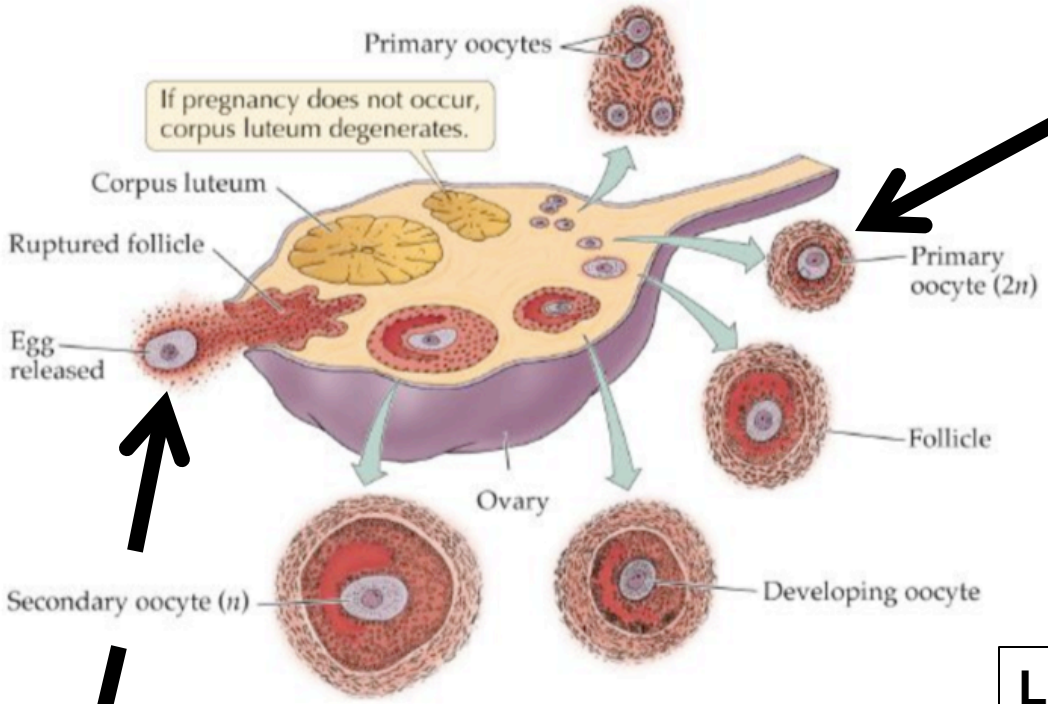
Booklet 2
Menstrual Cycle

Oogenesis… the formation of an ova



1.

-FSH from the pituitary stimulates the maturation of ova from immature **follicles** which are **2n** = 46 chromosomes.
-Follicles produce estrogen

2.

LH from the pituitary stimulates formation of the **Corpus Luteum** which secretes **progesterone and estrogen.**

3.

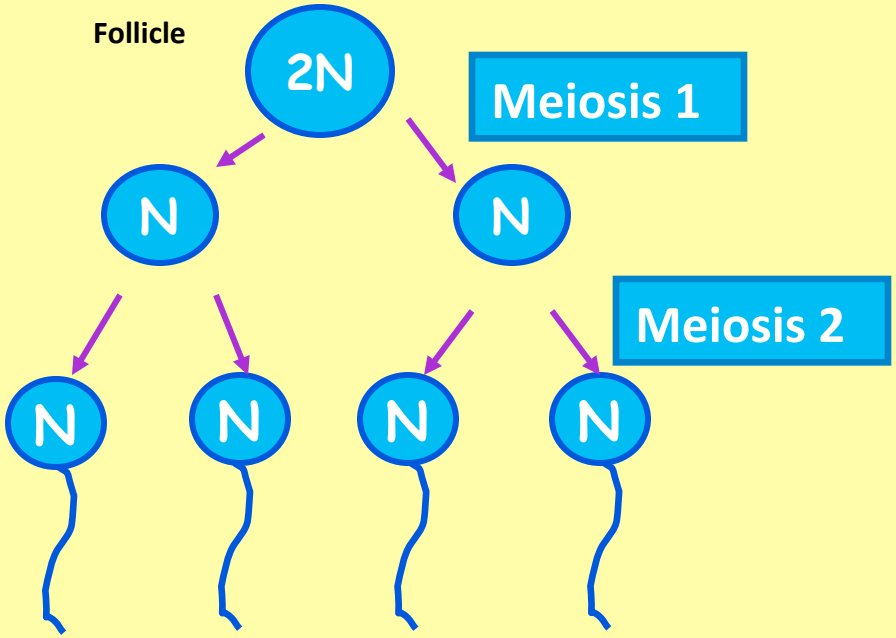
Mature ovum are released day 14 (ovulation) and are **"n"** = 23 chromosomes.
-occurs because of LH

F **FSH**
E **Estrogen from follicles**
L **LH**
P **Progesterone & estrogen**

Meiosis in Males and Females

Males - Spermatogenesis

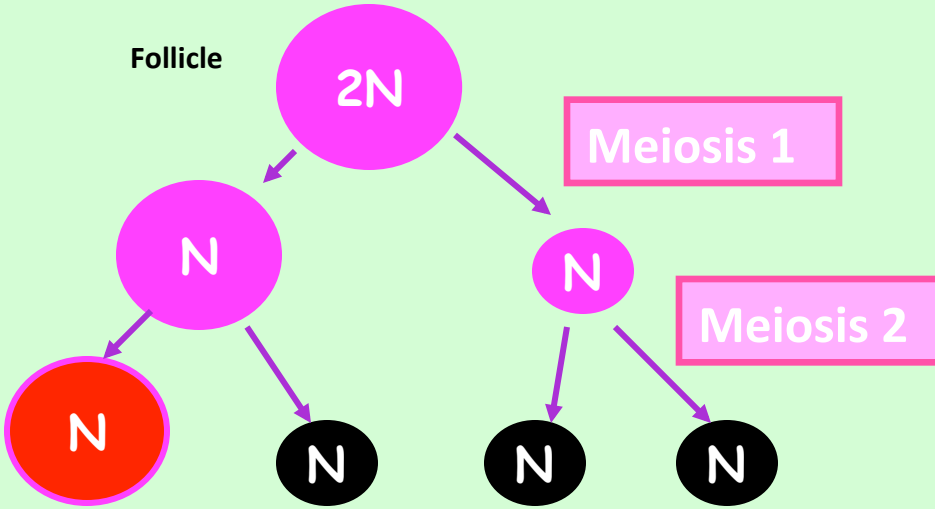
Location : **testes**



4 equal sperm

Females - Oogenesis

ovaries and fallopian tube



1 egg and 3 polar bodies

Egg (ovum) gets most of the cytoplasm. Polar bodies die and are absorbed by body.

Hormones of the Menstrual Cycle

Gonadotropins (Gn) are FSH and LD

GnRH: -causes FSH/LH release

-inhibited (halted) by high estrogen and progesterone

FSH: promotes follicle growth

LH: promotes ovulation & corpus luteum formation and maintenance

Hormones of the Menstrual Cycle

- Progesterone **- increased amount**

  - stimulates the endometrium (uterus lining) to prepare for for an embryo

  -inhibits menstruation by…

  inhibiting GnRH → inhibits FSH/LH→ inhibits follicle growth & ovulation

  -firms the cervix

- Estrogen – **increased amount**

- -thickening of endometrium

Decrease of E & P triggers menstruation

Hormones of the Menstrual Cycle

So if LH(which maintains corpus luteum) gets inhibited(b/c of high P and E), won't the corpus luteum stop making progesterone which is needed to keep the menstrual cycle from starting ?

It would but…

a. Positive feedback from follicle stimulates LH to be released so the corpus luteum is maintained

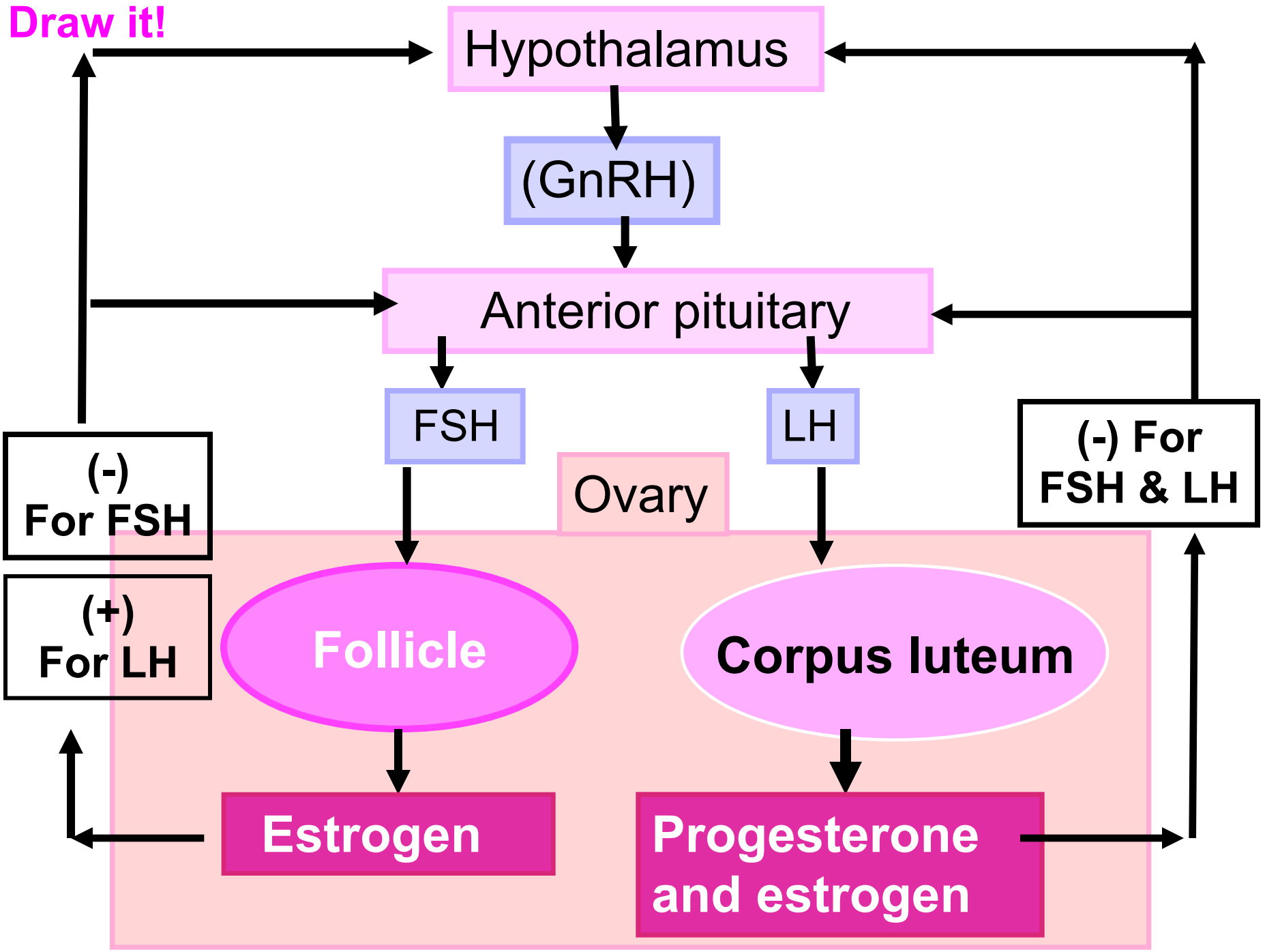
OR IF FERILIZATION OCCURS…

b. hCG - "human chorionic gonadotropin hormone" is secreted

-produced by cells around the embryo

-prevents corpus luteum breakdown so it can continue to produce progesterone until the placenta (organ that nourishes embryo) takes over

- **pregnancy test: checks hCG in urine**

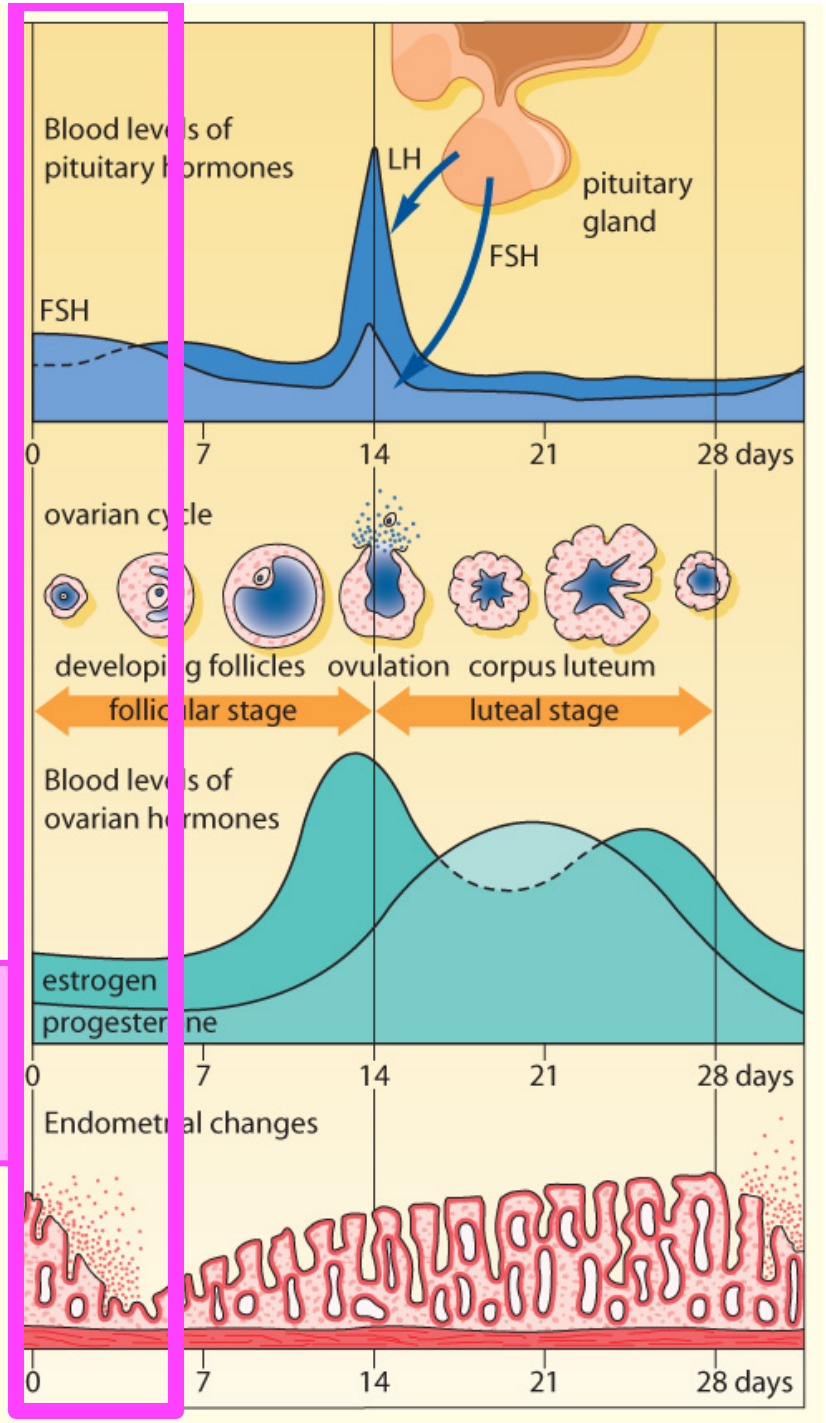

Draw it!
Hypothalamus
(GnRH)
Anterior pituitary
FSH
LH
(-) For FSH
(+) For LH
(-) For FSH & LH
Ovary
Follicle
Corpus luteum
Estrogen
Progesterone and estrogen

Menstrual Cycle: ~28 days

1. Flow phase (Day 1-5)

- endometrium is shed; follicle growth in ovary
- **Estrogen and progesterone levels are low**

Flow Phase



First moon party

https://www.youtube.com/watch?v=NEcZmT0fiNM

Menstrual Cycle: ~28 days

2. Follicular phase (Days 6-13):

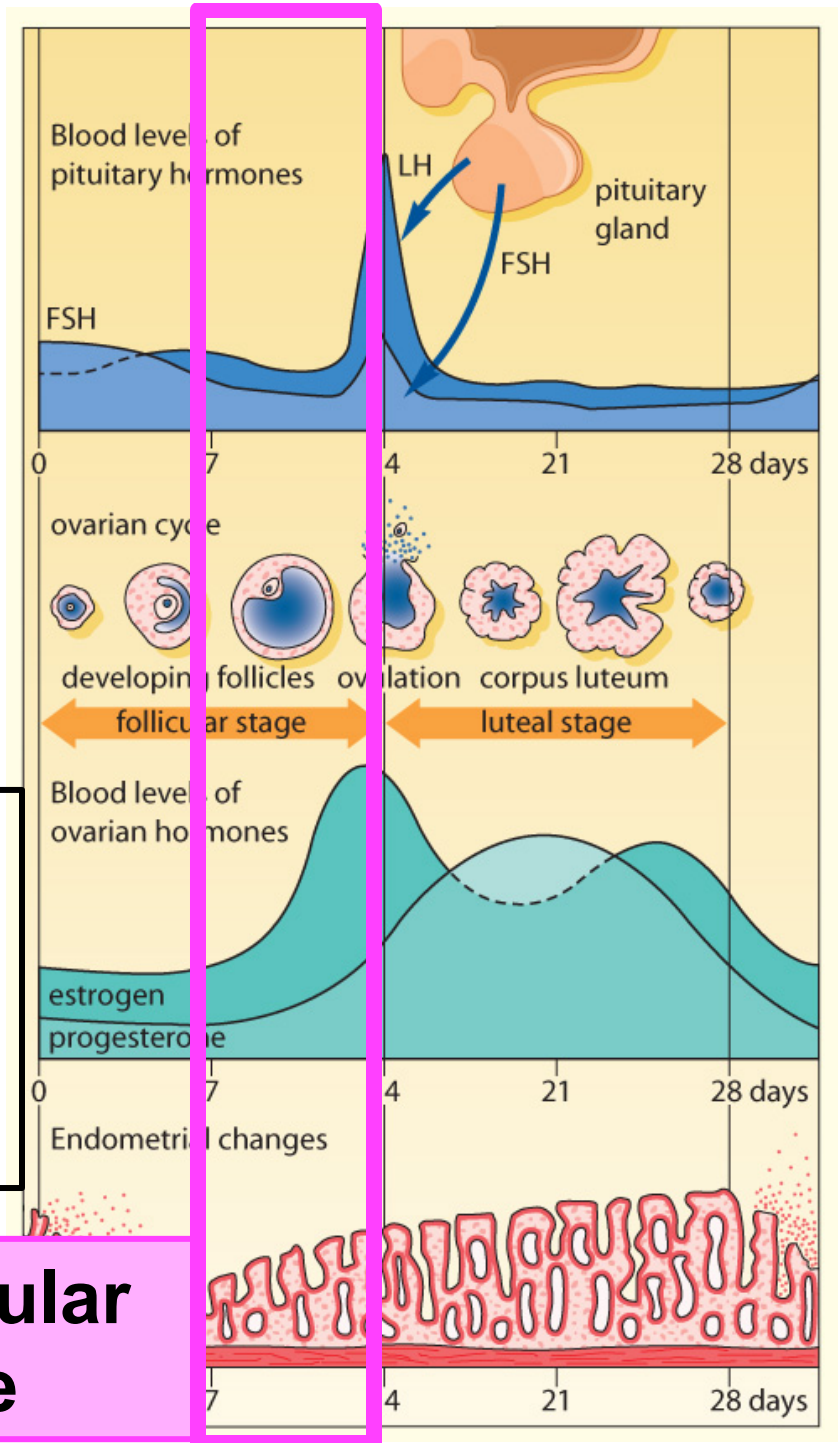
<u>follicles grow and mature</u>

→ secrete Estrogen

endometrium thickens

Stimulates GnRH → LH

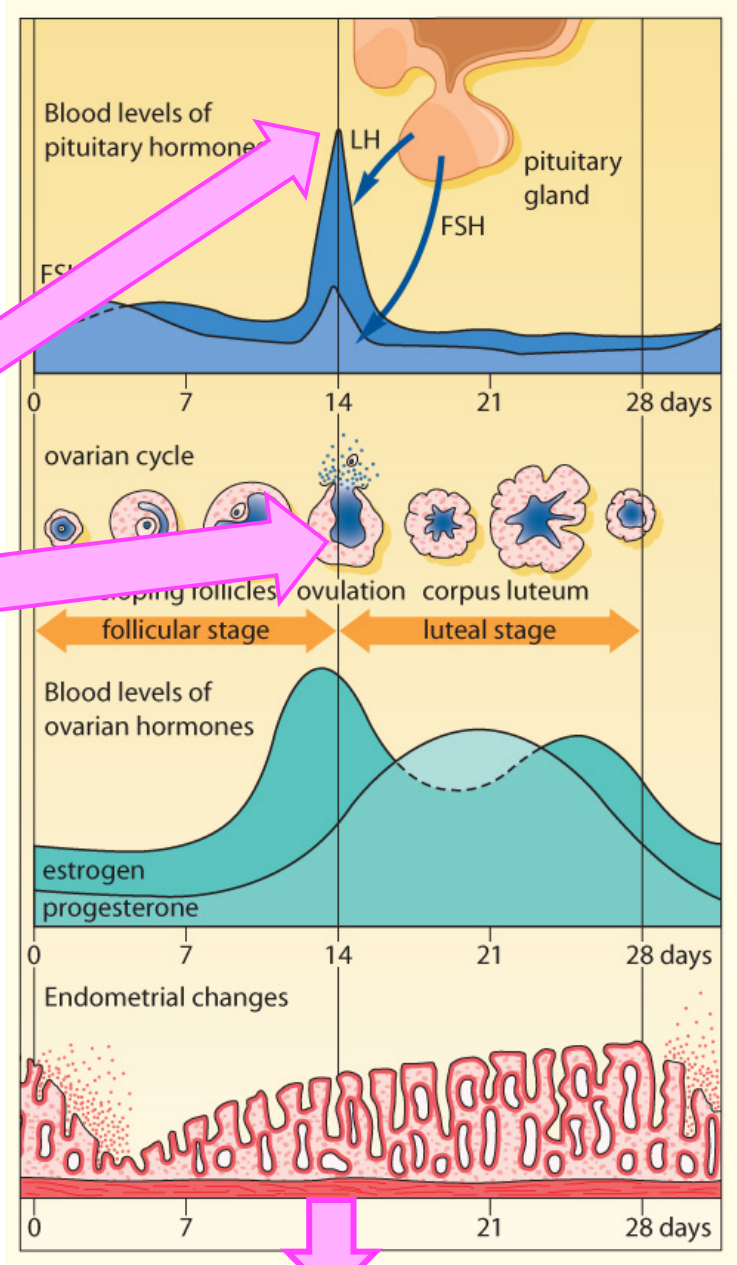
(via <u>positive</u>-feedback from estrogen prod.)



Follicular Phase

Menstrual Cycle: ~28 days

3. Ovulation (Day 14): LH peaks causing ovum to burst from the follicle in the ovary into oviduct



Ovulation

Menstrual Cycle

4. Luteal Phase (Day 15-28)

LH causes corpus luteum to develop from follicle

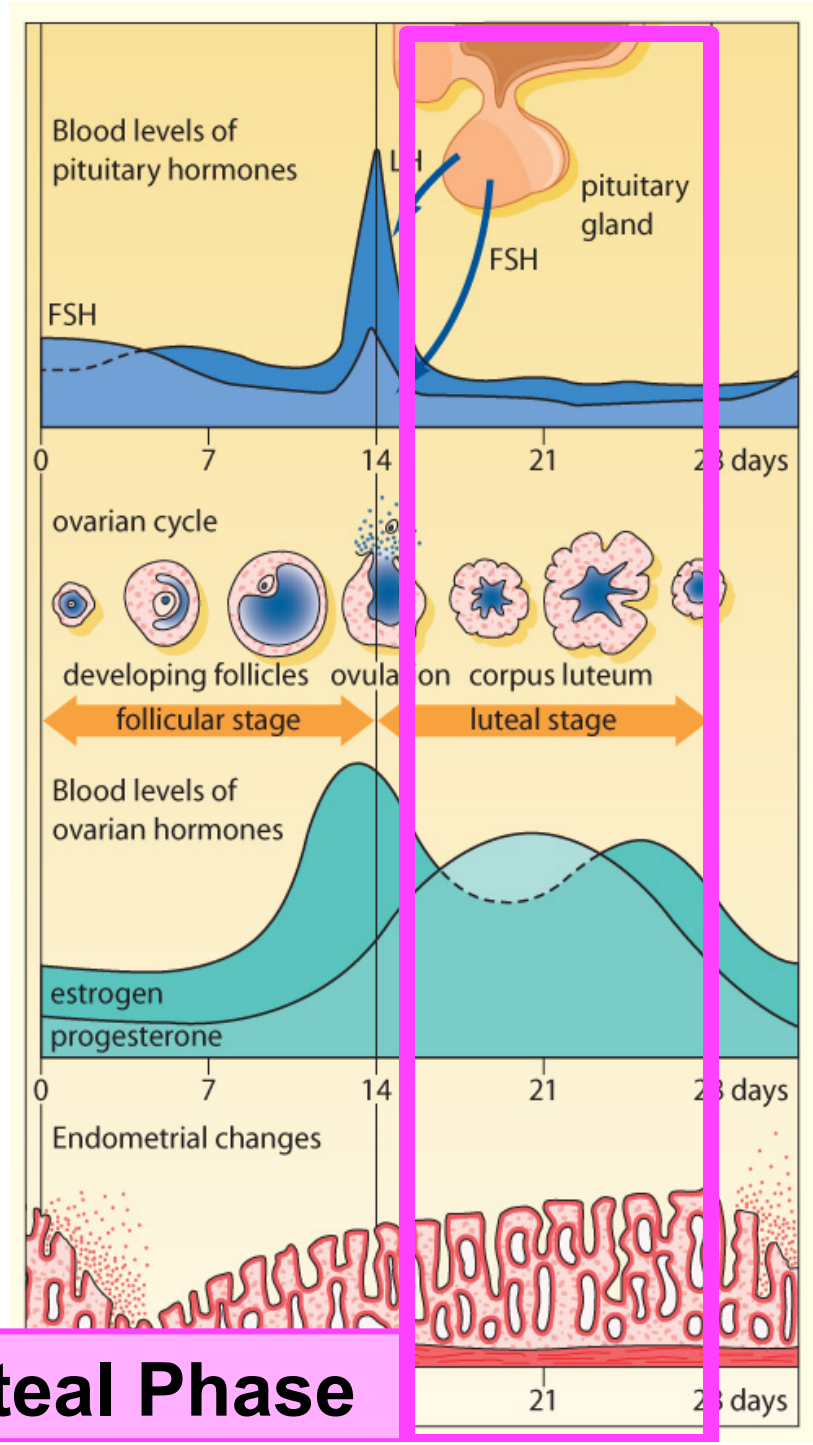
→ corpus luteum secretes

Progesterone & estrogen

Endometrium thickens and is maintained (progesterone prevents **contractions**)

Inhibits **GnRH →LH & FSH**

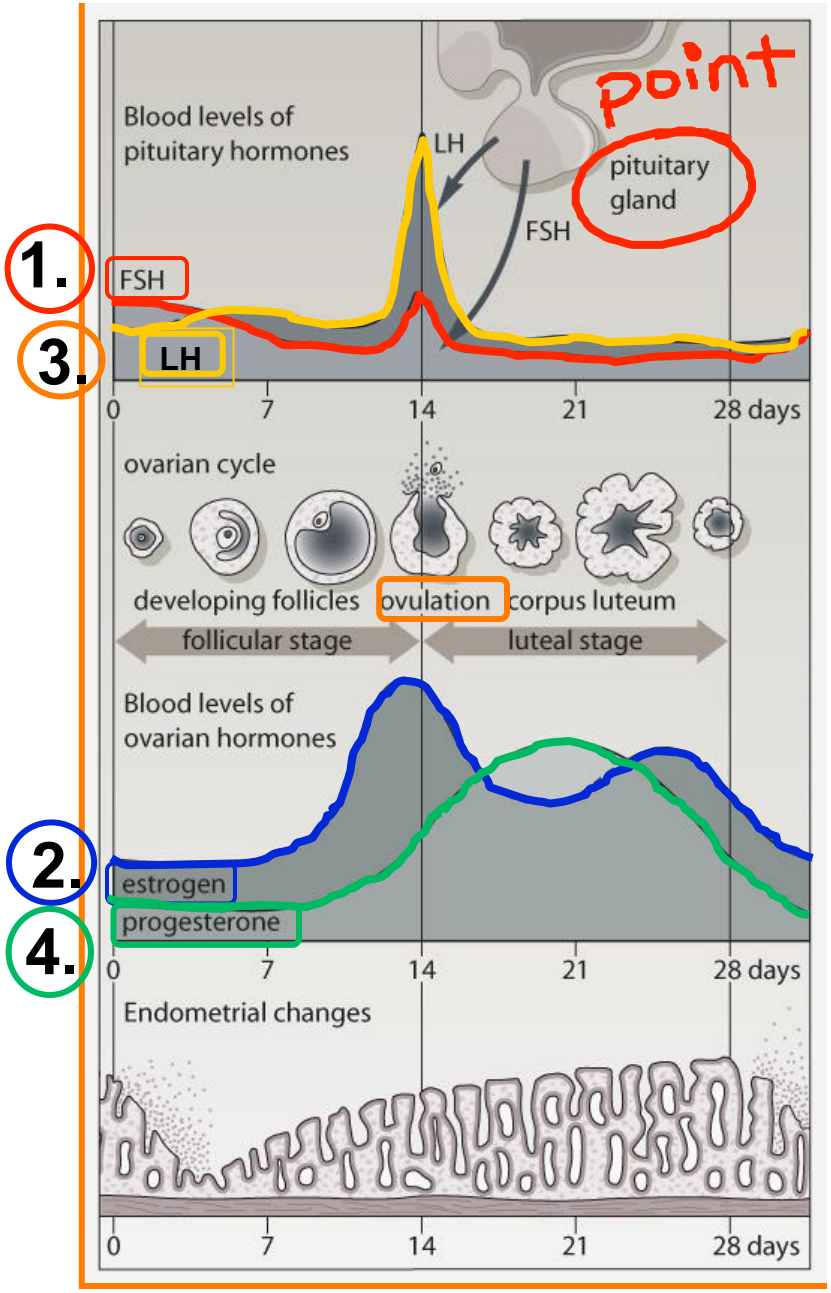
(via negative-feedback)



Menstrual Cycle: ~28 days

Label the hormones:

FELP



Bozeman: Repro system
3:08 – 6:50

http://www.youtube.com/watch?v=QSN5gfbzgwc

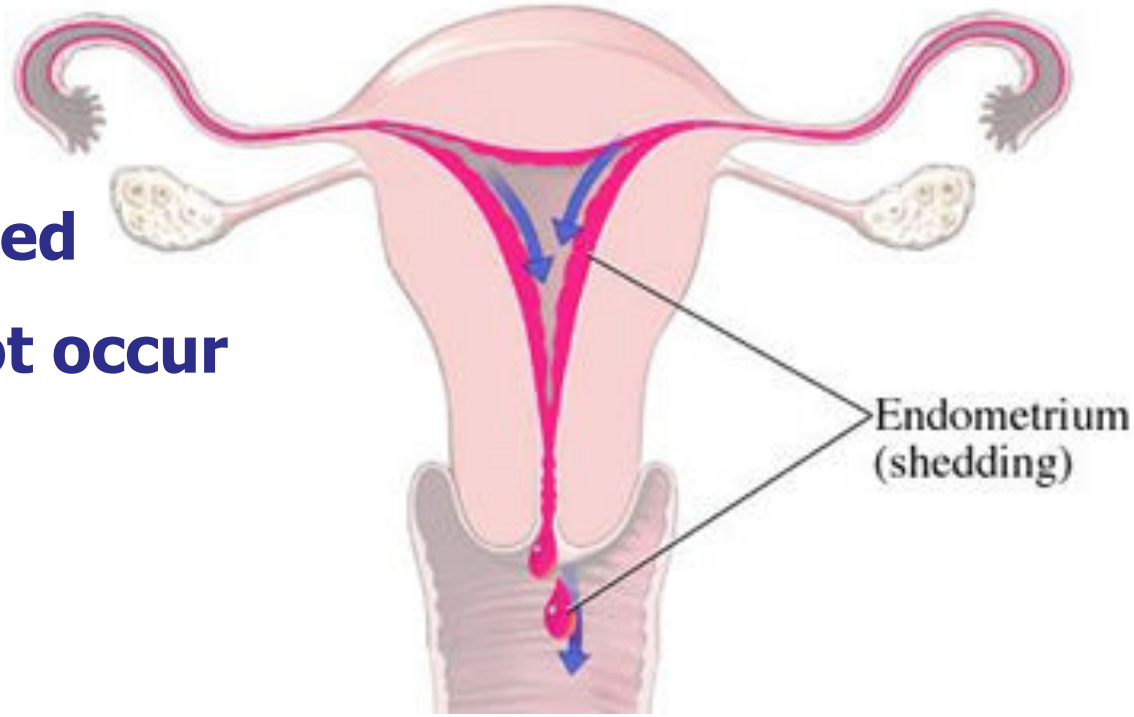
Menstrual Cycle

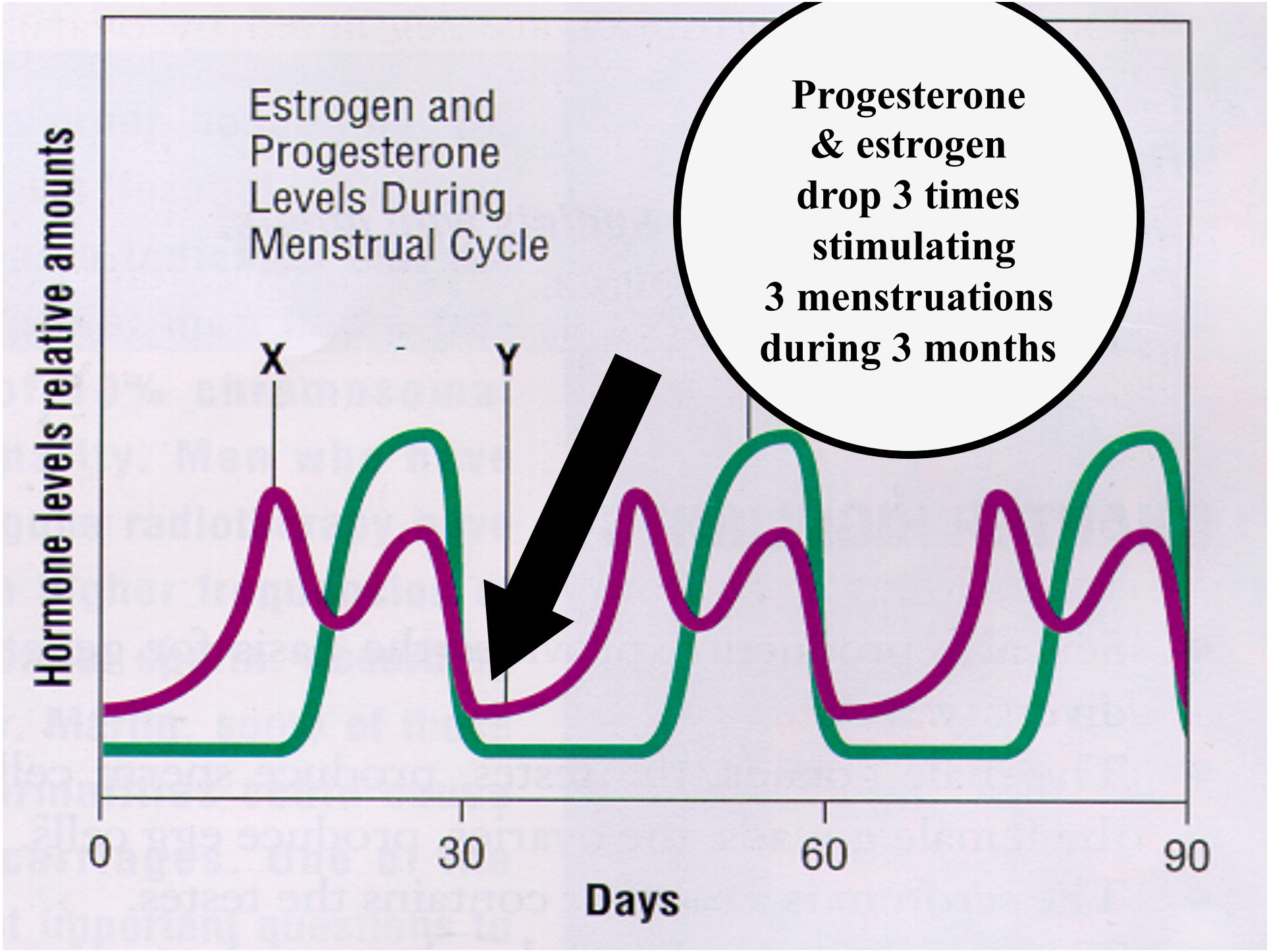
1. The loss of the endometrium (a monthly occurrence during the reproductive phase of a female's life) is termed menstruation and occurs over approximately 4-5 days.

2. The endometrium is shed on a monthly basis but the immediate reason is because of :

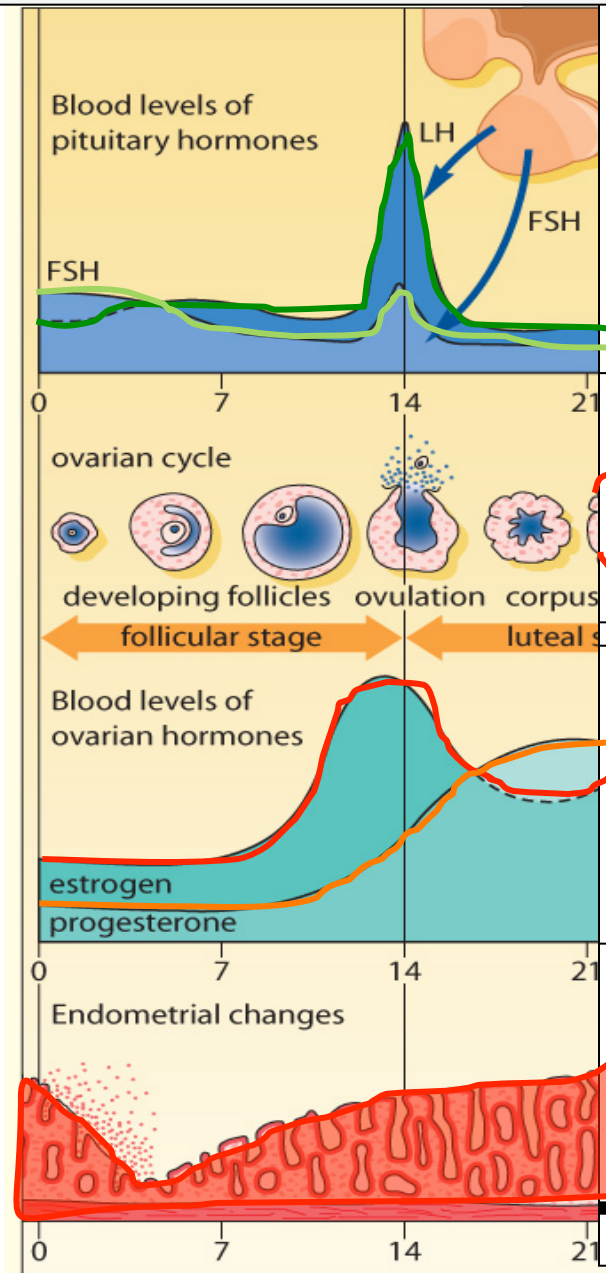
Low estrogen & progesterone.

3. If the egg is fertilized menstruation does not occur




Estrogen and
Progesterone
Levels During
Menstrual Cycle
Progesterone
& estrogen
drop 3 times
stimulating
3 menstruations
during 3 months
X
Y
Hormone levels relative amounts
0
30
60
90
Days

But what if the egg gets fertilized?…
What will happen to the hormone levels?



1. Predict, with a sketch, what each diagram/graph should look like if a woman were to become pregnant at around day 21.

Day 45

For the first 3 months stimulated by hCG

Estrogen and Prog. cause growth of the endometrium

Progesterone prevents contractions

Endometrium forms part of placenta

QUESTIONS?

Where is the high estrogen amount coming from at day 14?

Estrogen is being produced by the stimulated follicle cells

Why does the amount of progesterone increase from about day 7 to 21?

The corpus luteum has begun to produce progesterone

Why do the amounts of FSH and LH decline and stay low after day 14?

The high amounts of progesterone and estrogen produce a negative feedback loop thus inhibiting the amount of FSH and LH released by pituitary.

Why does the "second spike" in estrogen amount occur?

The corpus luteum has begun to produce estrogen

When is the endometrium at its thickest? Why?

Between days 14 and 21 right when the egg is released….so the uterus is ready for a potential embryo implantation

MORE QUESTIONS:

Which phase is dominated by estrogen? follicular

Which phase is dominated by progesterone? luteal

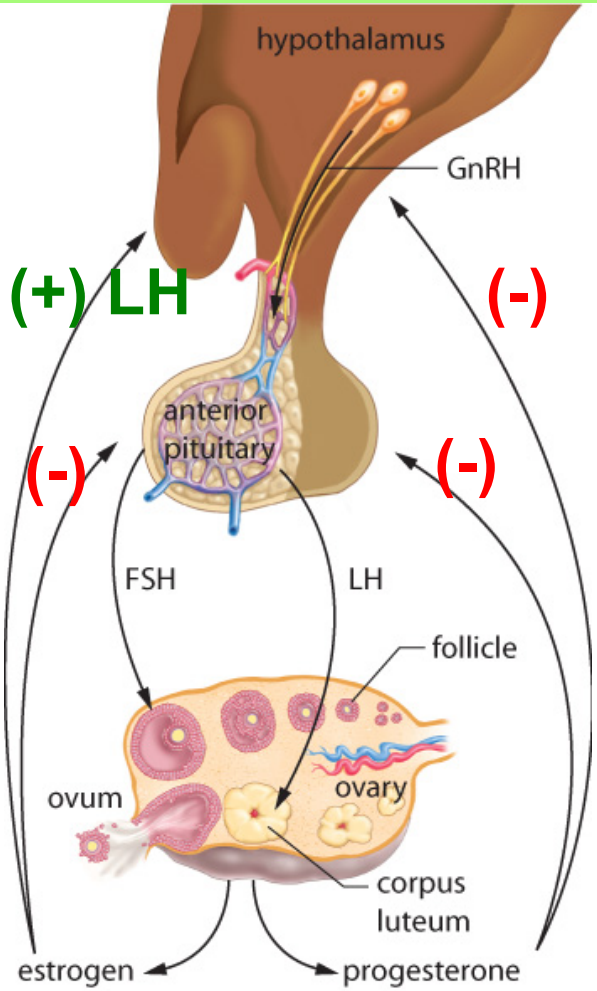
The sharp rise in temperature signals what event? ovulation

Menstrual Cycle Animations

1)
http://wps.prenhall.com/wps/media/objects/1115/1142409/36_1_7a_plain.html

2)
http://wps.prenhall.com/wps/media/objects/1115/1142409/36_2_1a_plain.html

Hormone Review



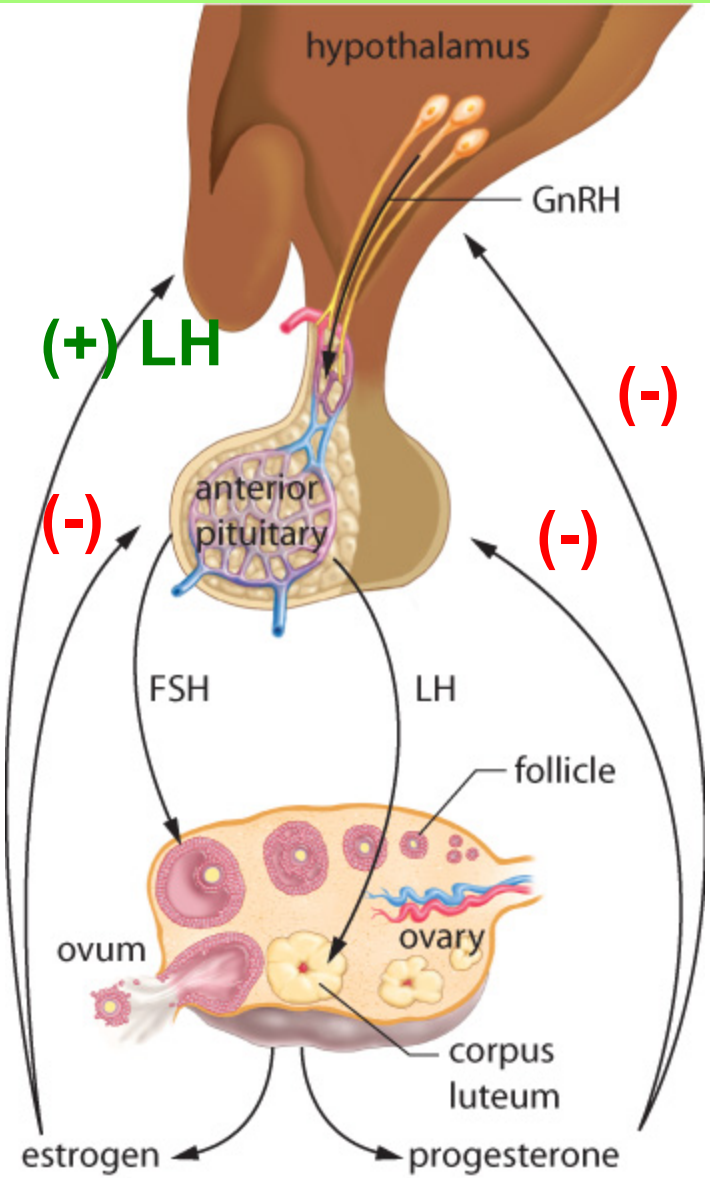
1. FSH

- **Target:** follicles in the ovary
- **Effect:** Ova and estrogen

2. Estrogen

- **Target:** -various cells
  -endometrium,
  -hypothalamus(feedback loop)
- **Effect:** development 2º sexual characteristics (breasts, larger hips);
- neg. feedback to decrease **FSH**;
- positive feedback to increase **LH** production;
- growth of **endometrium**

Hormone Review



3. LH

- **Target**: follicle (ovulation) corpus luteum
- **Effect**: ovulation & progesterone and estrogen production

4. Progesterone

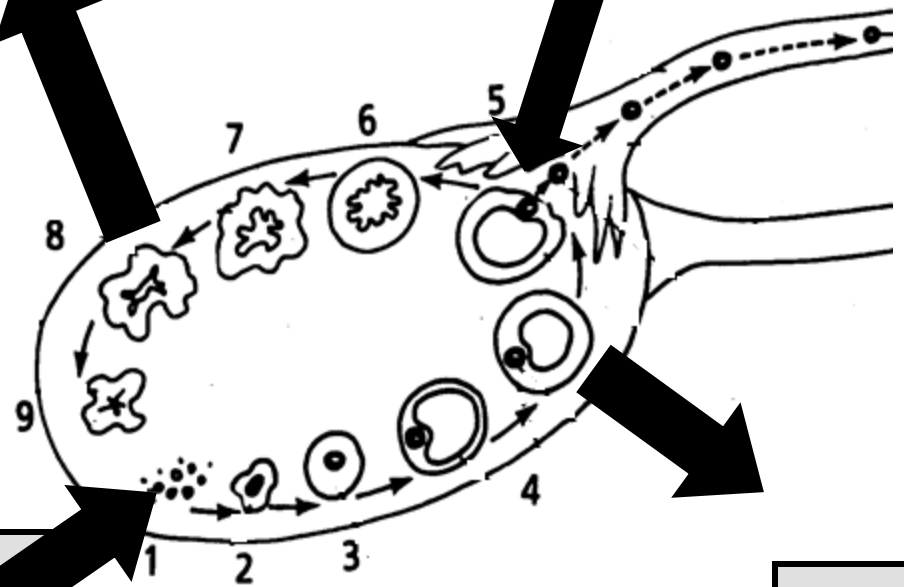
- **Target**: -endometrium & -hypothalamus(feedback loop)
- **Effect:** thicken and maintain **endometrium** (inhibit contractions); negative feedback to **stop FSH and LH**

Ovary hormone review

Which hormones are involved?

4 **Progesterone** & estrogen from corpus luteum

3 **LH** from pituitary stimulates ovulation



1 **FSH** from pituitary

2 **Estrogen** from follicle

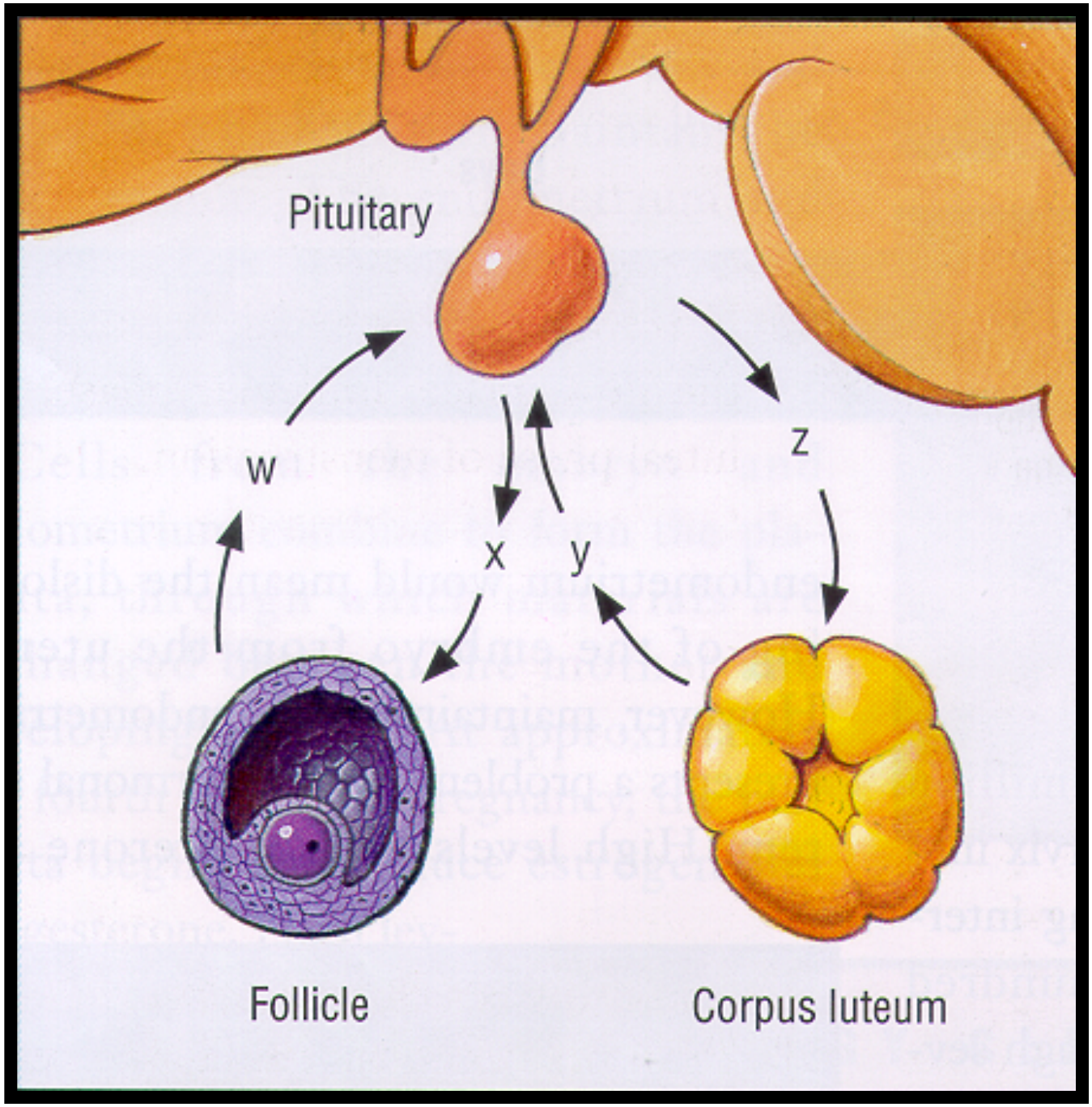
Hormones Controlling Menstruation

X = FSH

W = Estrogen

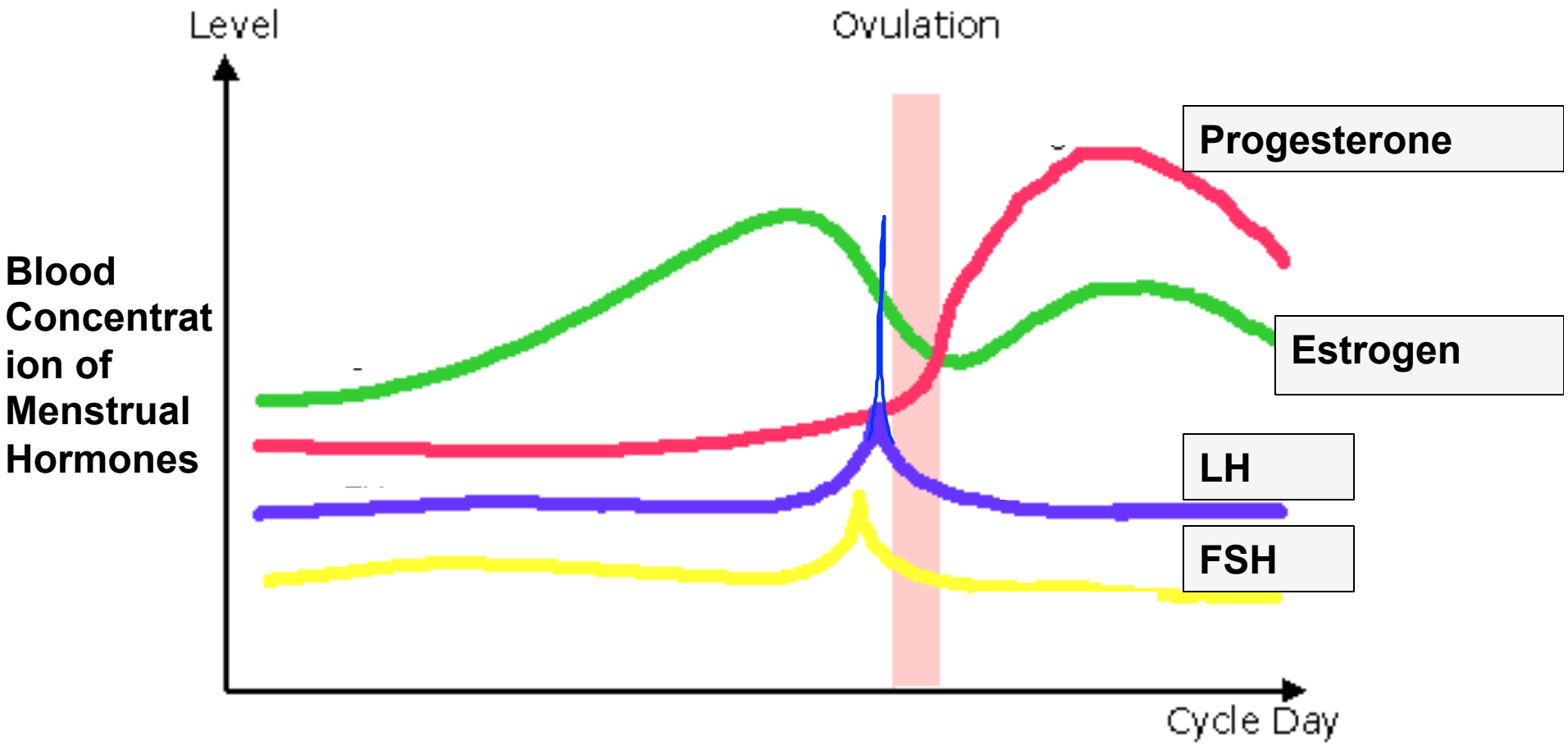
Z = LH

Y = Progesterone



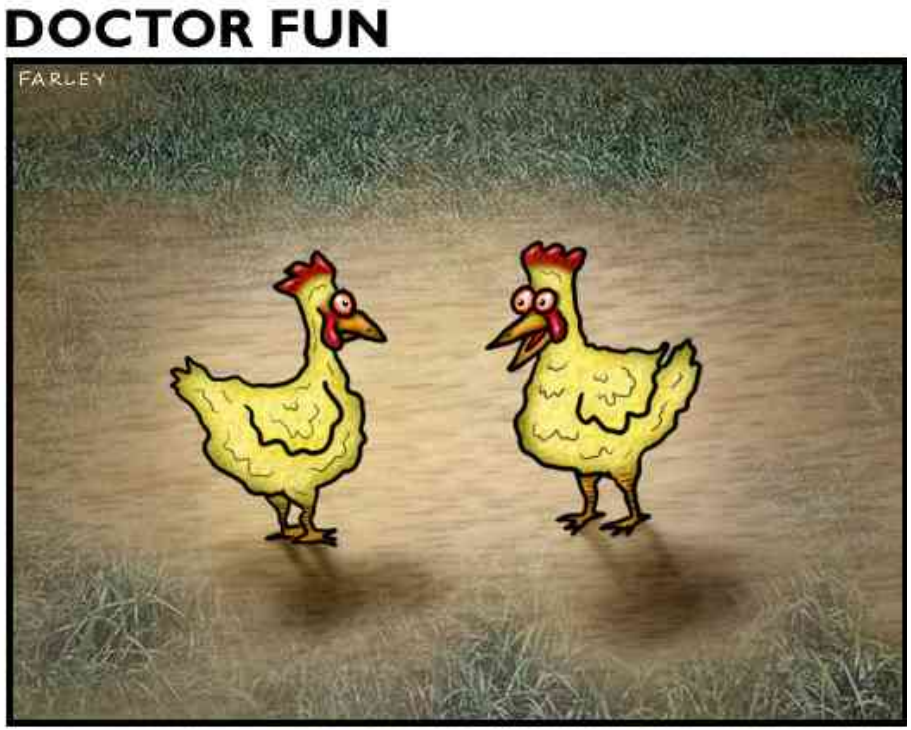

Degernating
corpus luteum

Which color represents which hormones?



Menopause

- Occurs at around ~50
- **Ova stop being produced**
- Ovaries and follicles **don't produce estrogen and progesterone**
- **Symptoms**: hot flashes, joint pain and decreasing bone mass(osteoporosis)
- **Hormone replacement therapy** – women are given low doses of estrogen (some progesterone)
  - But this has many possible side effects:
    - Possible cancer
    - Appetite and weight changes
    - Cramps or bloating etc,etc, etc..



"Menopause is easy - after you stop laying eggs, they eat you."