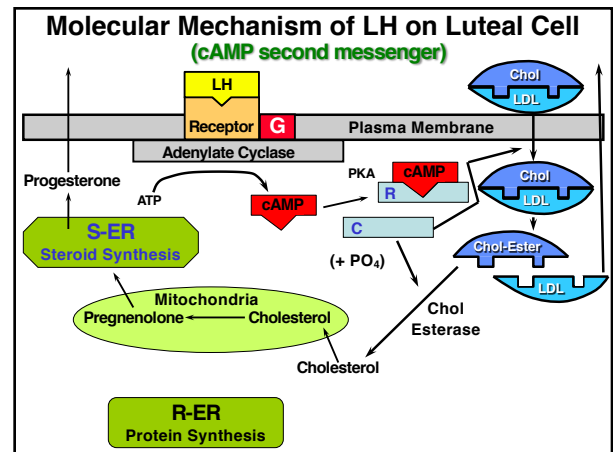
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LH receptor location

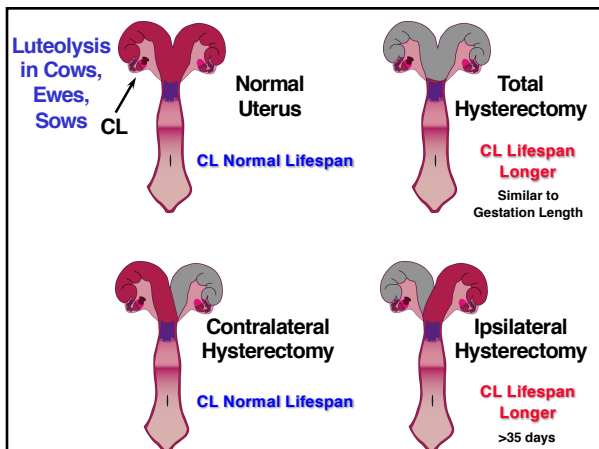
- Small luteal cells
 - LH receptors
 - Progesterone production driven by LH
- Large luteal cells
 - Very few LH receptors
 - Progesterone production mostly independent of LH

13

Luteolysis

- Uterus
- $\text{PGF}_{2\alpha}$
- Oxytocin

14

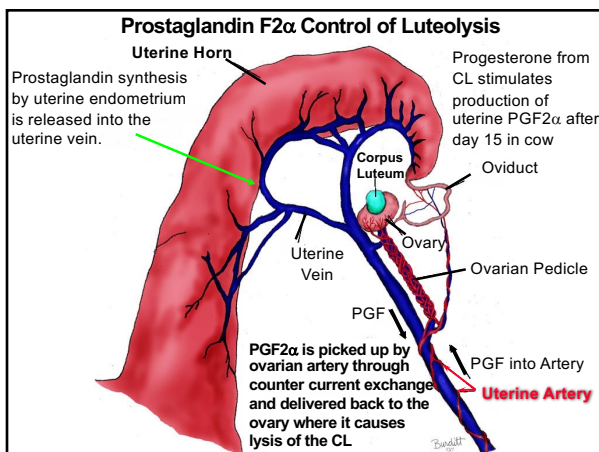


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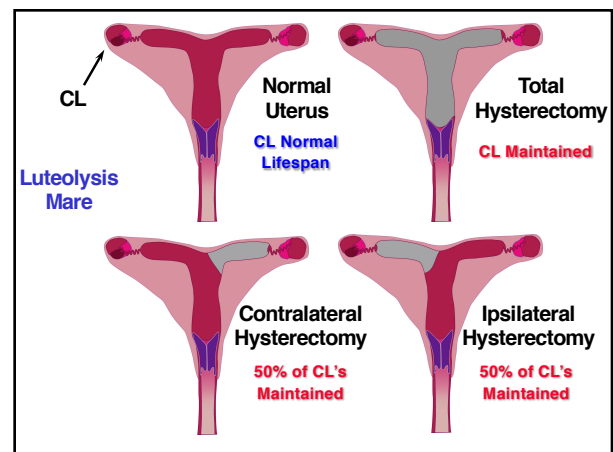
Luteolysis

- Uterus
- $\text{PGF}_{2\alpha}$
- Oxytocin

16

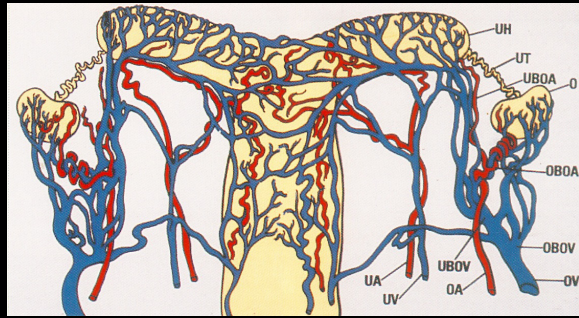


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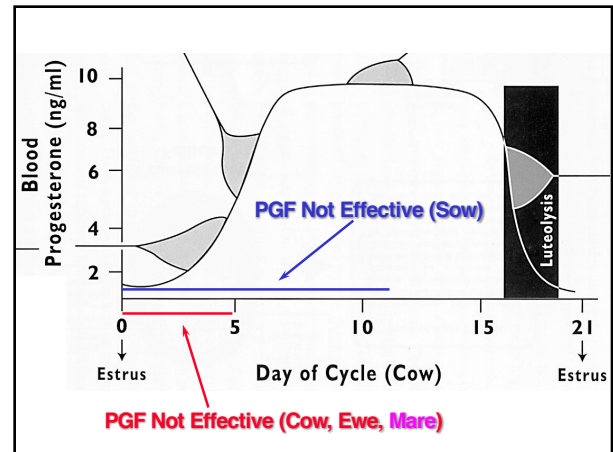


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Blood Supply to Uterus and Ovary in the Mare



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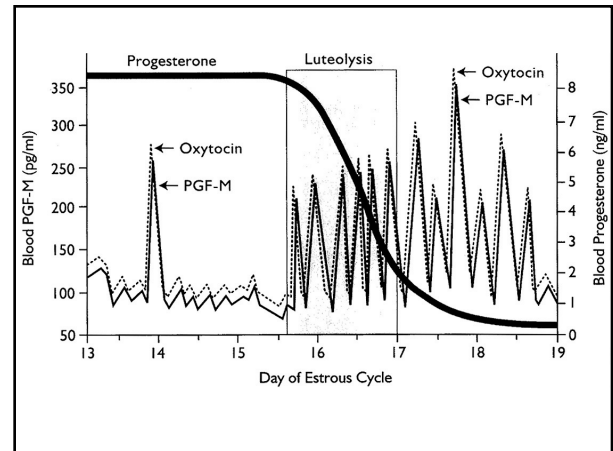


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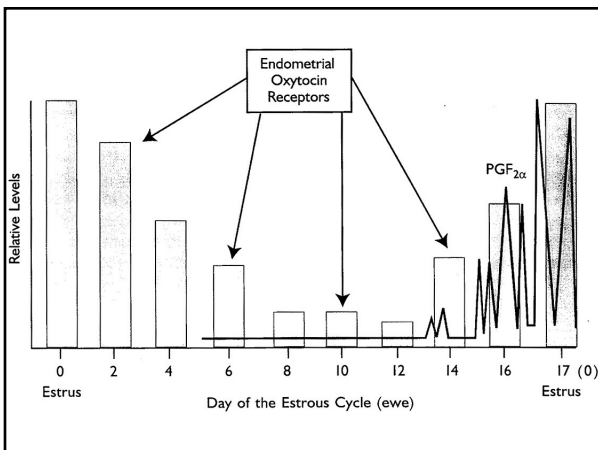
Luteolysis

- Uterus
- $\text{PGF}_{2\alpha}$
- Oxytocin

21

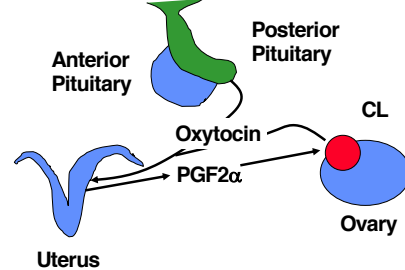


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Relationship of Oxytocin and $\text{PGF}_{2\alpha}$

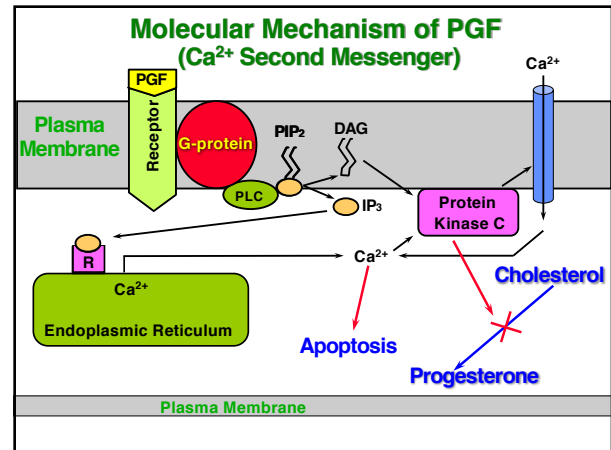


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Luteolysis

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

25



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Luteolysis

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

27

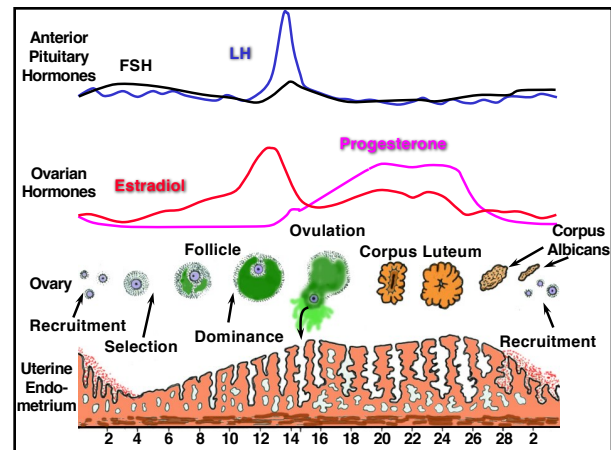
PGF action in CL

- 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

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Menstrual Cycle

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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 $\text{PGF}_{2\alpha}$ (oxytocin?) and luteal regression.

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Luteolysis in the Primate (cont.)

- Menstruation
 - Drop in P_4 and E_2
 - Endometrial $\text{PGF}_{2\alpha}$, vasoconstriction, necrosis
 - Endometrial inflammation and tissue degeneration

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Manipulating Ovulation and Estrous Synchronization

John Parrish

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Why Cycle Control?

1. Group females for parturition:
 - a) Decrease labor, calving period
Reduce calving season
 - b) More uniform weaning weights.
2. Reduce or eliminate estrus detection.
3. Needed for artificial insemination:

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Manipulating Ovulation

- Hormonal induction of ovulation
 - $\text{PGF}_{2\alpha}$
 - GnRH
 - Progestins
- Superovulation
 - FSH
 - eCG

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Cattle

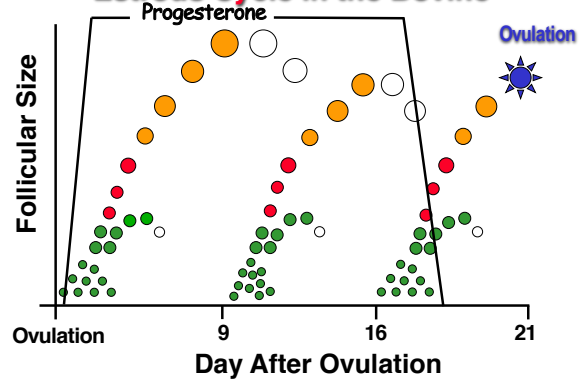
36

Principle of PGF_{2α} Use

- Regress active corpus luteum
 - Only effective on a day 5 - 17 CL
 - Not effective on days:
 - ✓ 1 - 4 (CL not responsive)
 - ✓ 18 - 21 (CL already regressed)
 - ✓ Non-responsive period represents 1/3 of estrous cycle

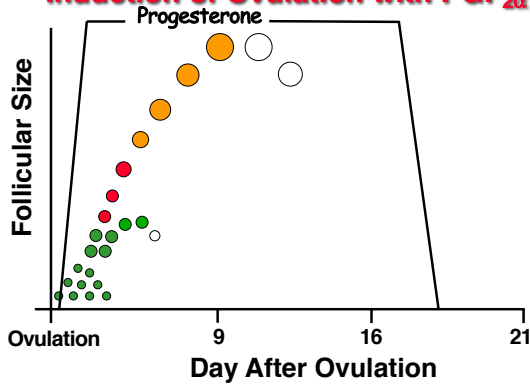
37

Estrous Cycle in the Bovine



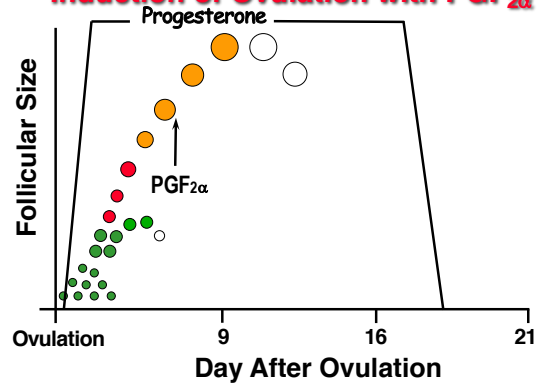
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Induction of Ovulation with PGF_{2α}



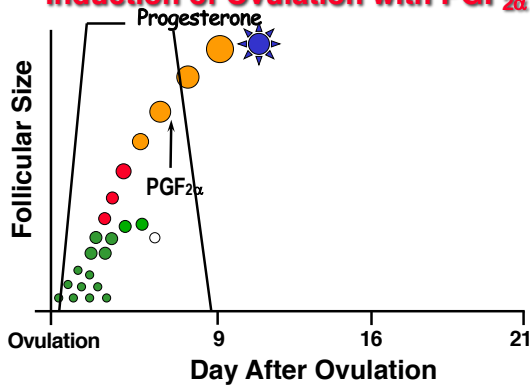
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Induction of Ovulation with PGF_{2α}



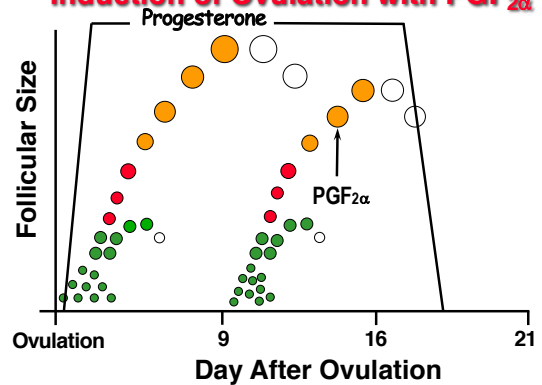
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Induction of Ovulation with PGF_{2α}

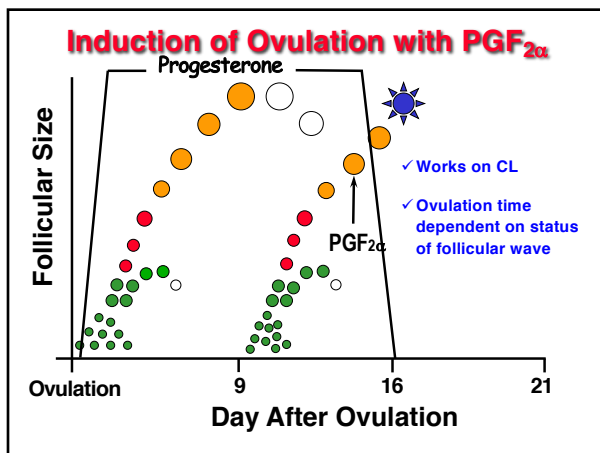


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Induction of Ovulation with PGF_{2α}



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Principle of GnRH Use

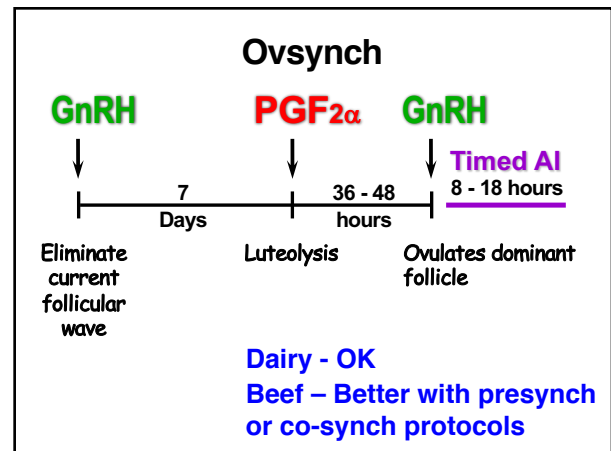
- Luteinize or Ovulate a dominant follicle
 - Terminates the current follicular wave
 - ✓ Inhibin and Estradiol decrease
 - ✓ FSH increases to “recruit” a new follicular wave
 - No effect on old CL if present
 - A dominant follicle must be present
 - Generally followed by PGF_{2α} to regress CL formed or old CL

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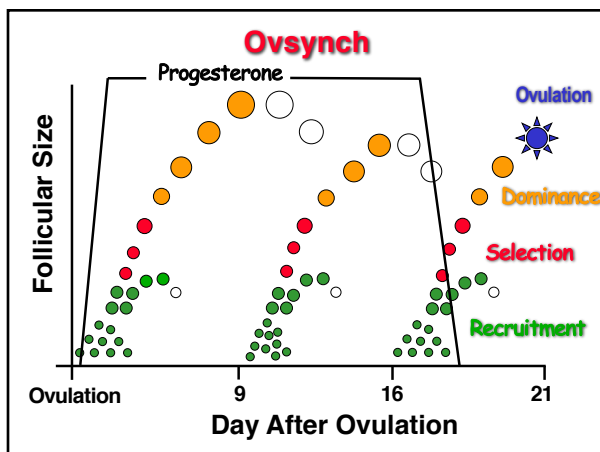
Principle of GnRH Use

- Induce ovulation of a dominant follicle
 - Used for timed AI
 - No CL present
 - Dominant follicle must be present

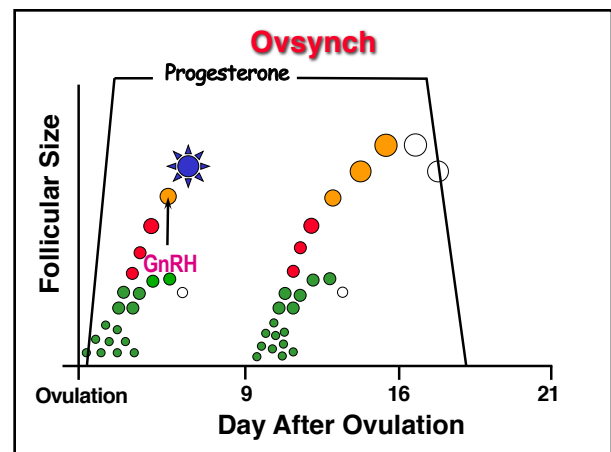
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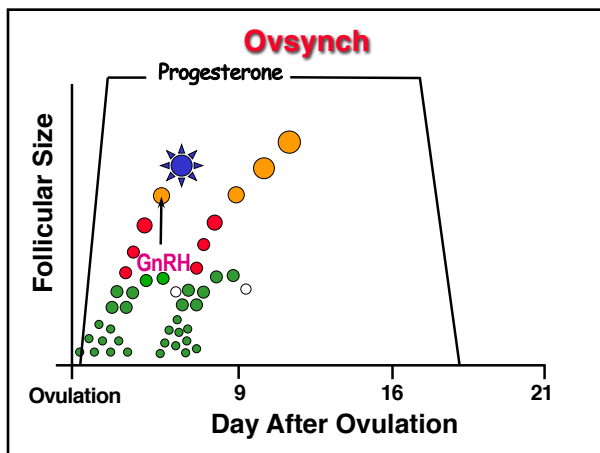
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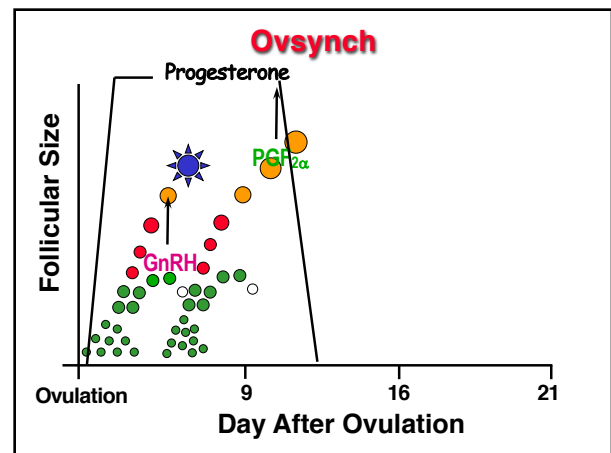
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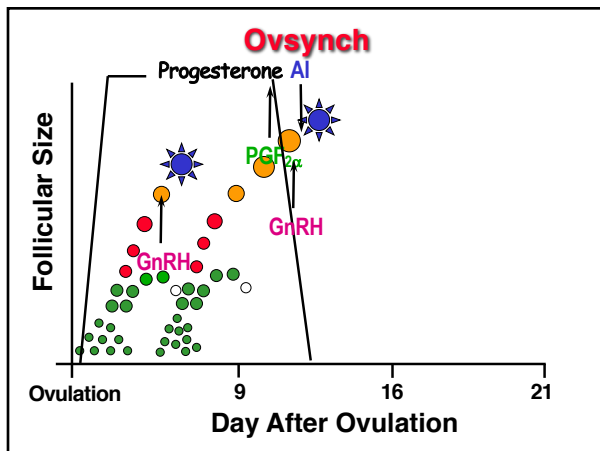
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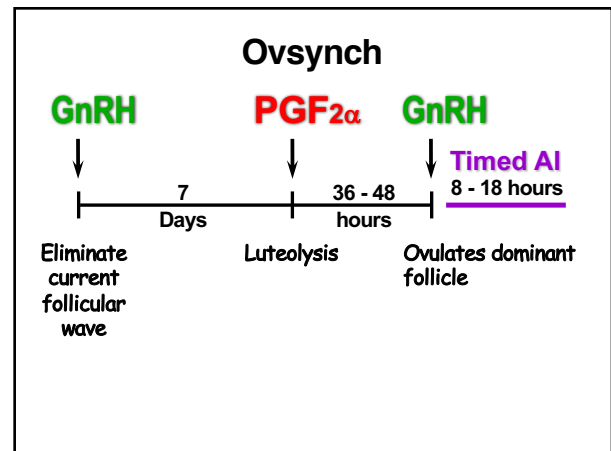
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Ovsynch Problems

- Works best on animals that are near day 7 of the cycle at 1st GnRH
 - Presynch
 - PG, 14 days, PG, 10 days, Ovsynch
 - G, 7 days, PG, 3 days, G, 7 days, Ovsynch (double Ovsynch)
 - G, 7 days, PG, 11 days, Ovsynch
 - G, 7 days, Ovsynch (GGPG)
 - PG, 3 days, G, 7 days, Ovsynch (PG-3-G)

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Use of Progestogens

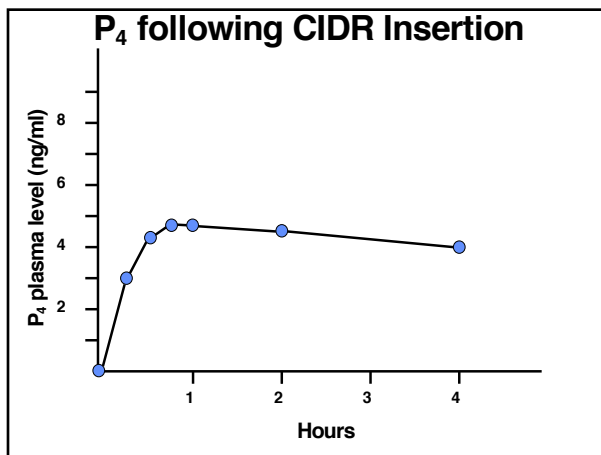
Principle

- Provides progesterone
- Simulates a CL (**not stimulate**)
- Prevents ovulation
- Has no effect on the animal's CL (ie. normal lifespan)
 - **Does not regress the CL!!!!**
- Remove after animal's CL regresses
 - **Current or next follicular wave will ovulate!!!!**
 - Occurs 2 – 5 days latter
 - May use PGF_{2α} to regress animal's CL

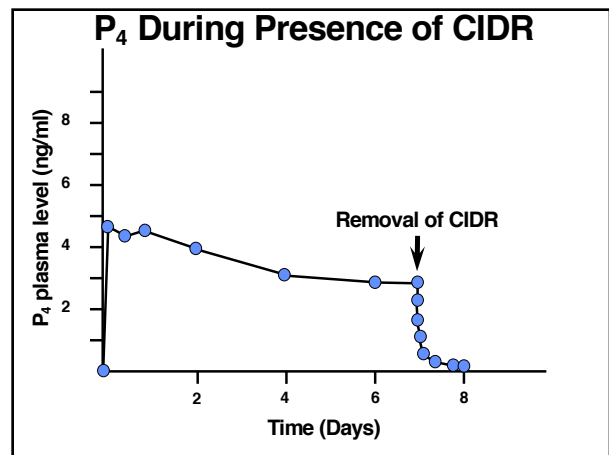
Administration

- Injection, Feed (MGA), Implant, Control Internal Drug Release (CIDR)

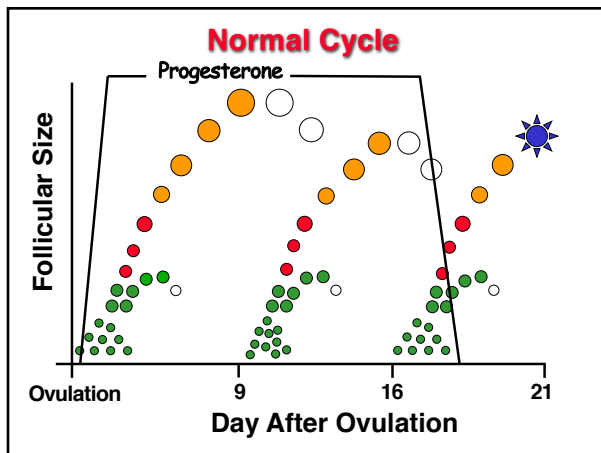
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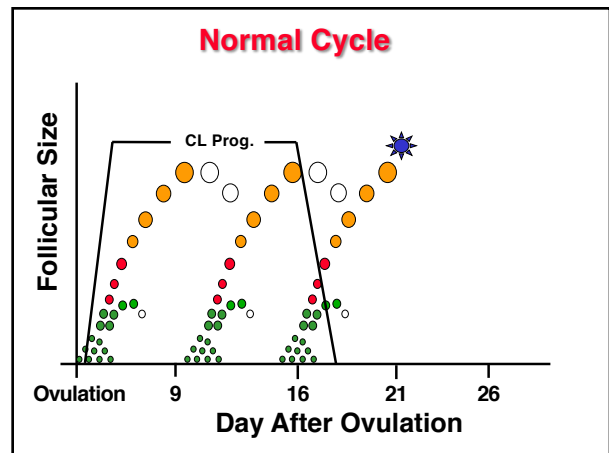
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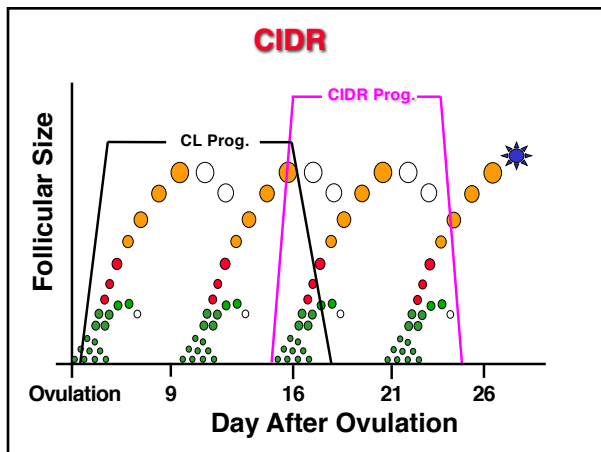
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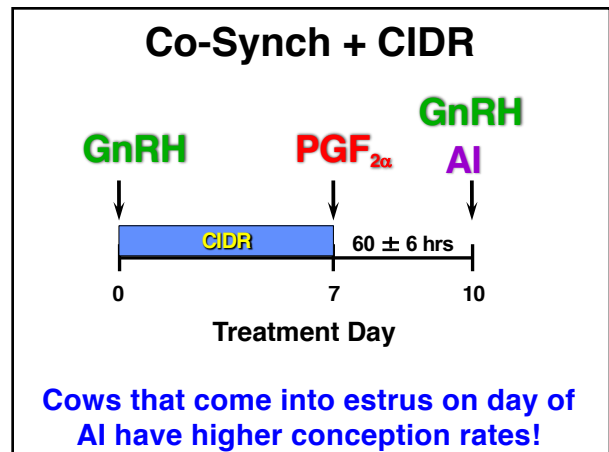
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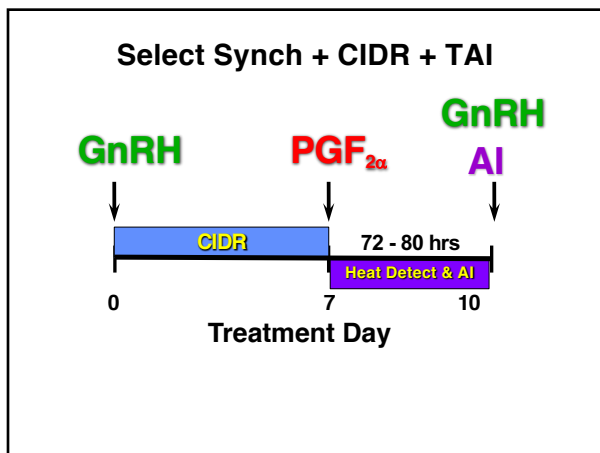
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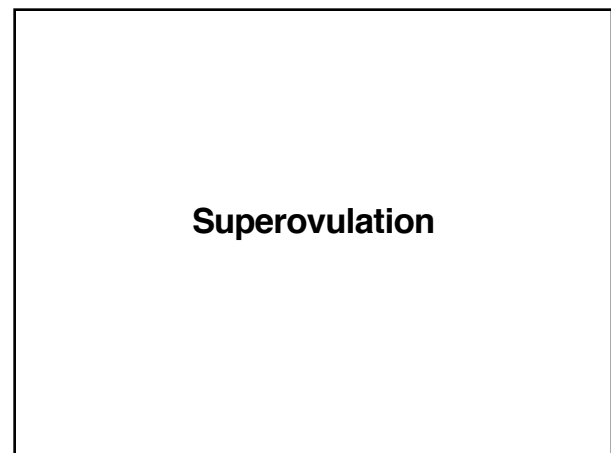
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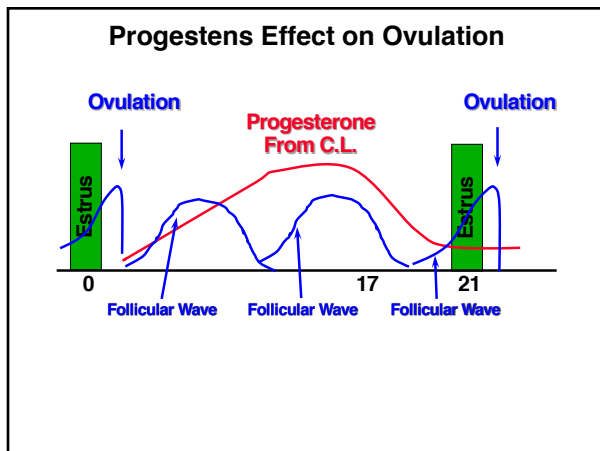
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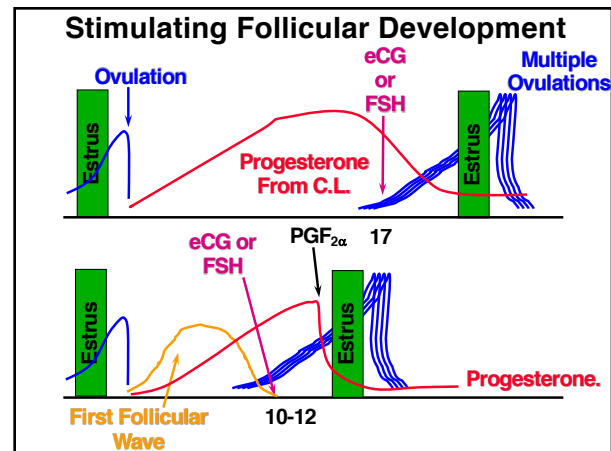
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- Sheep**
- Progestin
 - CIDR
 - In season - works alone
 - Out of season - requires eCG
 - Prostaglandin
 - Only works in season
 - Lights - decrease day length
 - Melatonin - give orally or IM

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- Swine**
- Prostaglandin
 - Not of practical
 - Only effect days 12 - 17
 - Progestins - Altrenogest (Matrix)
 - MGA causes ovarian cysts
 - Regumate (oral) for 18 days
 - Cost is \$5 - \$10/day
 - Wean Piglets
 - Puberty Induction - PG600 (eCG + HCG)

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Equine

- **Prostaglandin**
 - Mare CL more sensitive than cow's
 - Only effective in season
- **HCG** – ovulation induction, >35 mm follicle
- **Progestins**
 - Altrenogest (Regumate)
 - Only effective in season
 - Reduce estrus behavior in competition animals
- **Light**
 - 16 hrs day light for 60 - 90 days.