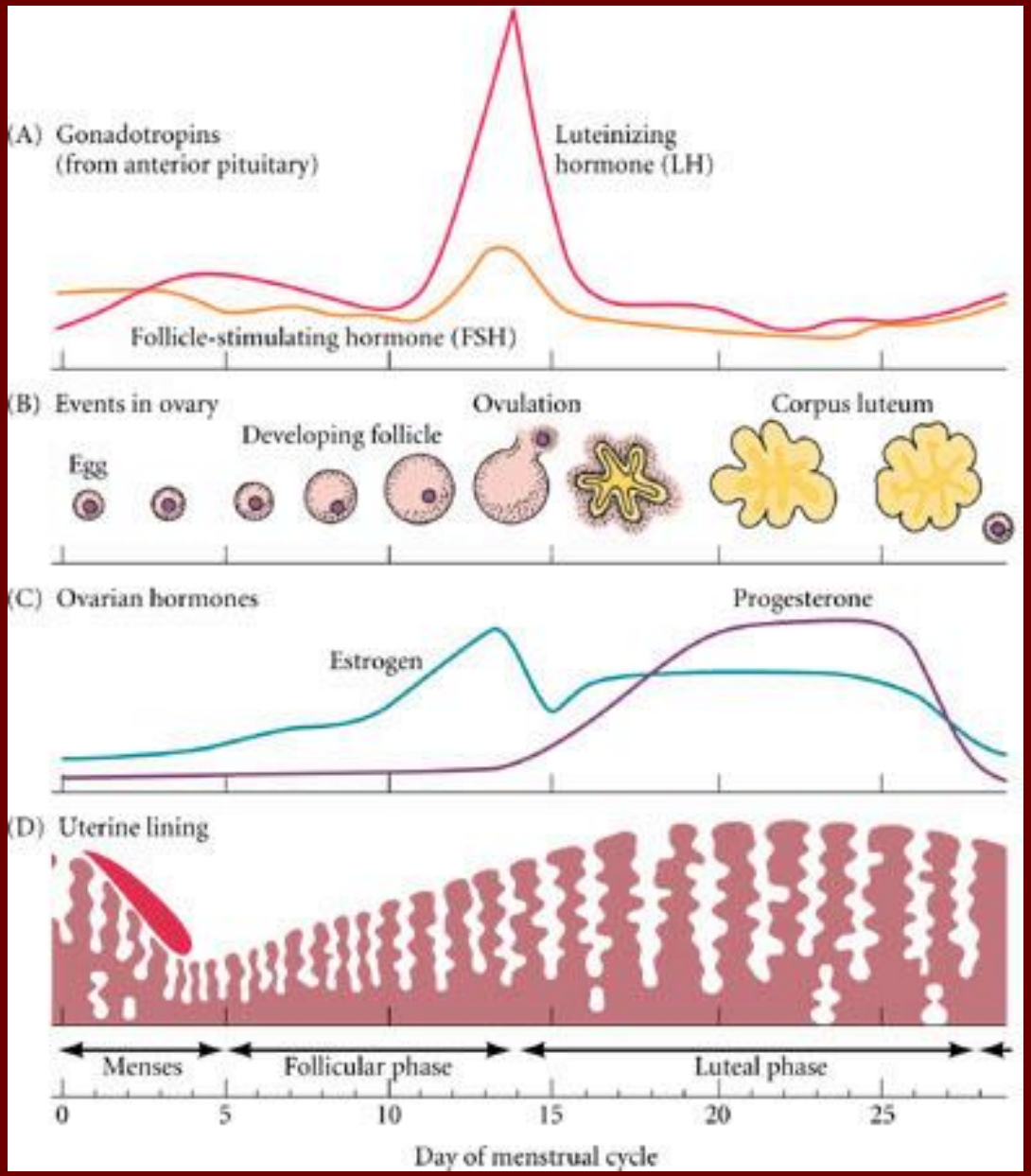
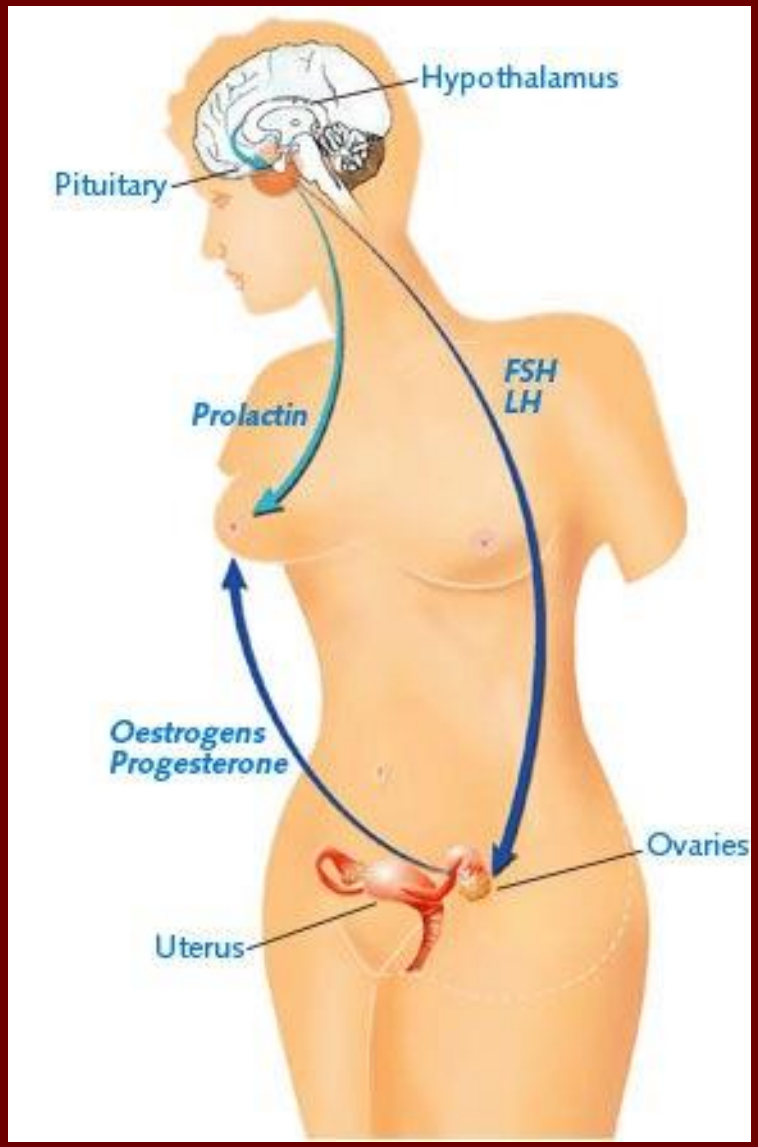
King Saud University Medical City
Department of Obstetrics & Gynecology
Course 482

Physiology of Menstrual Cycle & ovulation

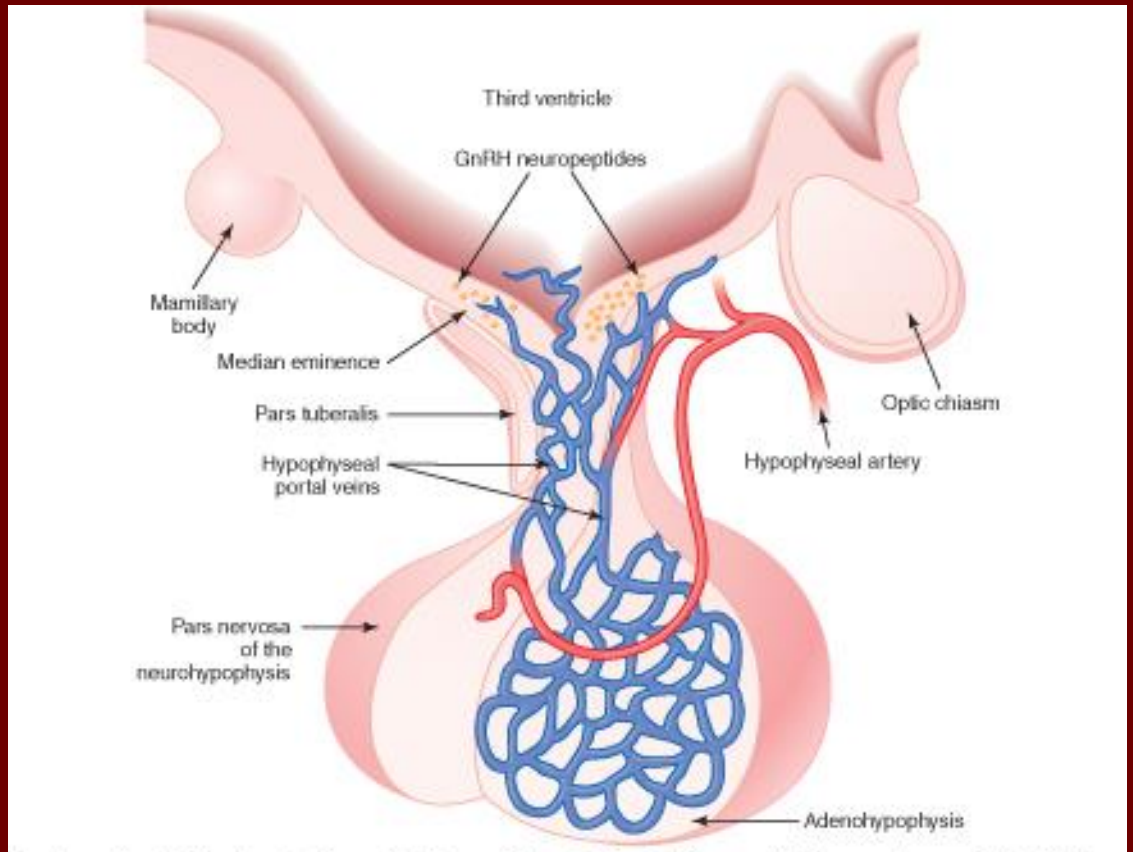
Menstrual Cycle

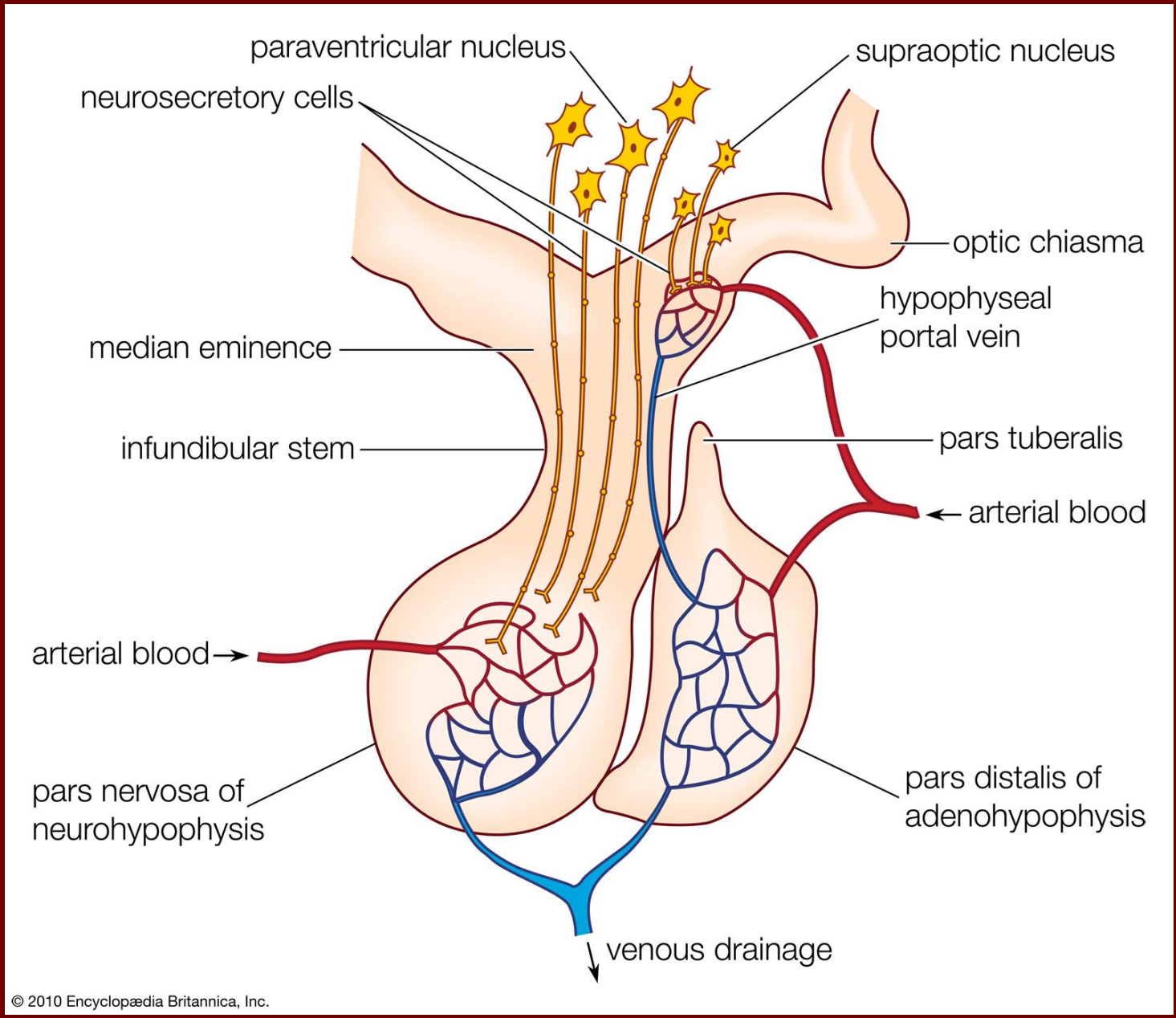
- Complex interactions among hypothalamus, pituatary gland , ovaries & endometrium
- Ovary: functional & morphologic changes resulting in follicular maturation, ovulation and corpus luteum formation
- Endometrium: functional and morphologic changes, either to prepare it for conception or shedding of the menstrual endometrium

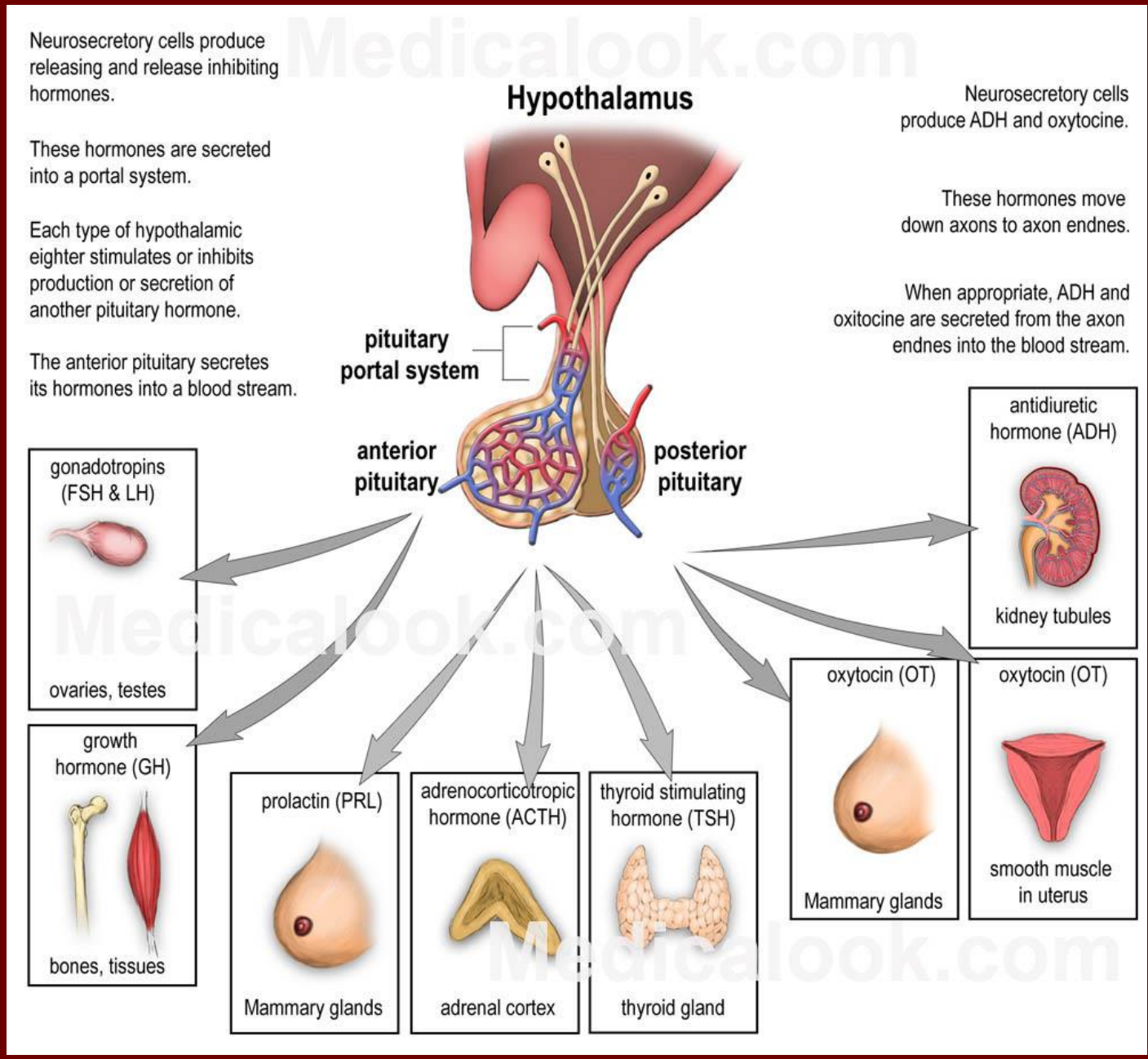

(A) Gonadotropins
(from anterior pituitary)
Luteinizing
hormone (LH)
Follicle-stimulating hormone (FSH)
(B) Events in ovary
Egg
Developing follicle
Ovulation
Corpus luteum
(C) Ovarian hormones
Progesterone
Estrogen
(D) Uterine lining
Menses
Follicular phase
Luteal phase
0
5
10
15
20
25
Day of menstrual cycle


Hypothalamus
Pituitary
FSH
LH
Prolactin
Oestrogens
Progesterone
Ovaries
Uterus

- Pituitary Gland:
  - Below the hypothalamus
  - within a bony cavity (sella turcica)
  - above it, dura matter (diaphragma sellae)
  - divided into 2 portions



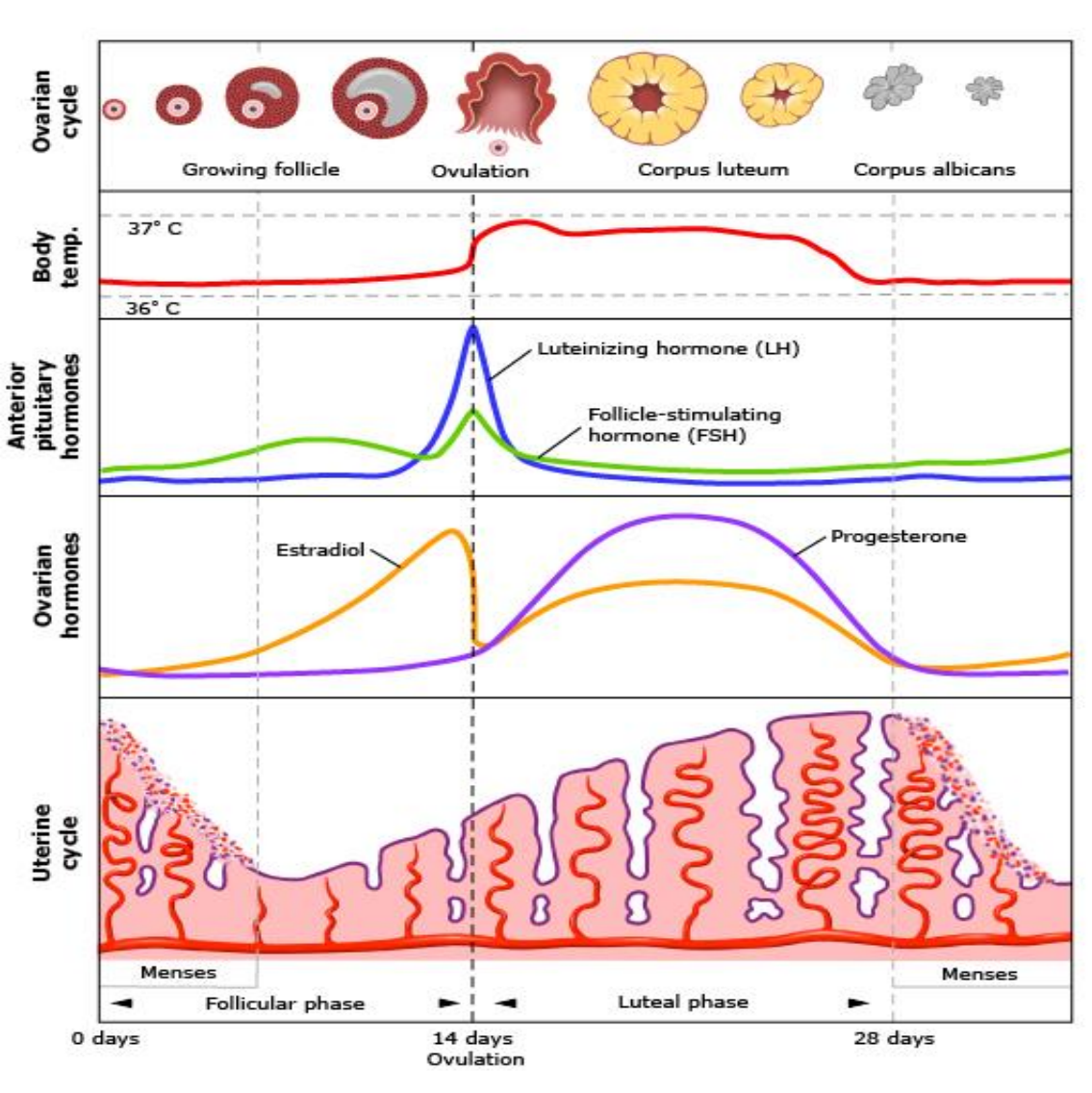


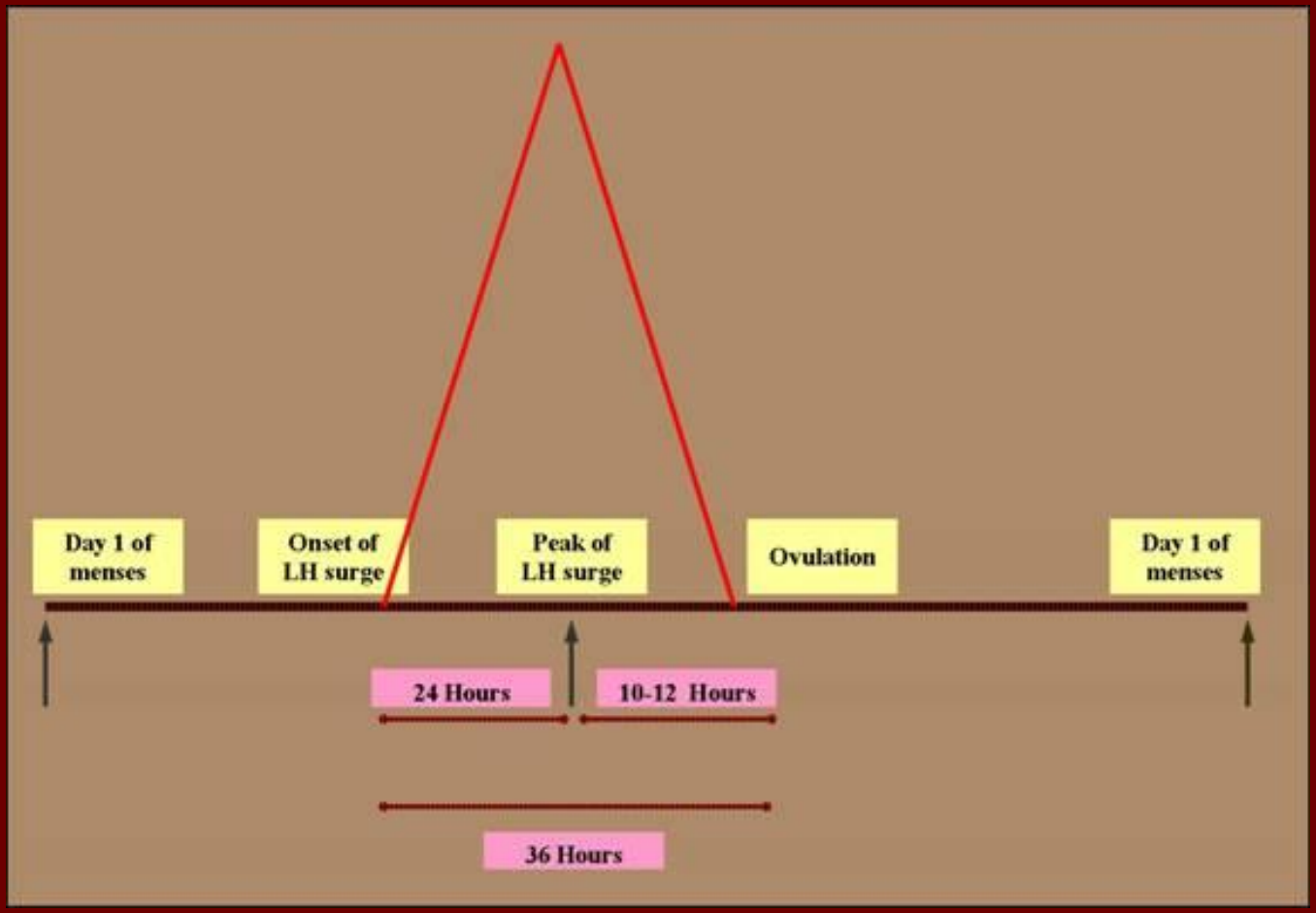

Neurosecretory cells produce releasing and release inhibiting hormones.
These hormones are secreted into a portal system.
Each type of hypothalamic eighter stimulates or inhibits production or secretion of another pituitary hormone.
The anterior pituitary secretes its hormones into a blood stream.
Hypothalamus
Neurosecretory cells produce ADH and oxytocine.
These hormones move down axons to axon endnes.
When appropriate, ADH and oxitocine are secreted from the axon endnes into the blood stream.
pituitary portal system
anterior pituitary
posterior pituitary
gonadotropins (FSH & LH)
ovaries, testes
growth hormone (GH)
bones, tissues
prolactin (PRL)
Mammary glands
adrenocorticotropic hormone (ACTH)
adrenal cortex
thyroid stimulating hormone (TSH)
thyroid gland
antidiuretic hormone (ADH)
kidney tubules
oxytocin (OT)
Mammary glands
oxytocin (OT)
smooth muscle in uterus

Pituitary Gland

- FSH and LH: synthesized and stored in gonadotrophs
  - glycoproteins: alpha and beta subunits
  - alpha: similar (FSH, LH and TSH)
  - beta: variable
  - half-life: LH: 30 min, FSH: several hrs

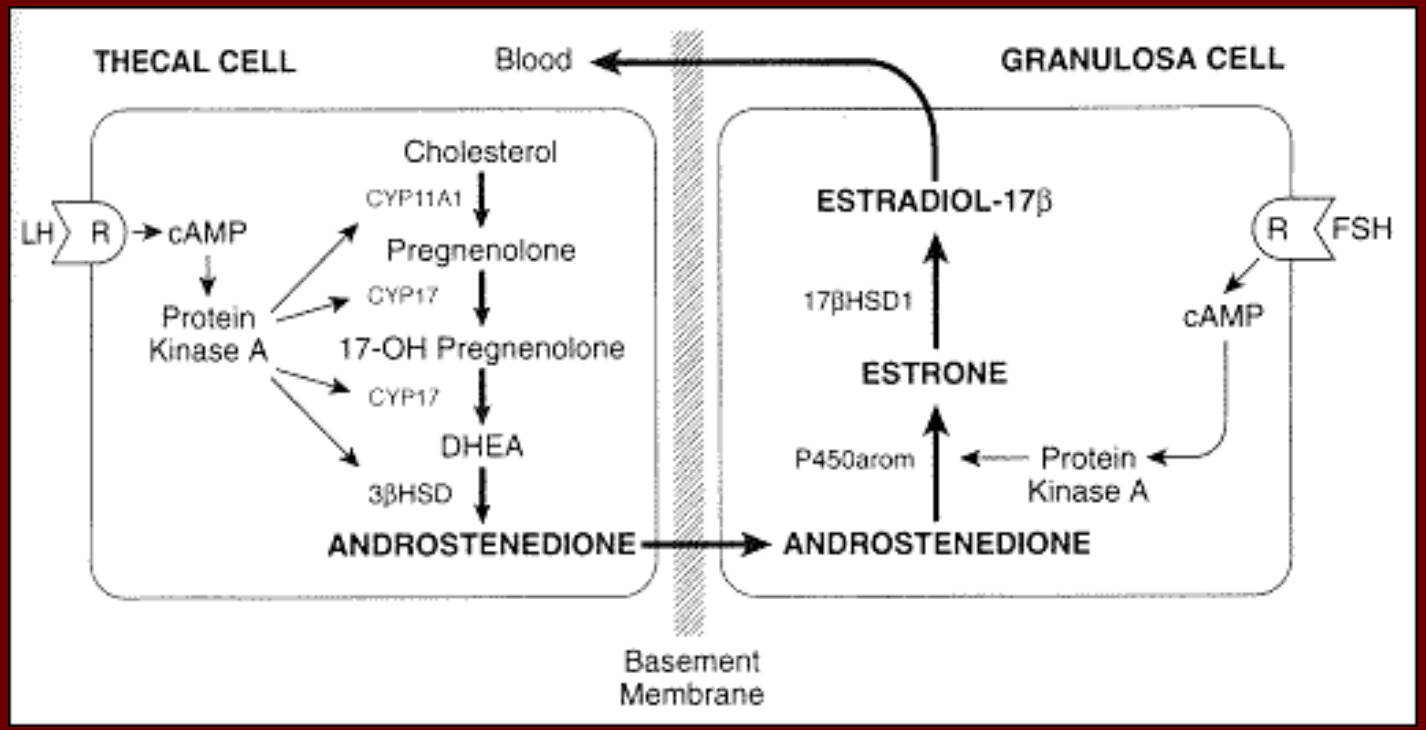
Gonadotropin Secretory patterns



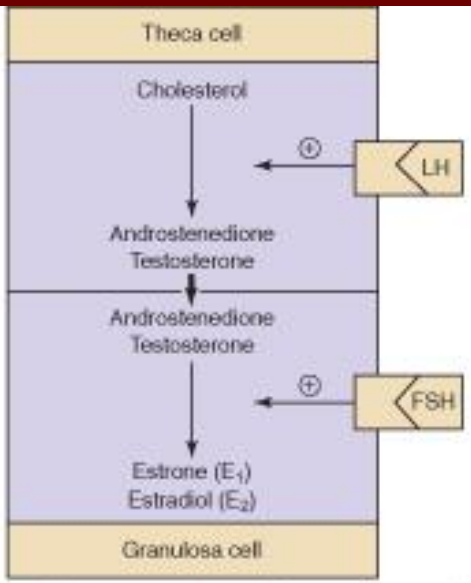

Day 1 of menses
Onset of LH surge
Peak of LH surge
Ovulation
Day 1 of menses
24 Hours
10-12 Hours
36 Hours

Steroidogenesis

- Two gonadotropin-two- cell theory



Two gonadotropin-two- cell theory



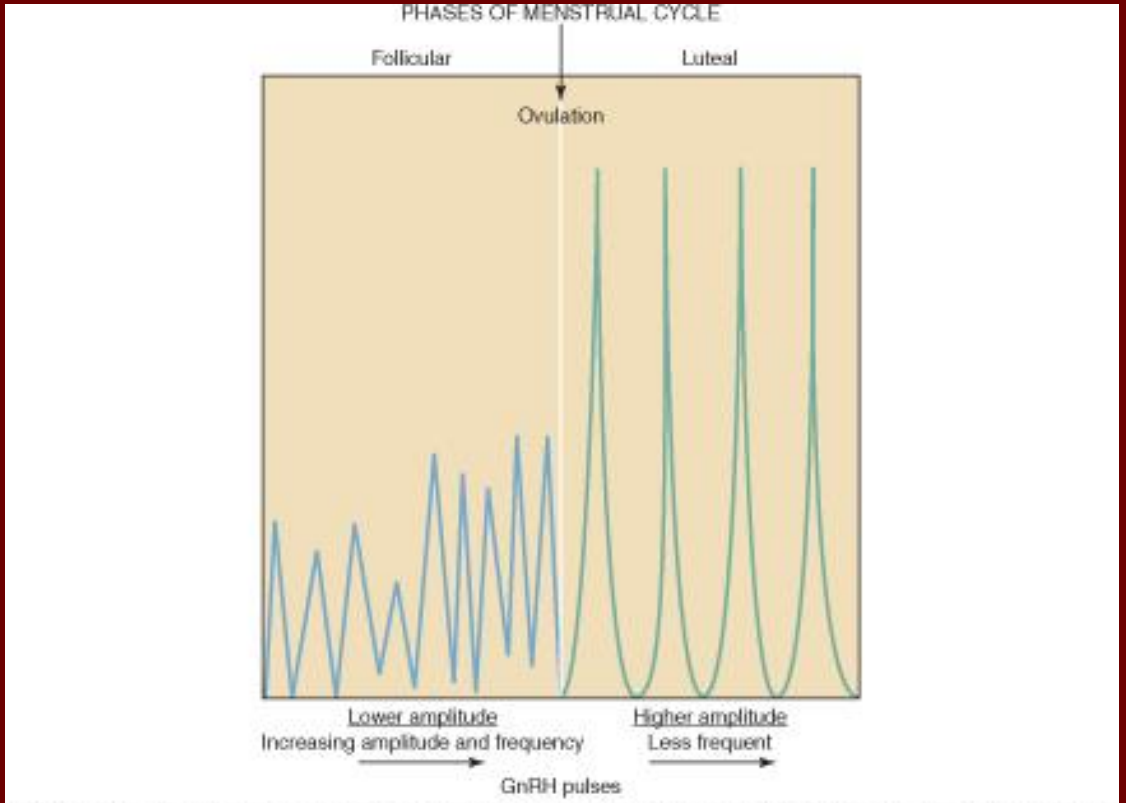
Hypothalamus

- GnRH: decapeptide
- In the arcuate nucleus
- Responsible for the synthesis and release of FSH & LH
- Reaches anterior pit via hypophyseal portal vessels
- Its receptors are present in other sites beside pituitary gland e.g., ovary

GnRh

- Secreted in a **pulsatile** fashion
  - early follicular phase: Q 90 mins
  - preovulatory: Q 60-70 mins
  - luteal: variable
- Continuous → downregulation/desensitization
  - GnRh agonist: endometriosis, fibroids, hirsutism

GnRh release pattern



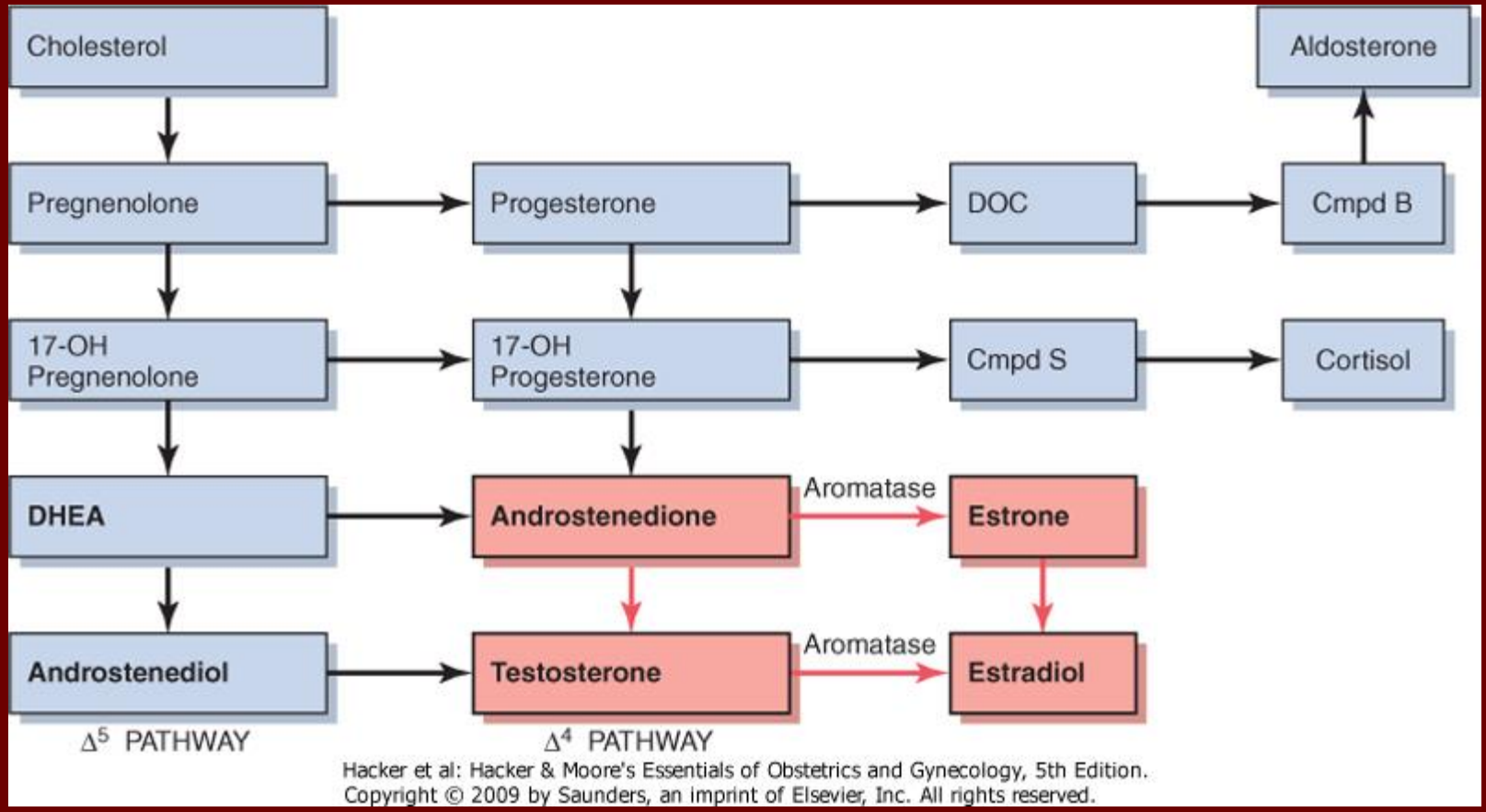
Ovarian Cycle

- Estrogens:

  - gradually increase during follicular phase

  - remember: 2 gonadotropin-two - cell theory

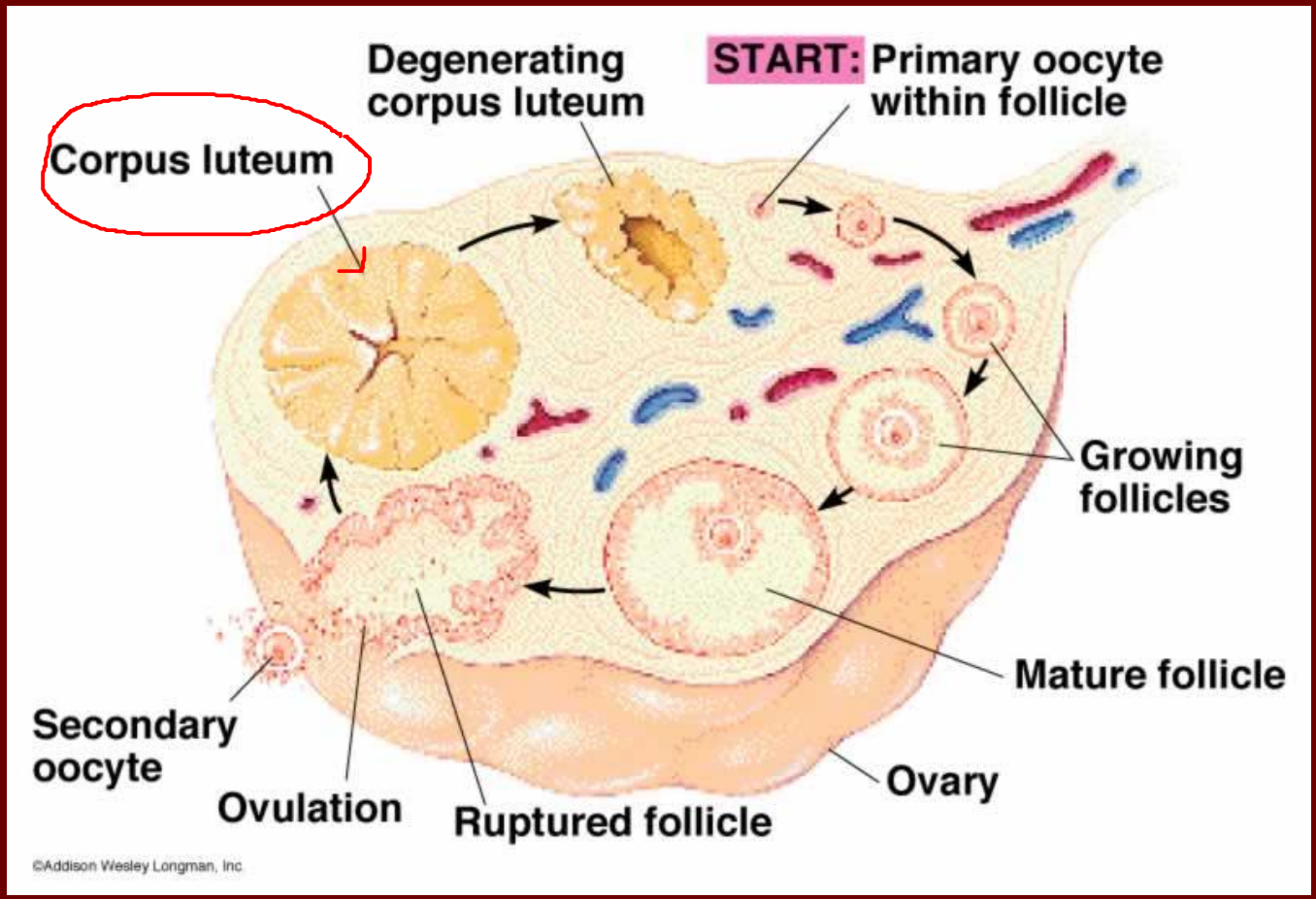
Steriodogenic pathways in the ovary



Progestins

- Follicular phase: very little from the ovary
- The bulk: peripheral conversion of adrenal pregnenolone and P sulfate
- High production: after ovulation/ CL
- Corresponds with ↑ basal body temperature
- Max: 5-7 days after ovulation

Follicular development



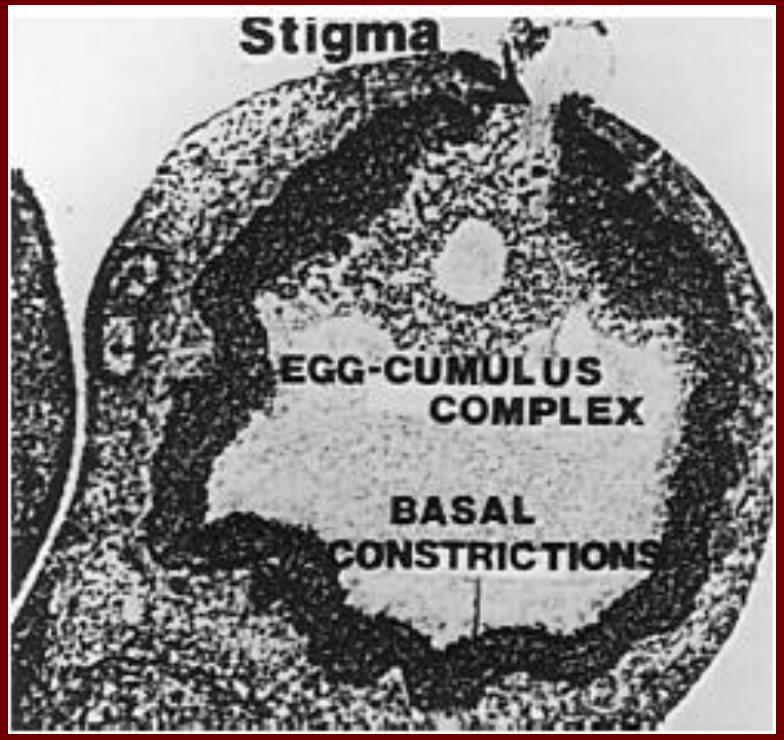
Follicular development

- Primordial follicle
- Primary follicle
- Secondary follicle
- Cohort of follicles is recruited each cycle
- Only one continues differentiation and maturation
- Others: atresia
- Maturation depends on: FSH and LH receptors

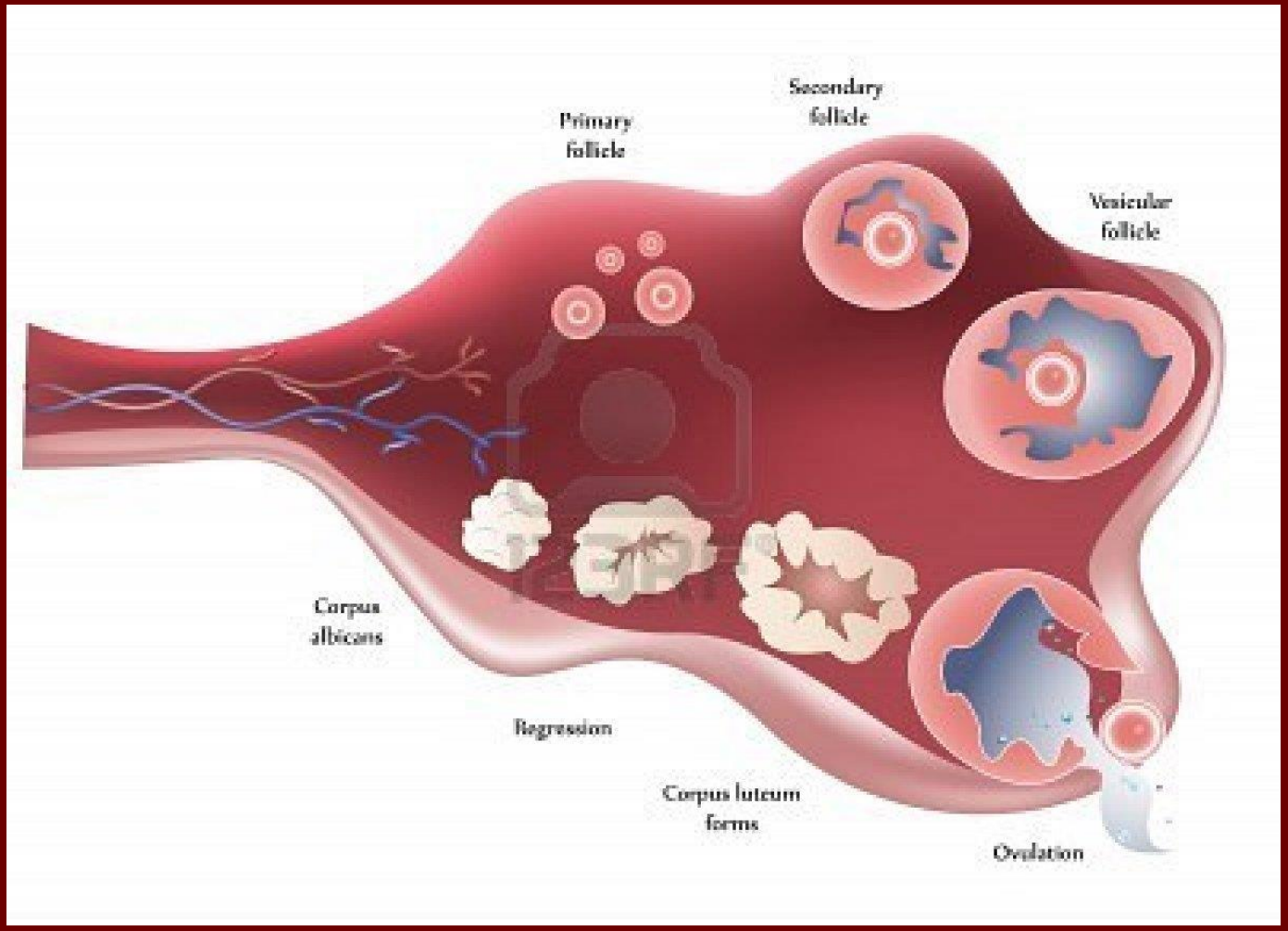
Ovulation

- Most important event: LH surge
- Proteolytic enzymes → dissolution of follicular wall
- Stigma formation
- Ovulation: rupture of the stigma
- Oocyte + corona radiata + cumulus cells
- Gradual: several minutes → an hour

Ovulation



Ovulation


Primary follicle
Secondary follicle
Vesicular follicle
Corpus albicans
Regression
Corpus luteum forms
Ovulation

Corpus luteum formation

- Lutenization of granulosa cells (LH)
- CL: luteinized GC + theca cells + capillaries + connective tissue
- Major source of ovarian progesterone
- Lives 9-10 days if no pregnancy
- It gradually regresses → corpus albicans

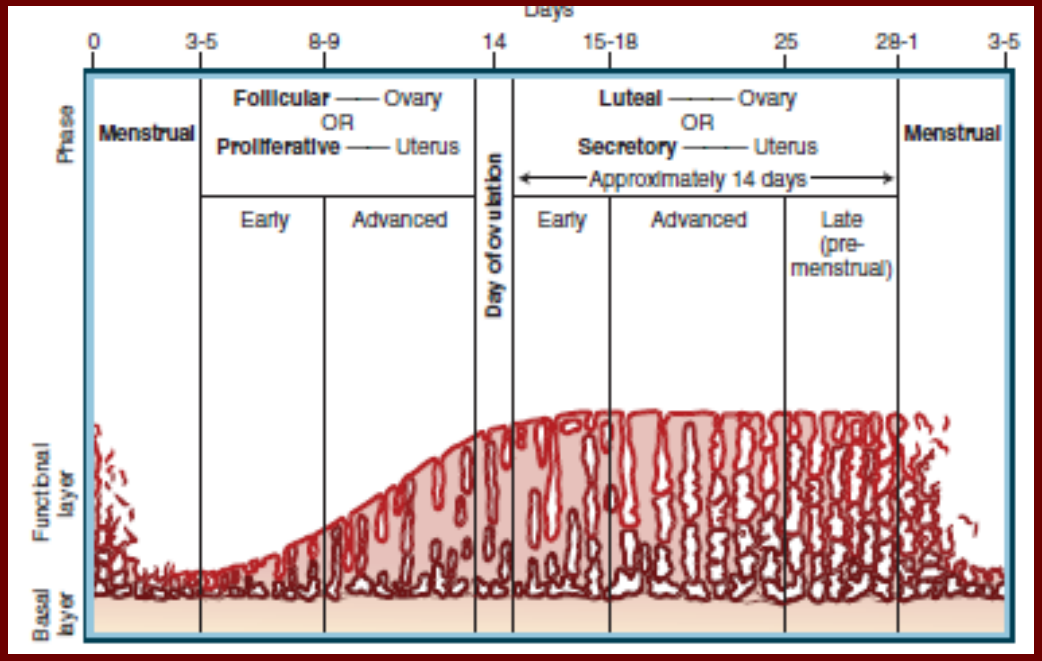
Endometrial physiology

- Responsive to E, P and A
- Results in: menstruation,?Implantation /pregnancy
- 2 zones:

  1- functional layer (outer)

  2- basal layer (inner)

Histophysiology of the Endometrium



1- Menstrual phase: disruption of endometrial tissues, WBC infiltration, RBCs extravasation

2- Proliferative phase: E-induced proliferation

3- Secretory phase: P- induced secretion of glycogen, mucus & other substances