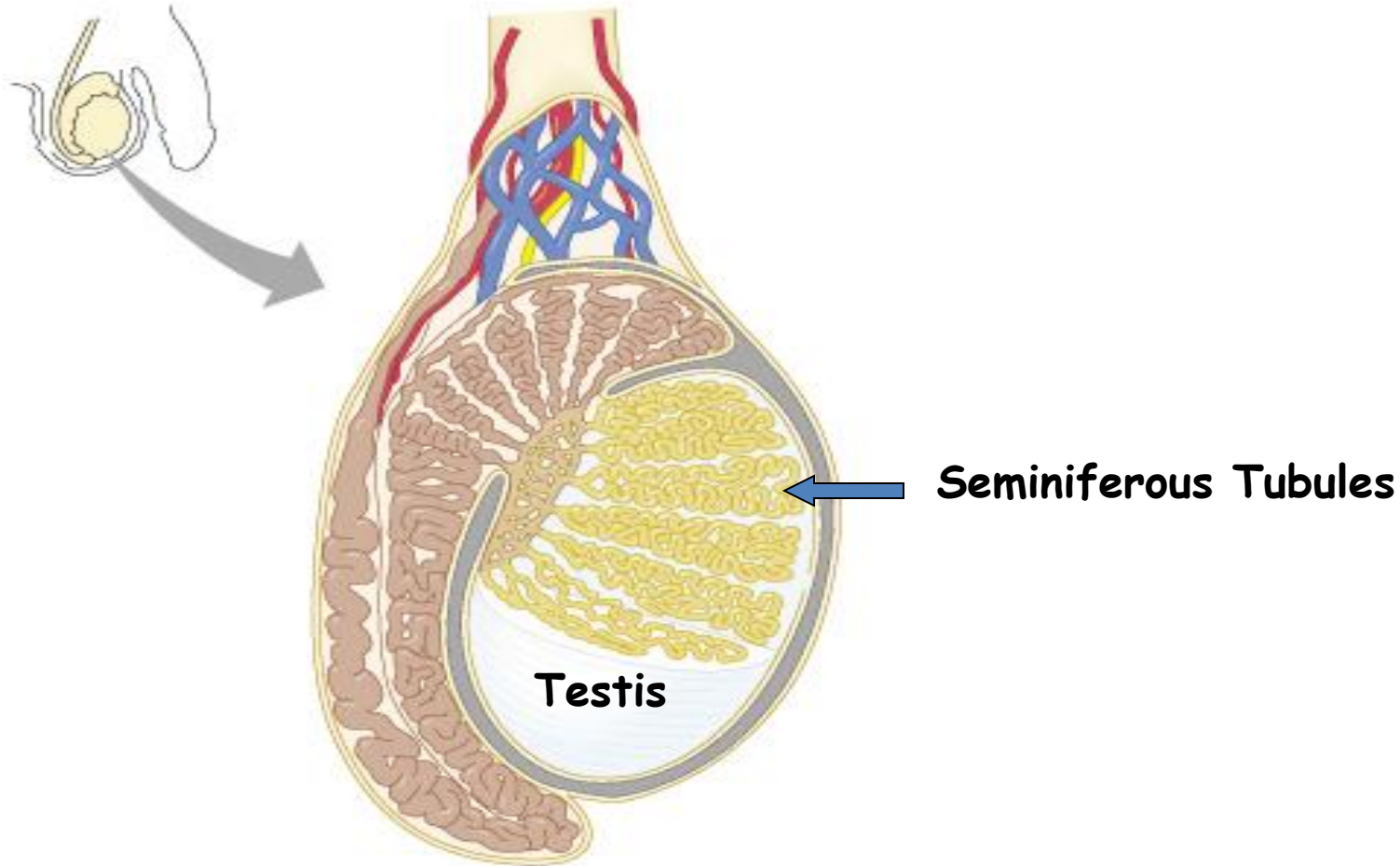


Reproductive System

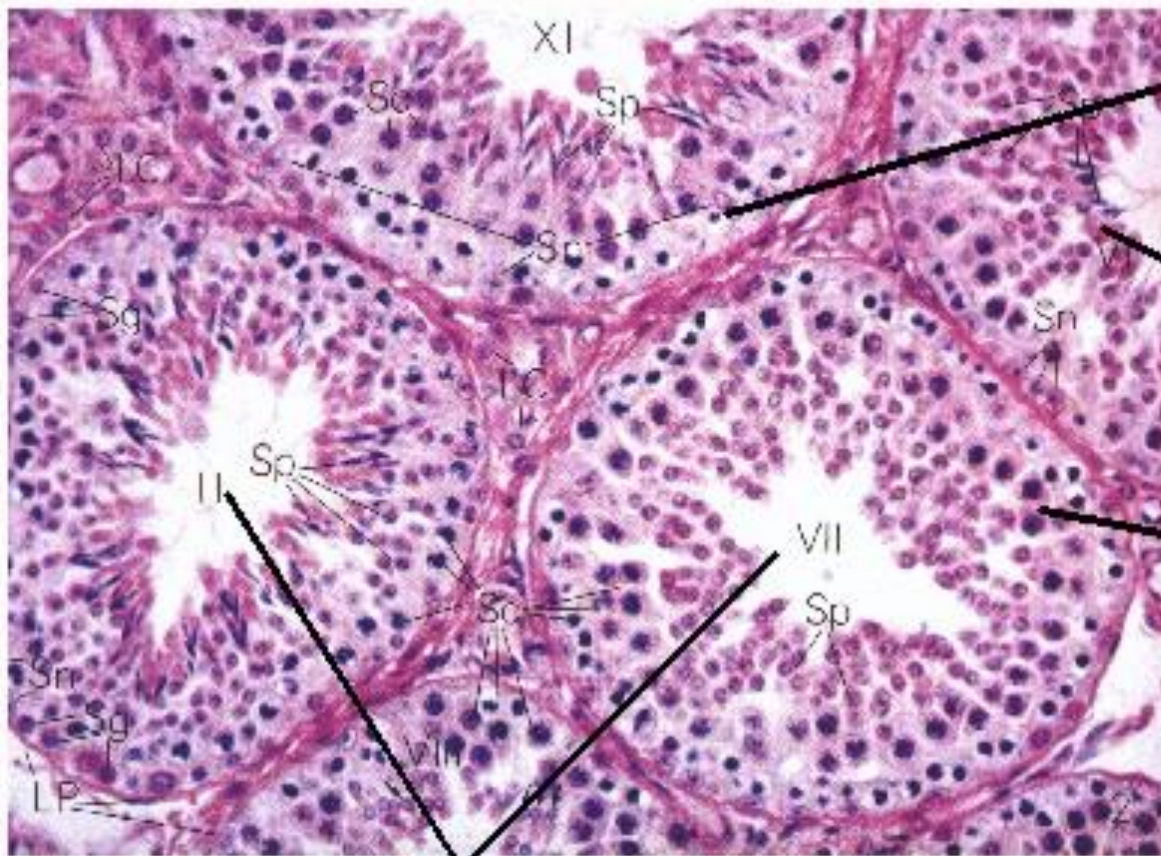
Function: Produce Sperm



(a)

Testis Cross Section

Seminiferous Tubules



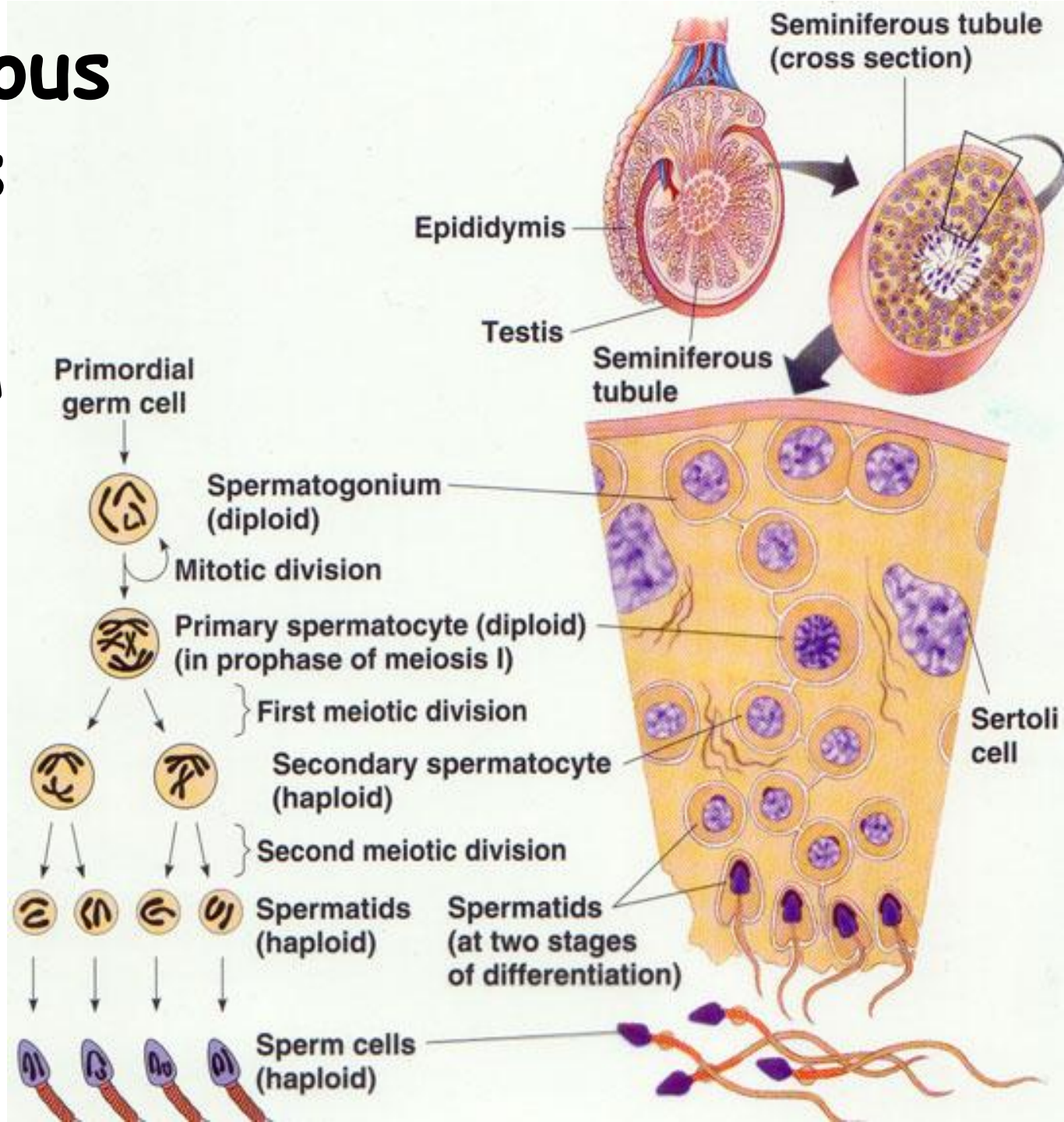
Sustentacular cells

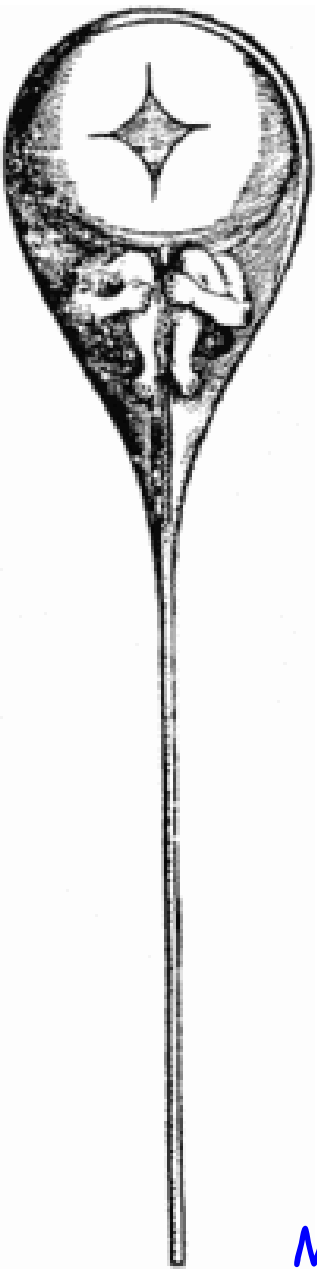
spermatids

spermatocytes

Seminiferous tubules

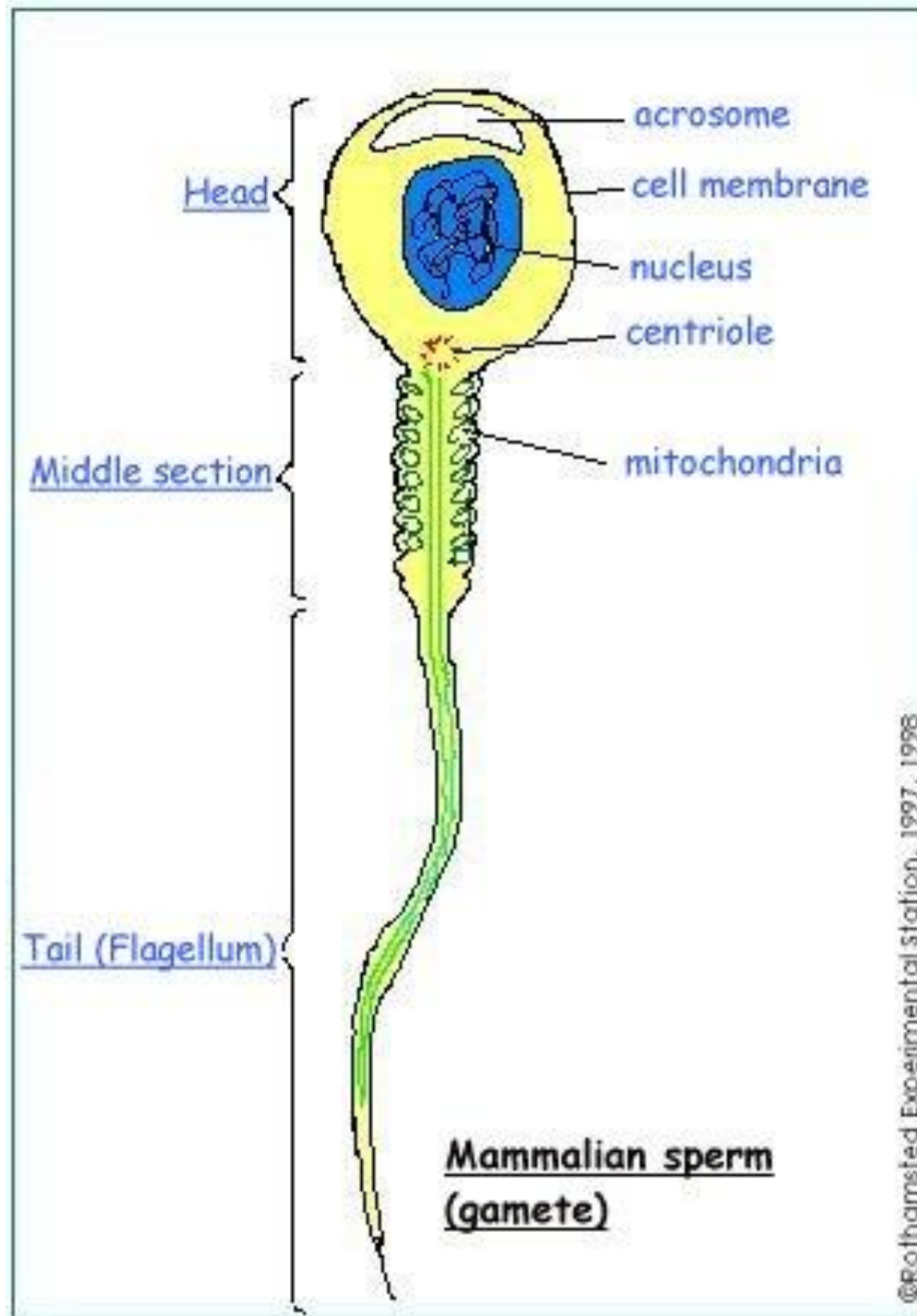
Seminiferous Tubules Cross Section



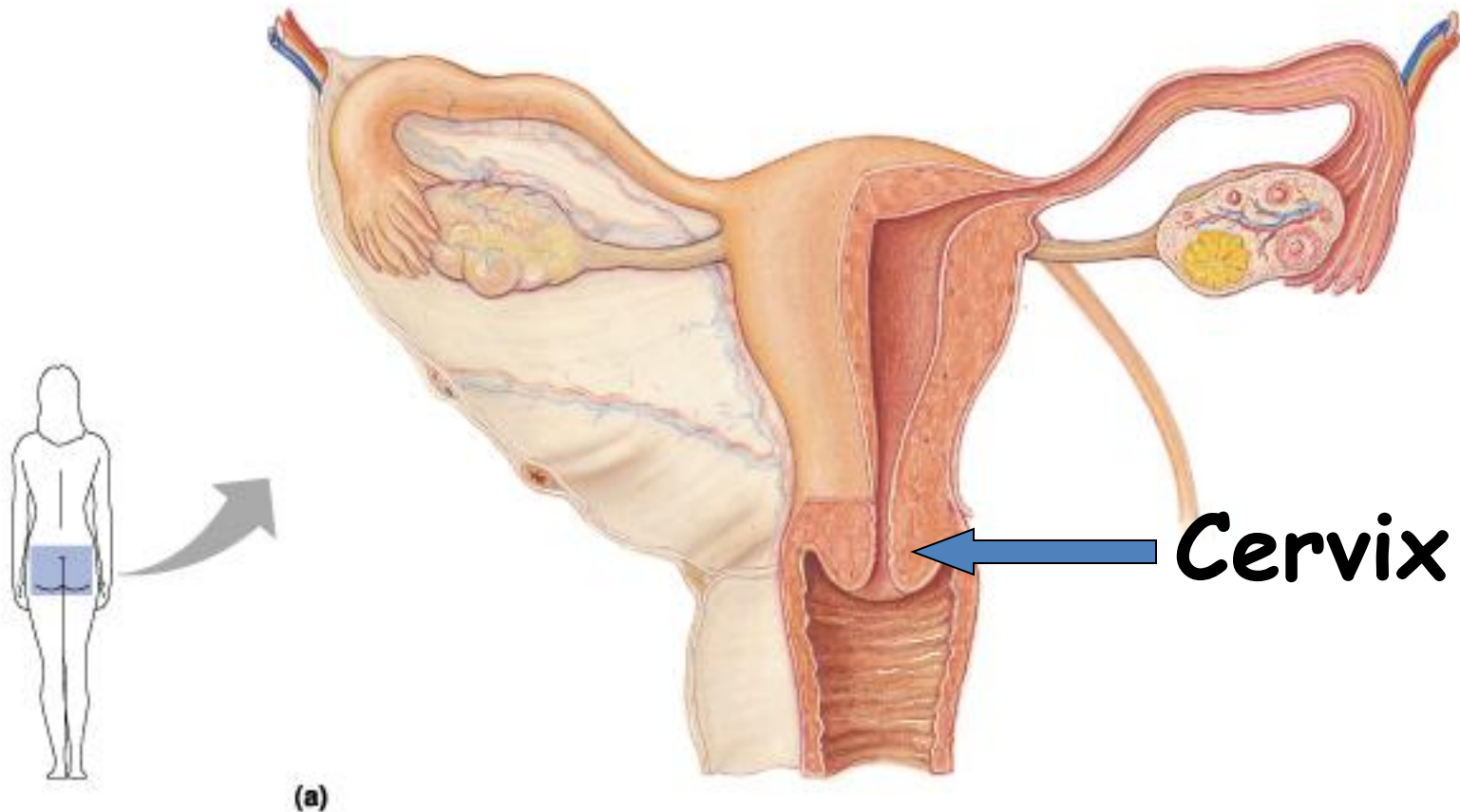


Meet Greg the Sperm

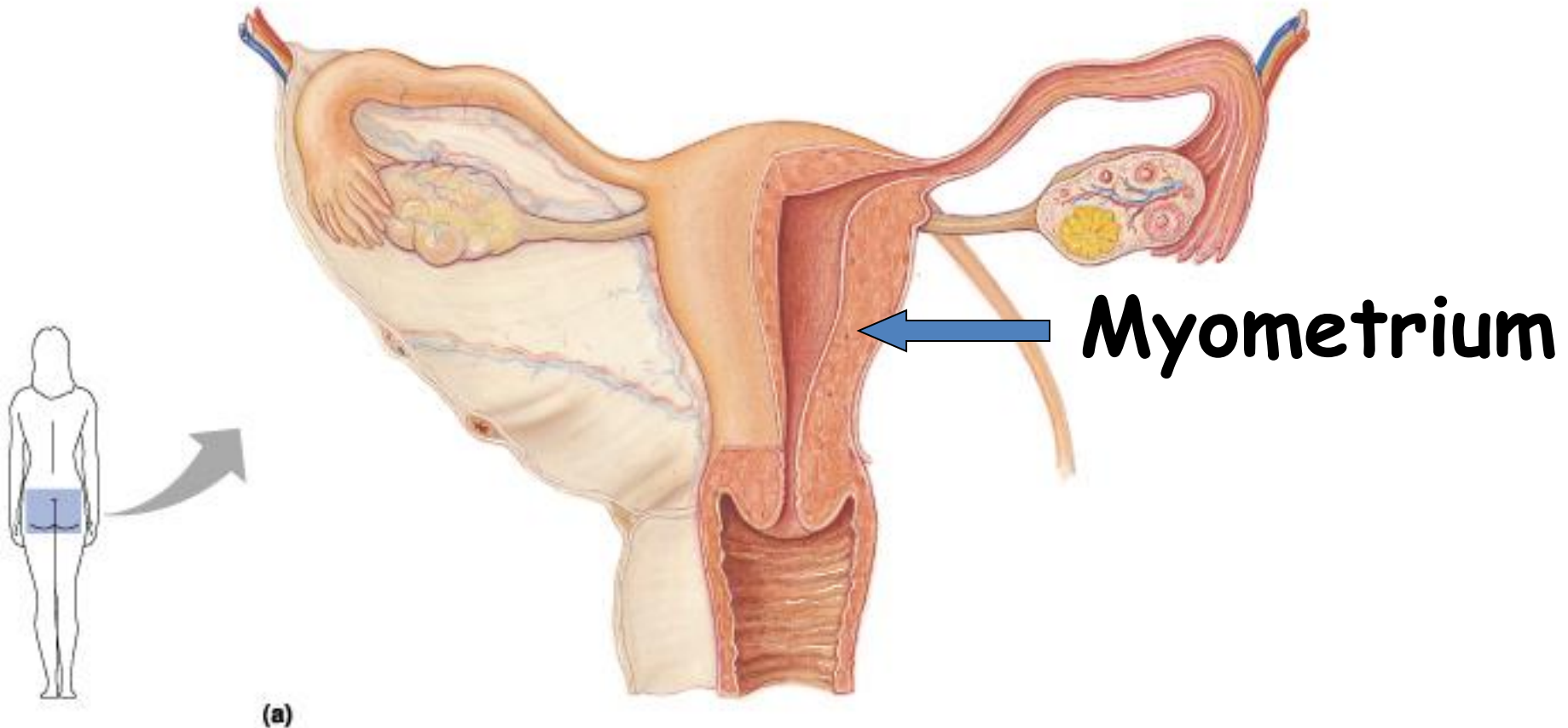
VS.



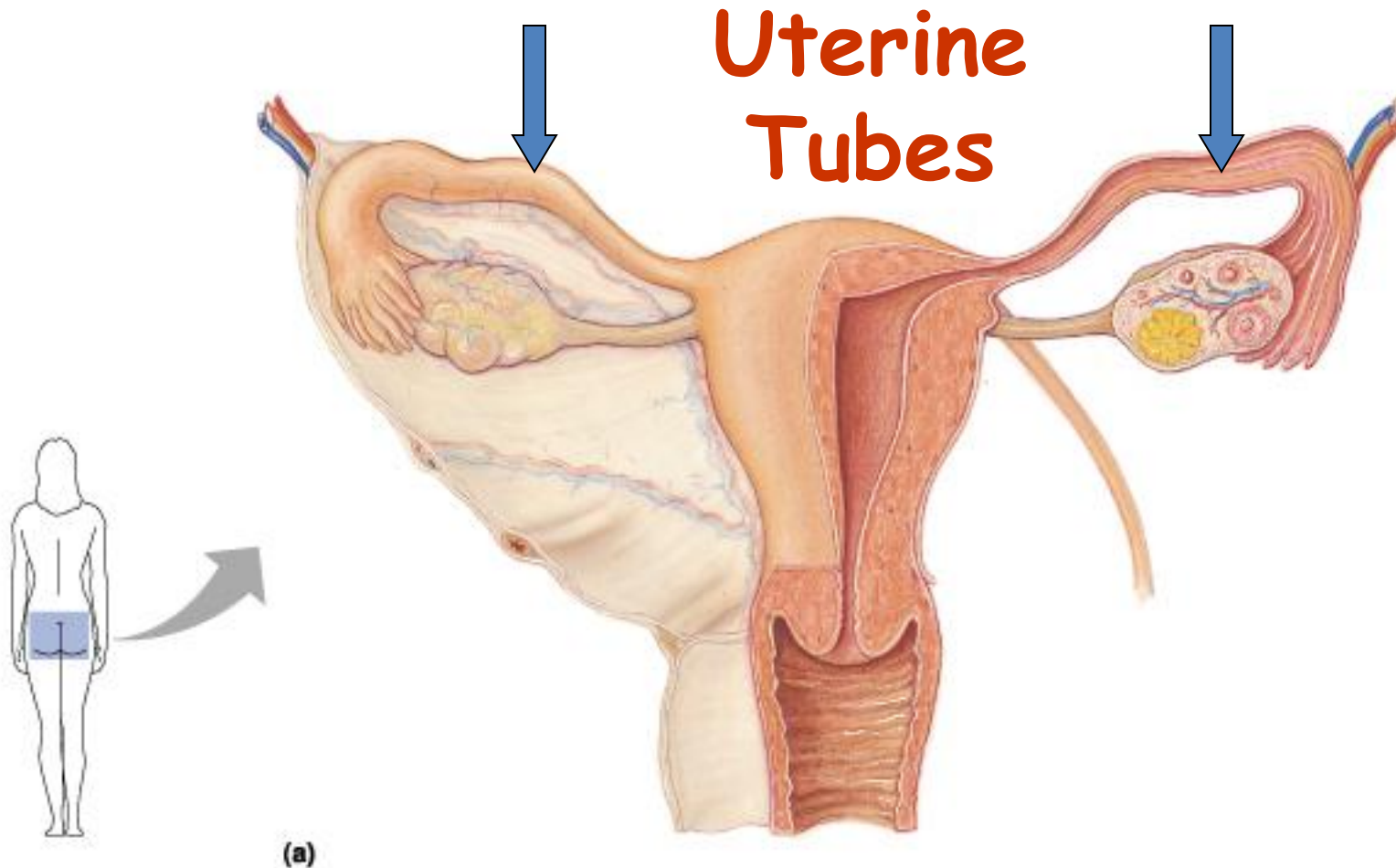
Function: Cervical mucosa secretes mucous blocking cervical canal entrance to uterus.



Function: Muscular contractions.



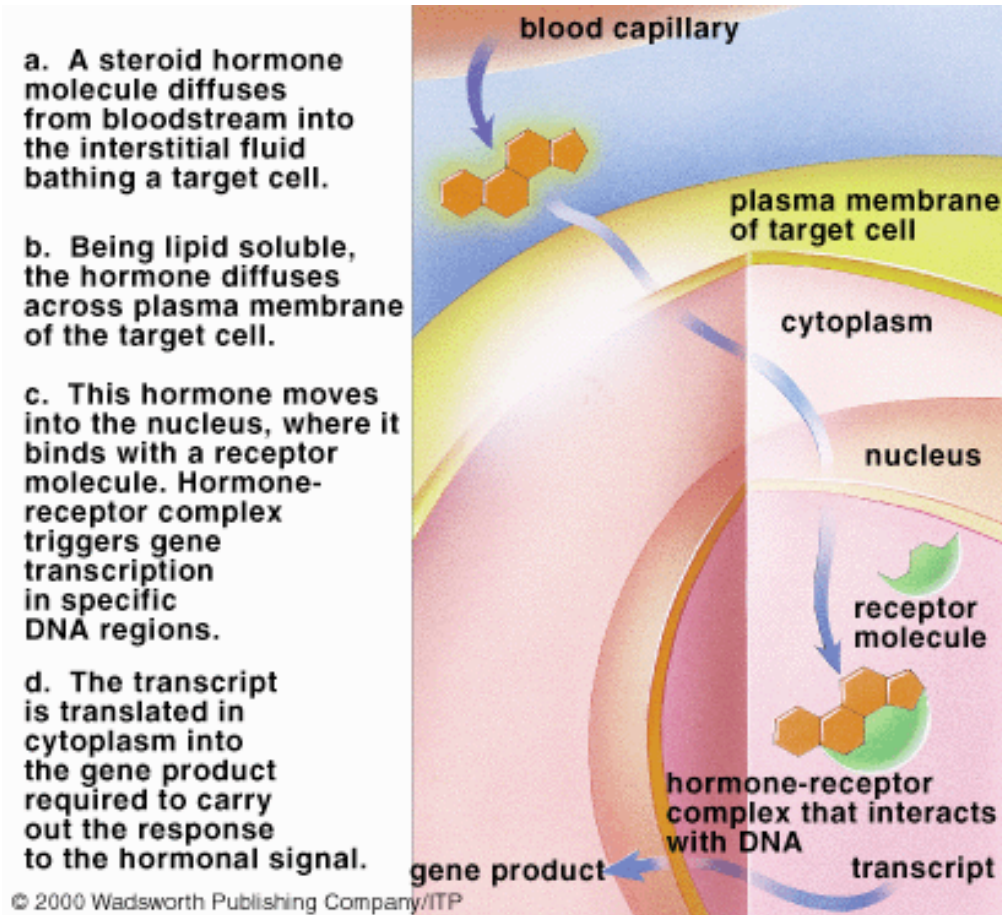
Function: Passageway for oocyte and site of fertilization.



(a)

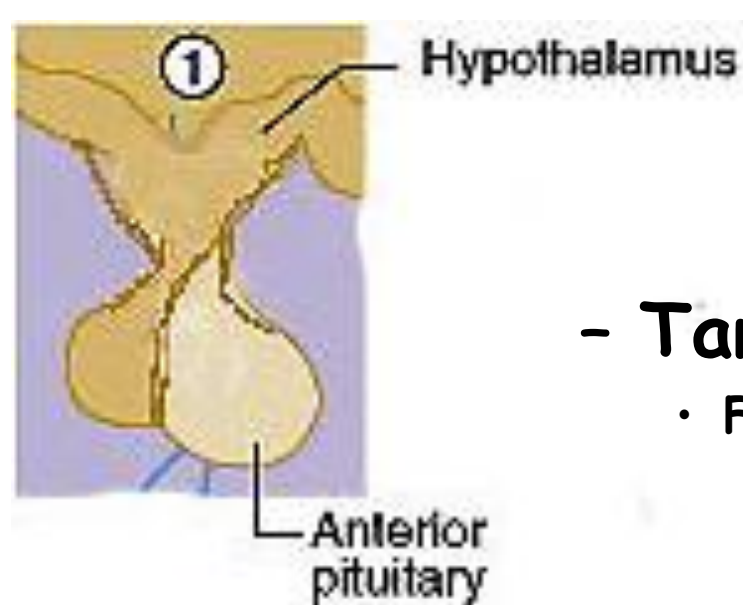
Mechanisms of Hormonal Action

- Direct Gene Activation
 - lipid soluble, steroid hormones
 - diffuse through cell membranes
 - bind to intracellular receptor
 - activated hormone receptor/complex binds with gene, turning it on
 - gene transcribes mRNA
 - ribosomes use mRNA to synthesize enzymes to stimulate cell activity or synthesize structural proteins to be excreted or used within the cell



Hormone Sources & Functions

- **Gonadotropin-releasing Hormone (GnRH):**
 - Source: **Hypothalamus**

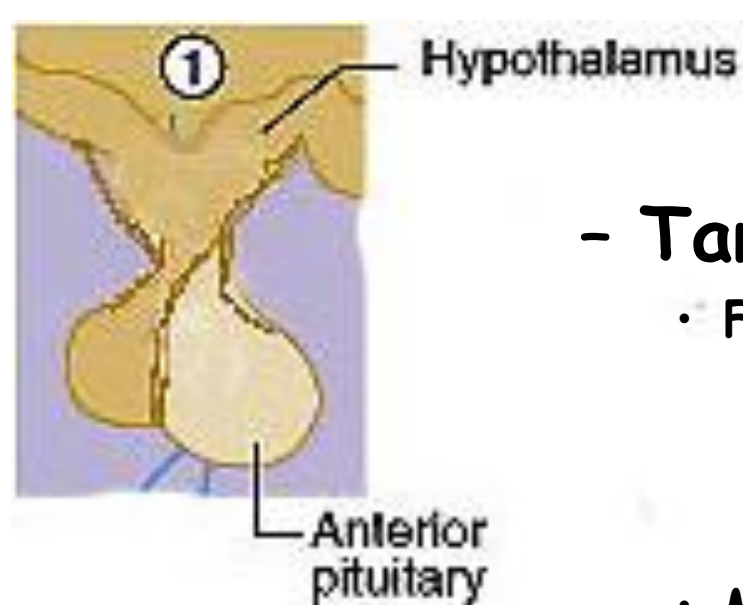


- Targets & Functions:

- Females & Males - **Anterior Pituitary**
 - Stimulates the production of Follicle Stimulating Hormone (**FSH**) & Leutinizing Hormone (**LH**)
 - Regulates the release of **FSH** & **LH** by the anterior pituitary gland

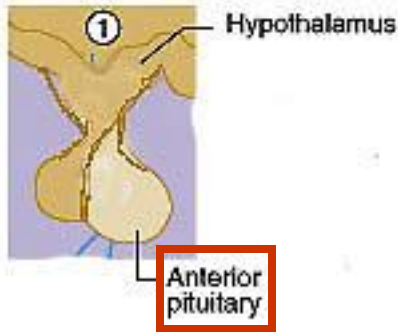
Hormone Sources & Functions

- Follicle Stimulating Hormone:
 - Source: **Anterior Pituitary**



- Targets & Functions:
 - Females - **Ovaries**
 - Stimulates follicle growth & maturation
 - Stimulates estrogen production
 - Males - **Seminiferous Tubules**
 - Promotes sperm production (Spermatogenesis) by establishing testosterone receptors on tubules

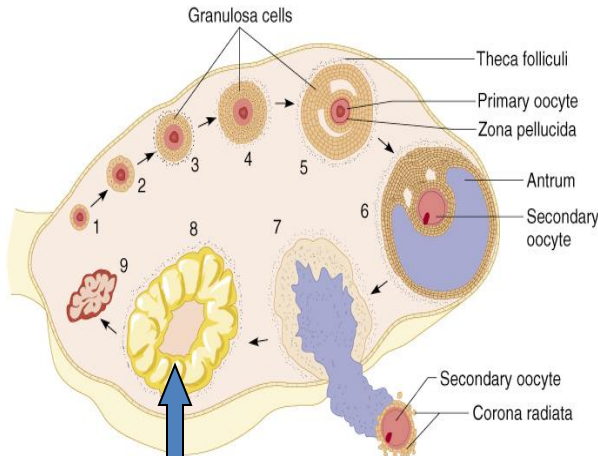
Leutenizing Hormone:



Source: **Anterior Pituitary**

- Targets & Functions:

- Females - **Ovaries**
 - Stimulates primary oocyte to complete first meiotic division to become secondary oocyte
 - Triggers ovulation of secondary oocyte
 - Transforms ruptured follicle into corpus luteum
 - Stimulates production of progesterone by corpus luteum
- Males - **Seminiferous Tubules**
 - Stimulates sperm production (Spermatogenesis) by causing interstitial cells in testes to secrete testosterone

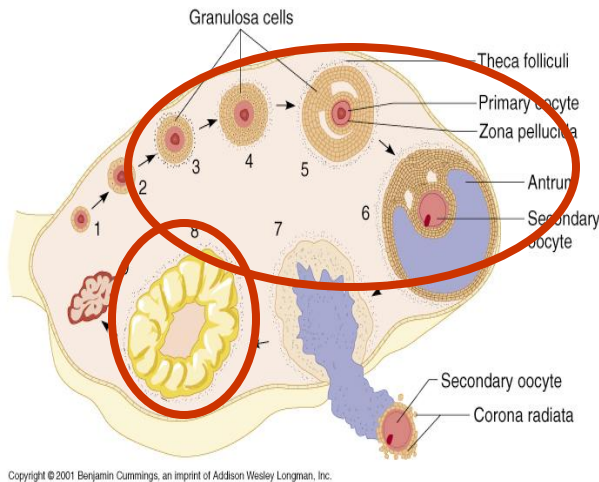


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Corpus luteum

Estrogen:

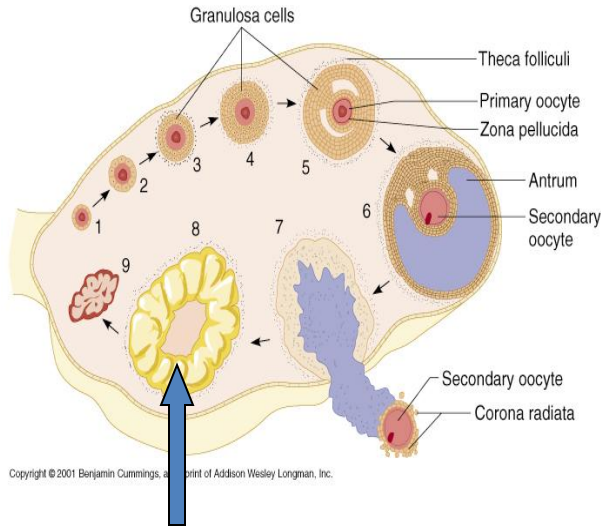
- **Sources:** **Maturing Follicles & Corpus Luteum**
 - **Targets & Functions:**



- **Body in general**
 - Stimulates the development of female secondary sexual characteristics
- **Uterus**
 - Stimulates proliferative phase of uterine cycle
- **Ovaries**
 - Promotes oogenesis
- **Breasts**
 - Stimulates development of milk ducts and sinuses (ampullae)
- **Anterior Pituitary**
 - Stimulates burst-like release of LH

Progesterone:

- **Source: Corpus Luteum & Placenta**



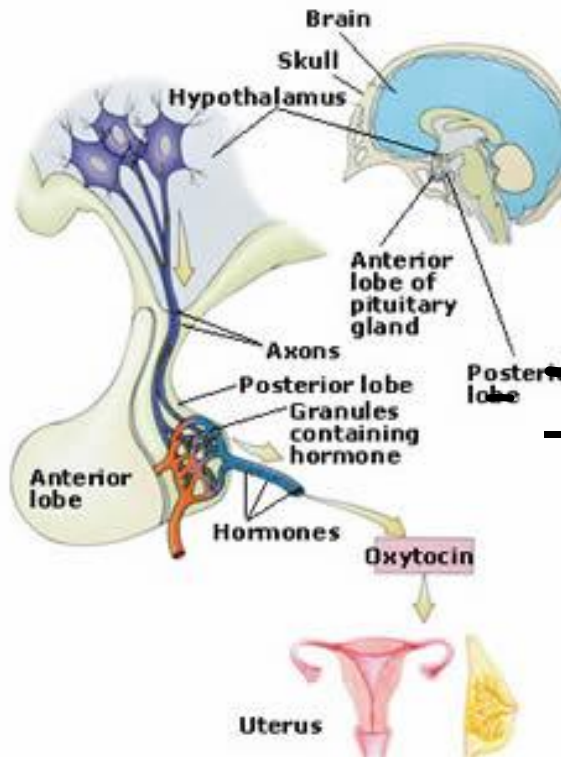
Corpus luteum

Targets & Functions:

- Females - **Uterus**
 - Maintains thickened endometrium
 - Stimulates nutrient release
 - Quiets myometrium
- Females - **Breasts**
 - Stimulates development of alveoli for milk production
- Females - **Anterior Pituitary**
 - Inhibits production & release of FSH & LH

Oxytocin:

- Sources: Manufactured by hypothalamus. Stored & released by **Posterior Pituitary**



Positive Feedback Mechanisms:

1. Childbirth - Stretching of uterus and cervix
2. Suckling - Milk letdown reflex

Targets & Functions:

- **Uterus**
 - Stimulates contraction of uterine myometrium causing lowering of fetus & labor
- **Breasts**
 - Stimulates contraction of milk ducts and sinuses, releasing milk

Prolactin:

- Source: **Anterior Pituitary**

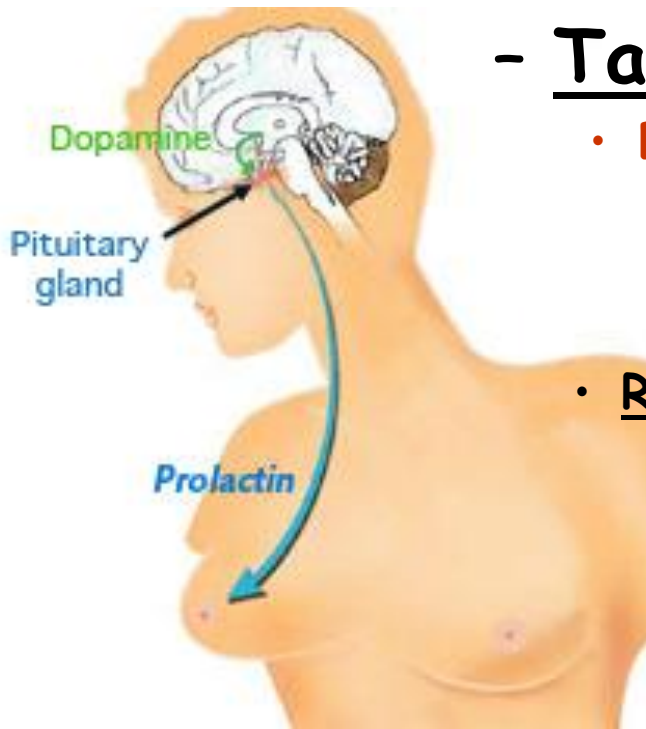
- Targets & Functions:

- **Breasts**

- Stimulates alveoli of breasts to produce milk

- Regulation

- Release of prolactin by anterior pituitary is regulated by hypothalamus production of Prolactin Releasing Hormone (PRH) & Prolactin Inhibiting Hormone (PIH)



Human Chorionic Gonadotropin:

- Source: Trophoblasts of blastocyst & Chorion

- Target & Functions:

- Corpus Luteum

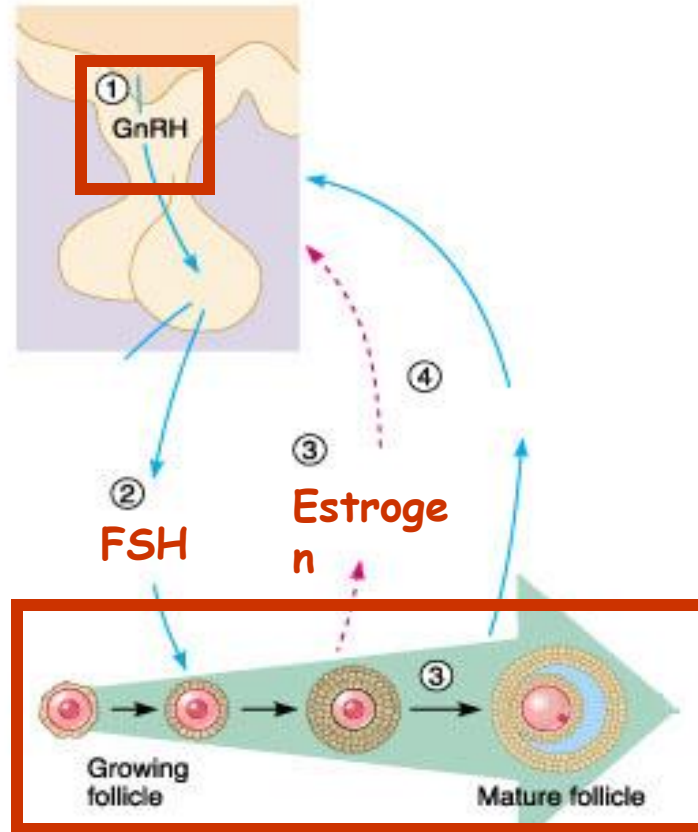
- Maintains corpus luteum & causes it to continue producing progesterone in the absence of LH through first four months of pregnancy till placenta produces sufficient estrogen & progesterone to maintain the pregnancy

Hormonal Regulation of Ovarian & Menstrual Cycles

1. Hypothalamus releases **GnRH**.

2. GnRH stimulates anterior pituitary to release **FSH**.

3. FSH stimulates a follicle to grow & produce **estrogen**.



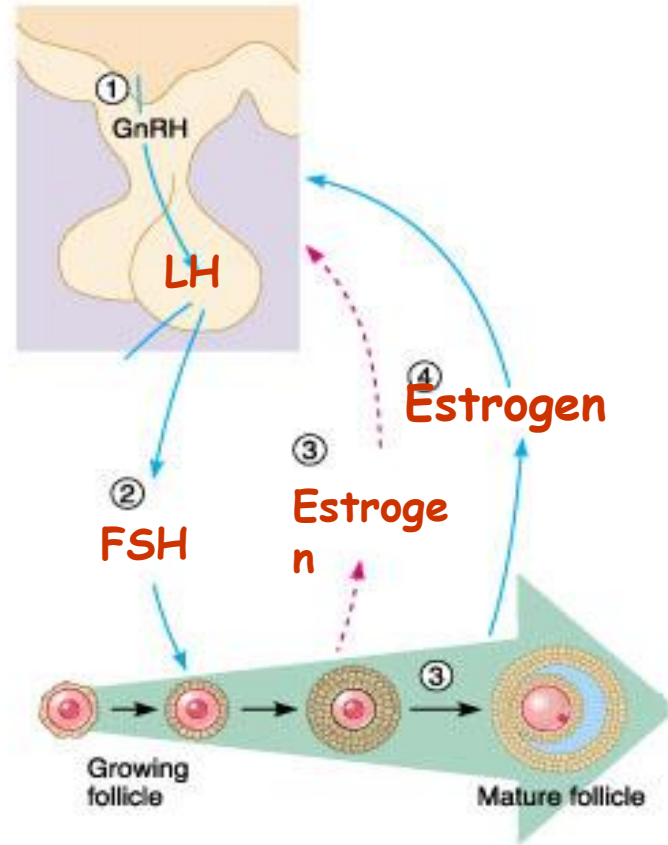
Key:

—> = Stimulates

- - -> = Inhibits

Hormonal Regulation of Menstrual & Ovarian Cycles

4. Rising levels of estrogen cause anterior pituitary to increase production & storage of LH.



Key:

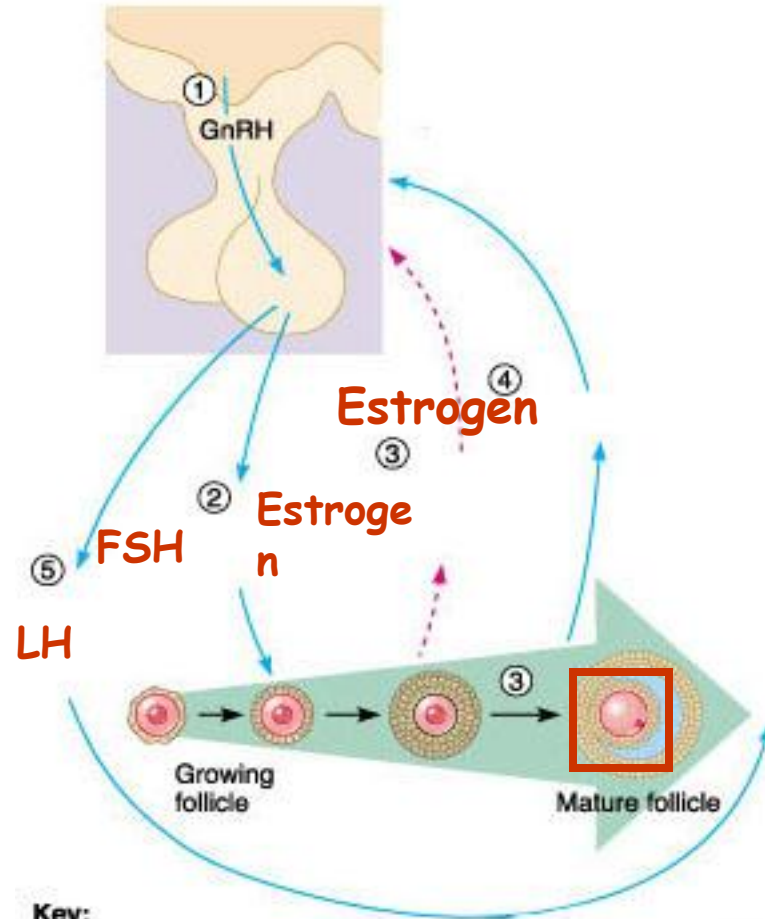
—> = Stimulates

- - -> = Inhibits

Hormonal Regulation of Menstrual & Ovarian Cycles

5. High estrogen causes LH to be released in a burst & the endometrium to thicken (proliferative phase).

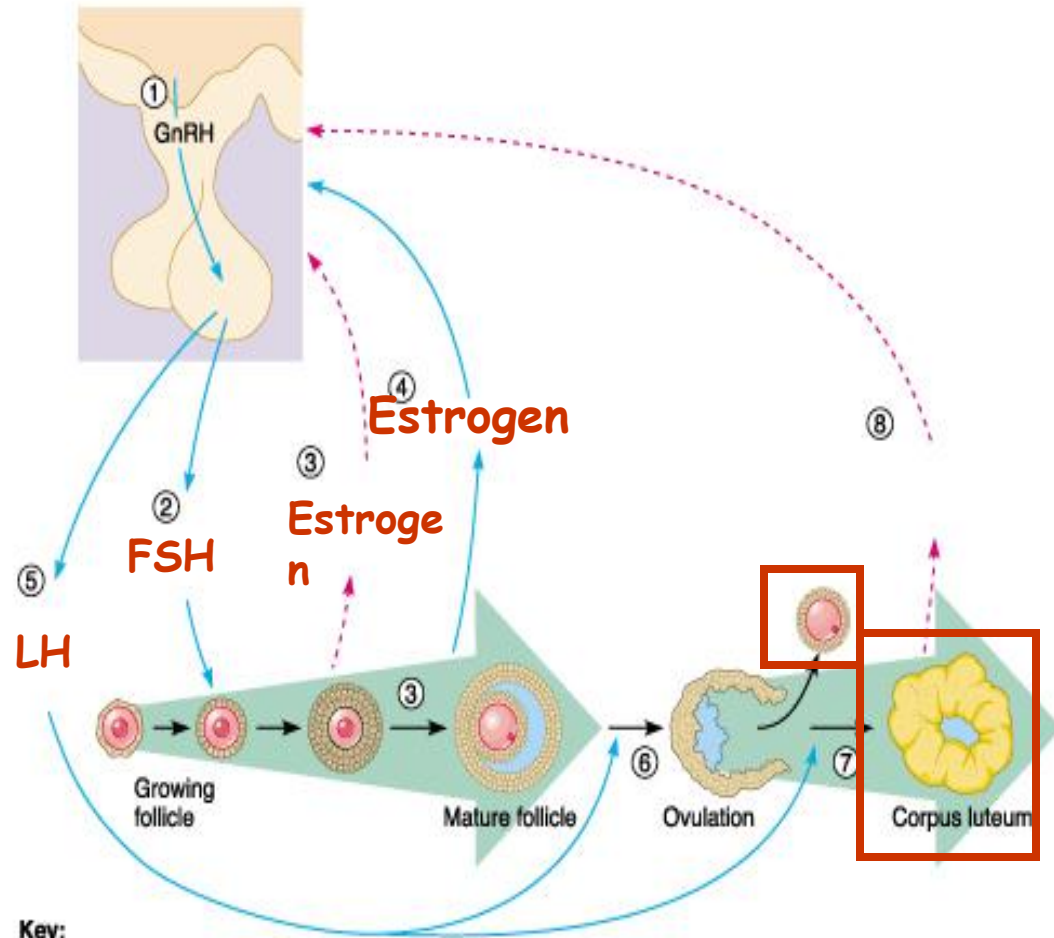
6. High LH stimulates first meiotic division of primary oocyte.



Hormonal Regulation of Menstrual & Ovarian Cycles

7. High LH triggers ovulation.

8. High LH causes ruptured follicle to become a corpus luteum.



Key:

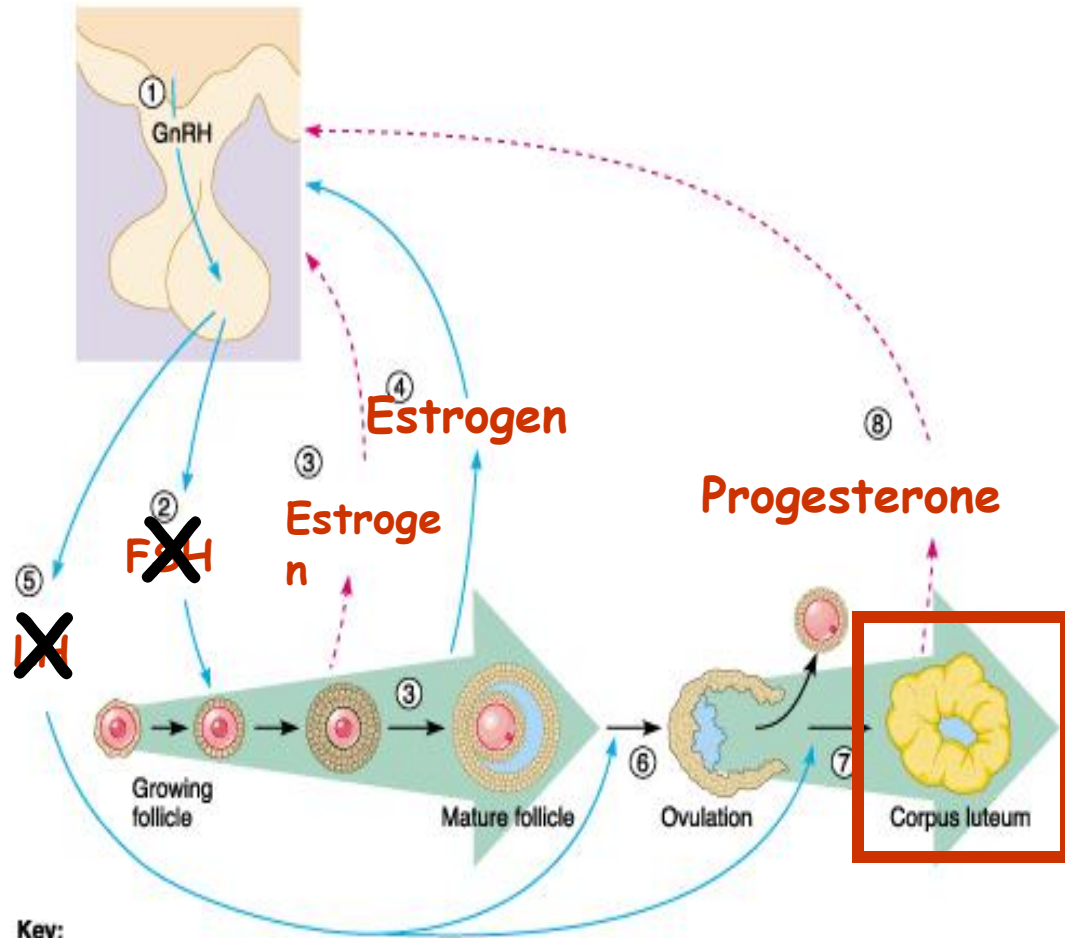
—> = Stimulates

- - -> = Inhibits

Hormonal Regulation of Menstrual & Ovarian Cycles

9. Corpus luteum produces progesterone.

10. Progesterone inhibits the production of FSH & LH by the anterior pituitary & stimulates secretory phase .



Key:

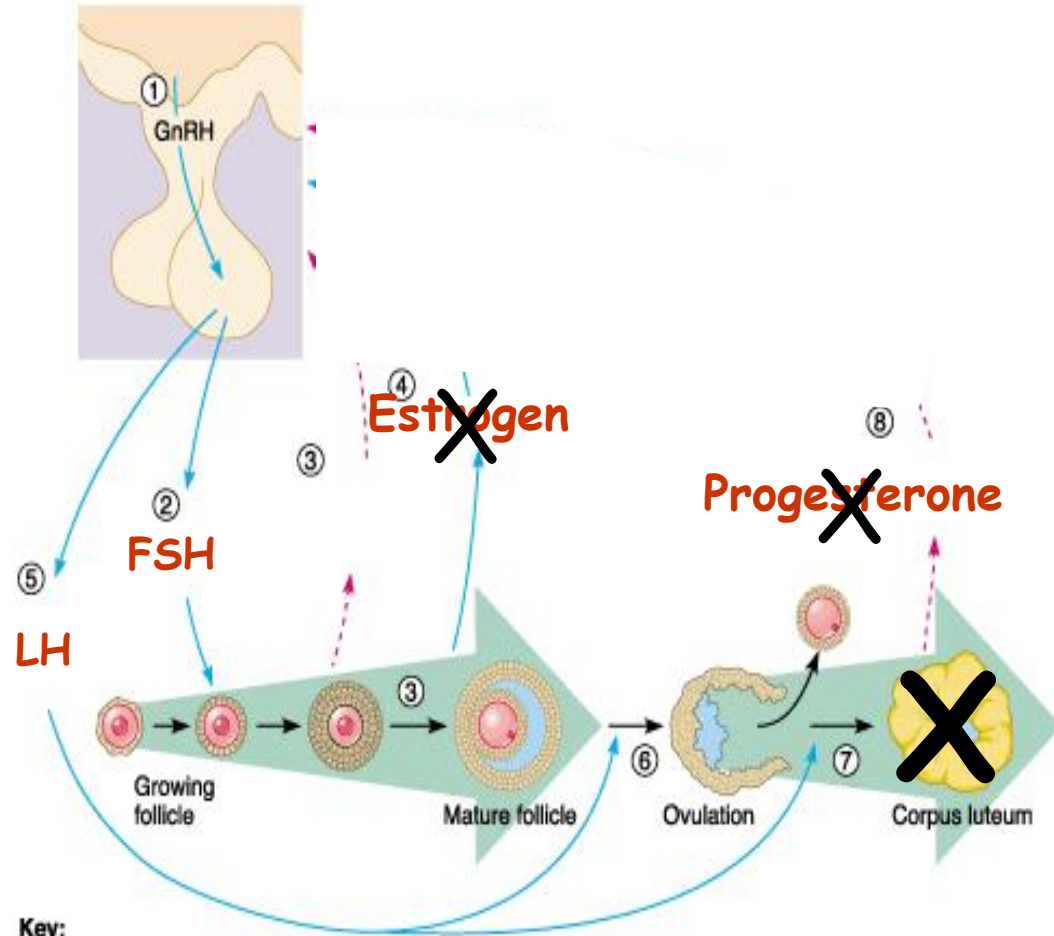
—> = Stimulates

- - -> = Inhibits

Hormonal Regulation of Ovarian & Menstrual Cycles

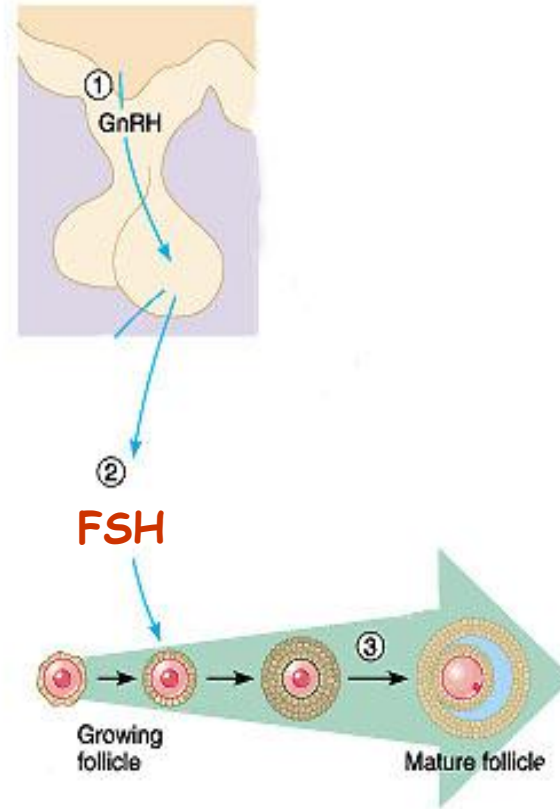
11. Diminishing levels of FSH & LH cause corpus luteum to deteriorate & produce less progesterone.

12. Diminishing levels of estrogen & progesterone cause inhibition of FSH & LH to end & thicken endometrium to slough (menses).



Hormonal Regulation of Ovarian & Uterine Cycles

13. Increasing levels of FSH cause a new cycle to begin.



Key:

→ = Stimulates

- - - → = Inhibits

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The Menstrual Cycle

Anterior Pituitary Hormones

FSH

LH



Ovarian Hormones

Estradiol

Progesterone



Ovulation

Corpus Albicans

Follicle

Corpus Luteum

Ovary

Recruitment

Selection

Dominance

Recruitment



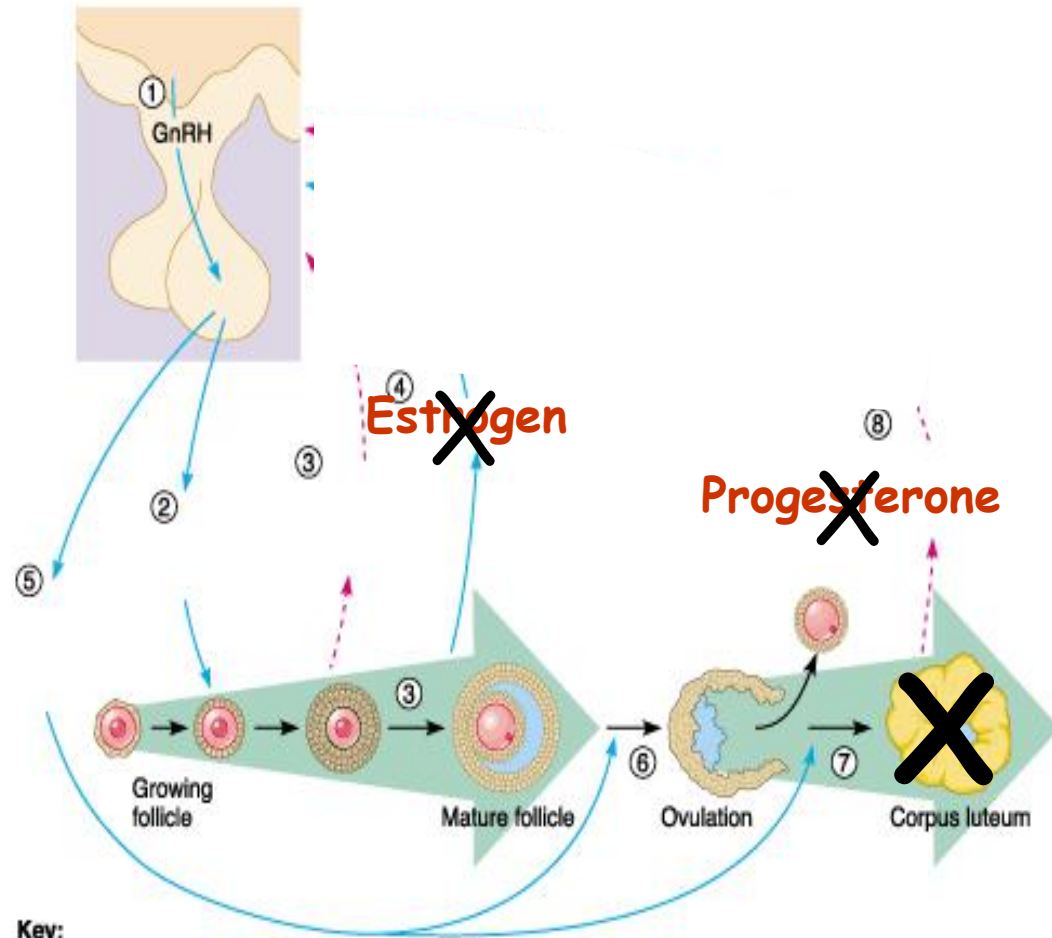
Uterine Endometrium



2 4 6 8 10 12 14 16 18 20 22 24 26 28 2

Hormonal Regulation in Pregnancy

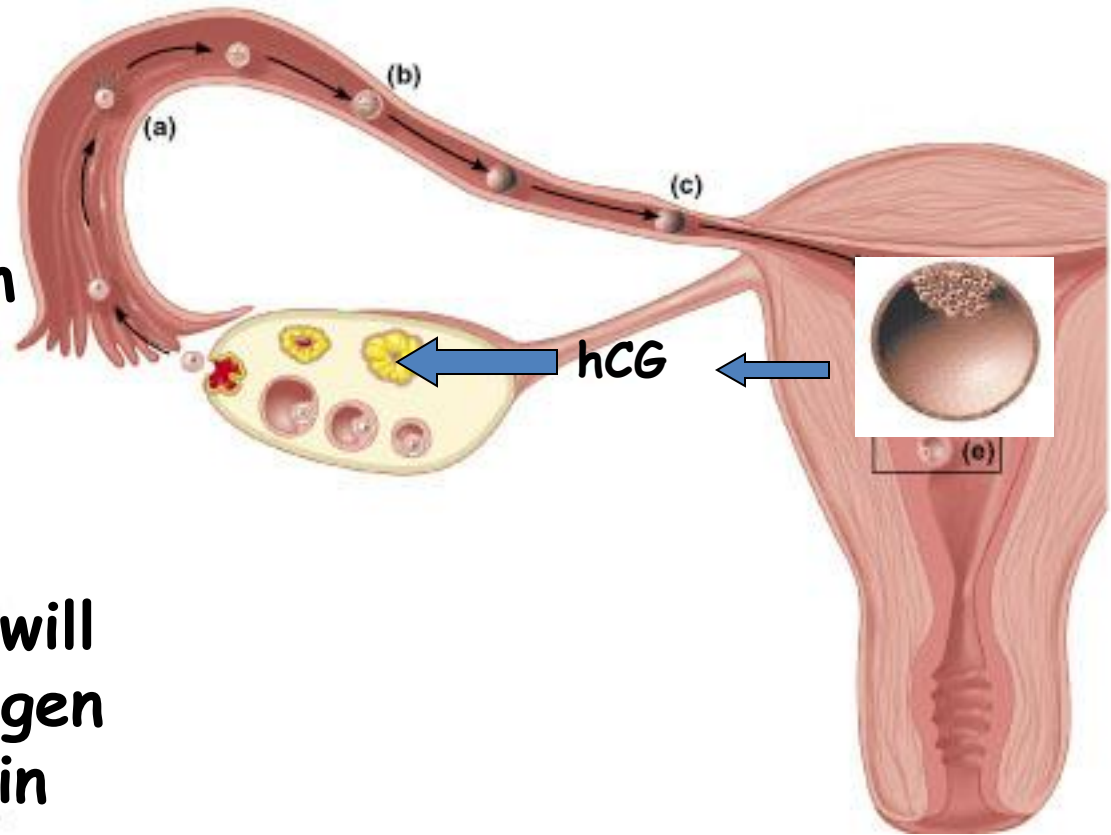
Normally diminishing levels of estrogen & progesterone from deterioration of the corpus luteum would cause thickened endometrium to slough (menses) which would terminating a pregnancy.



Hormonal Regulation if Pregnancy Occurs

Blastocyst produces **human Chorionic Gonadotropin (hCG)** hormone which maintains corpus luteum in the absence of FSH & LH for the first trimester.

Eventually the placenta will produce sufficient estrogen & progesterone to sustain the pregnancy.



Comparative Anatomy

Undifferentiated

Gonad

Mullerian duct

Mullerian duct

Wolffian duct

Mesonephric tubules

Wolffian duct

Wolffian duct

Wolffian duct

Wolffian duct

Urogenital sinus

Urogenital sinus

Genital swelling

Urogenital folds

Genital tubercle

Prepuce

Male

Testis

Appendix testis

Prostatic utricle

Rete testis

Efferent ducts

Epididymis

Vas deferens

Seminal vesicle

Prostate

Bladder, urethra

Bulbourethral gland

Scrotum

Distal urethra

Penis

Bulb of penis

Glans penis

Crus of penis

Female

Ovary

Fallopian tubes

Uterus, proximal

Rete ovarii

Epoophoron

Gartner's duct

Skene's glands

Bladder, urethra, distal

Bartholin's gland

Labia majora

Labia minora

Clitoris

Clitoral hood

Vestibular bulbs

Clitoral glans

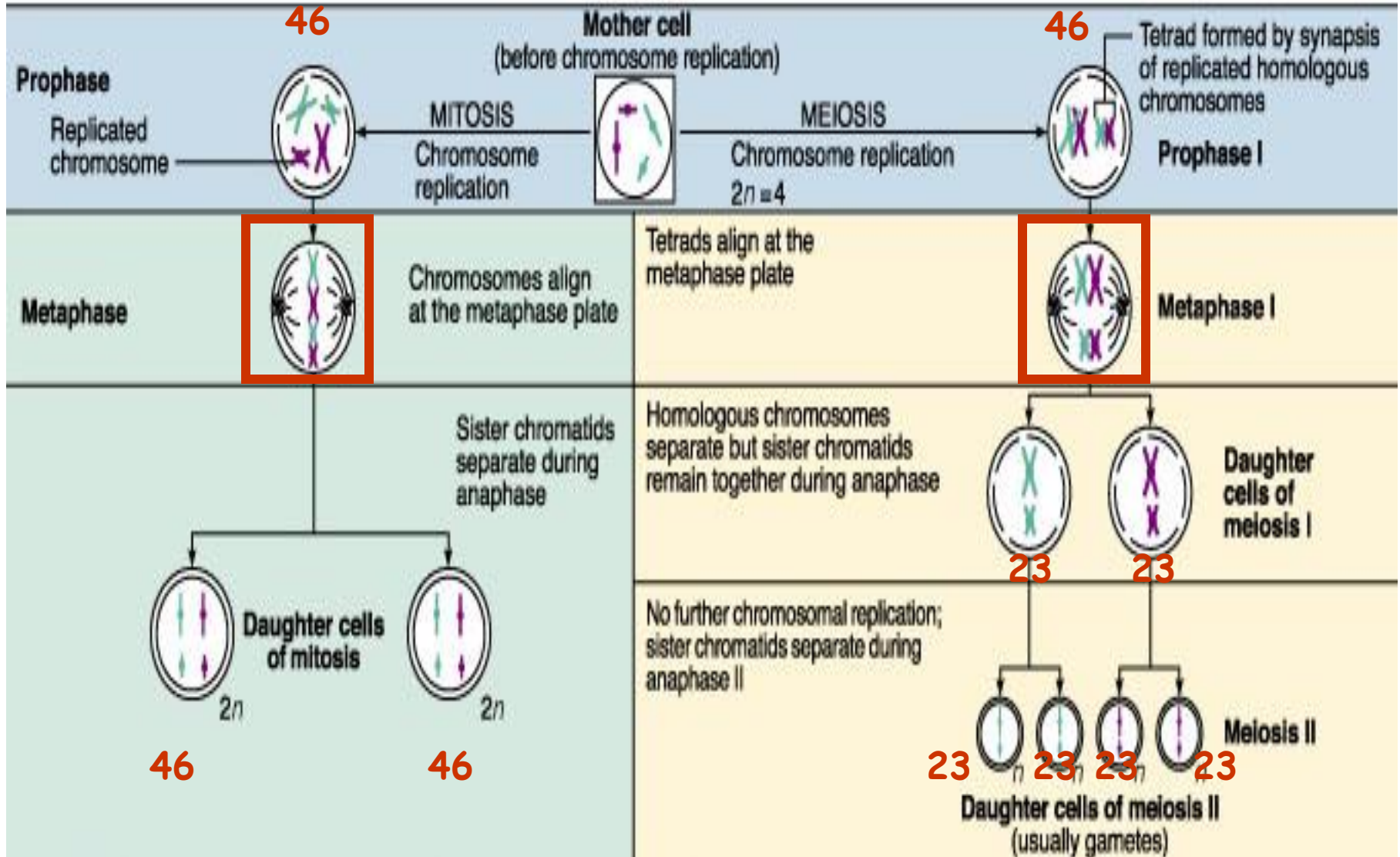
Clitoral crura

- Does a 5 year old boy have mitotic divisions occurring?
- Does a 5 year old boy have meiotic divisions occurring?
- Does a 5 year old girl have mitotic divisions occurring?
- Does a 5 year old girl have meiotic divisions occurring?



- [Mitosis vs Meiosis](#)

Mitosis/Meiosis Comparison



Gametogenesis:

Process through which gametes are formed

- Spermatogenesis:

- produces male gametes (sperm)
- occurs in the seminiferous tubules of the testes
- involves meiosis
- occurs throughout life after puberty
- may produce 400,000,000 per day

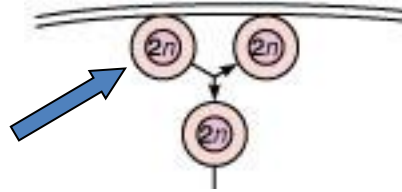
- Oogenesis:

- produces female gametes (oocytes)
- occurs in the ovaries
- involves meiosis
- occurs after puberty until menopause
- humans normally produce one oocyte during each ovarian cycle

Spermatogenesis

Spermatogonium (46)

Mitosis



Daughter Cells (46)

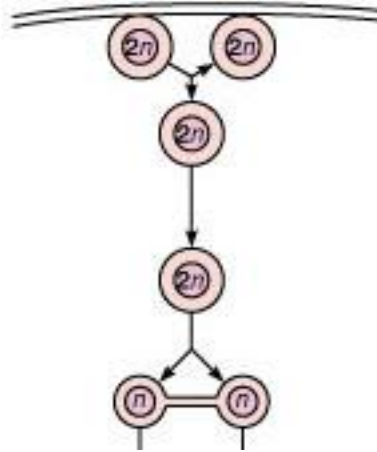
Spermatogenesis

Spermatogonium (46)

Mitosis

Primary Spermatocyte (46)

Secondary Spermatocytes (23)



Daughter Cells (46)

Growth

Meiosis I

Spermatogenesis

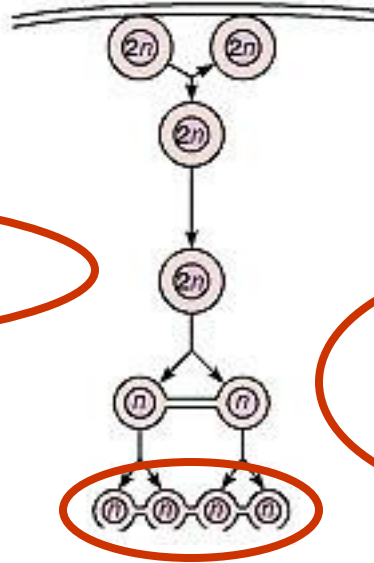
Spermatogonium (46)

Mitosis

Primary Spermatocyte (46)

Secondary Spermatocytes (23)

Early Spermatids (23)



Daughter Cells (46)

Growth

Meiosis I

Meiosis II

Spermatogenesis

Spermatogonium (46)

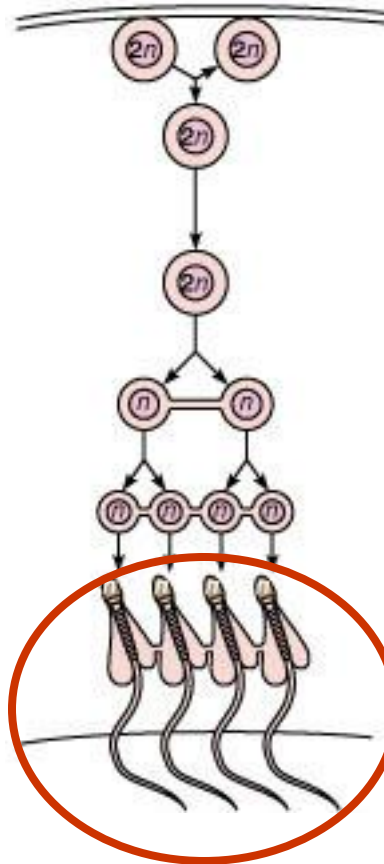
Mitosis

Primary Spermatocyte (46)

Secondary Spermatocytes (23)

Early Spermatids (23)

Late Spermatids (23)



Daughter Cells (46)

Growth

Meiosis I

Meiosis II

Spermiogenesis

Spermatogenesis

Spermatogonium (46)

Mitosis

Primary Spermatocyte (46)

Meiosis I

Secondary Spermatocytes (23)

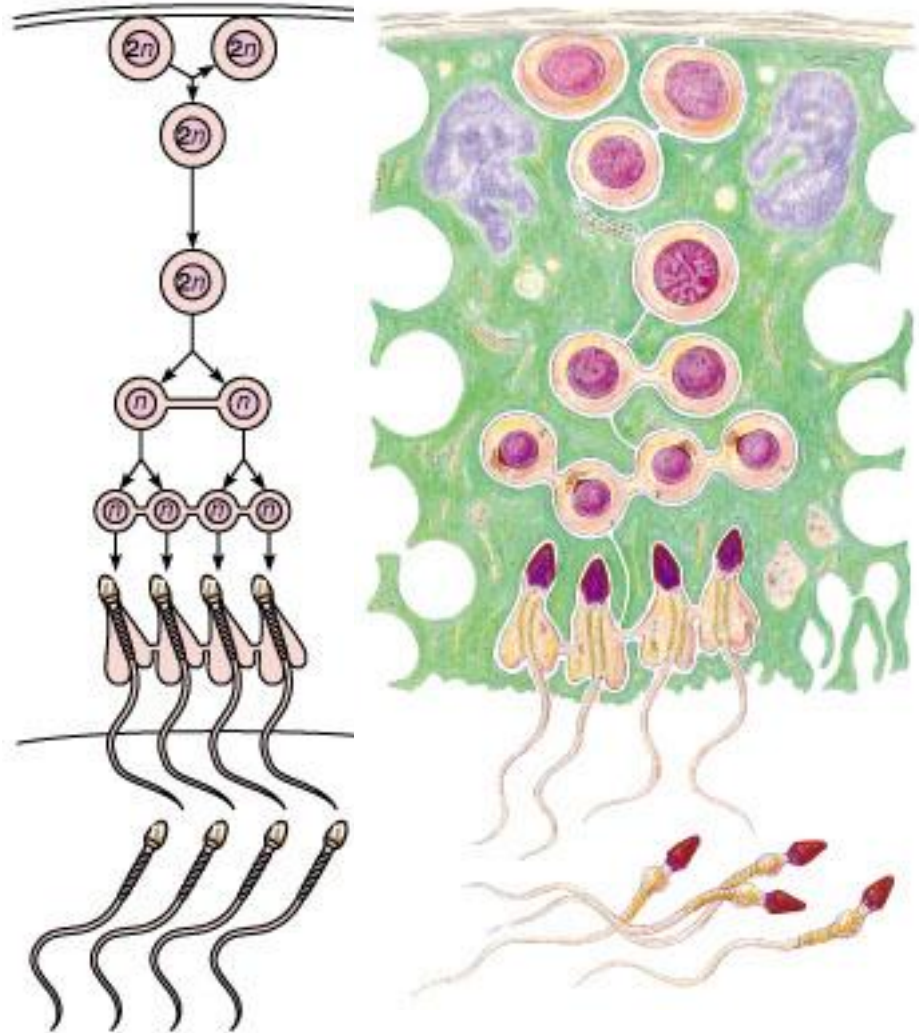
Meiosis II

Early Spermatids (23)

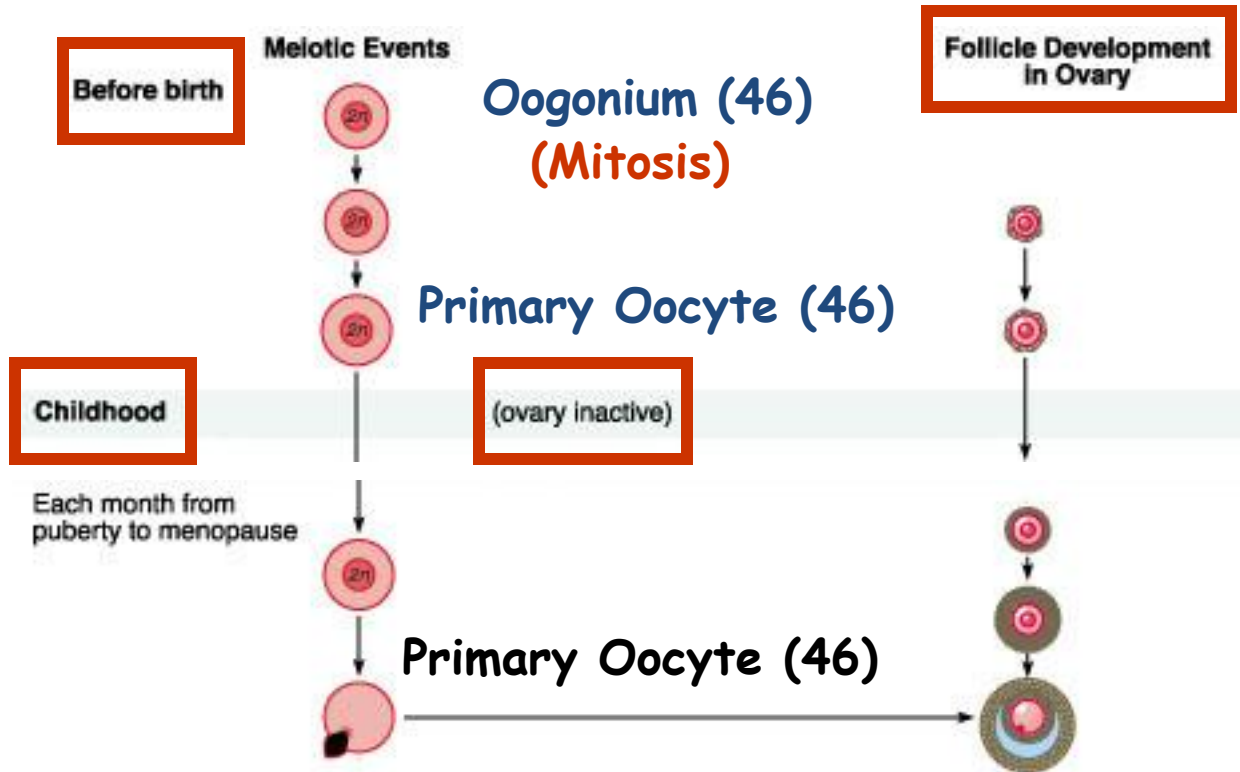
Late Spermatids (23)

(Lumen)

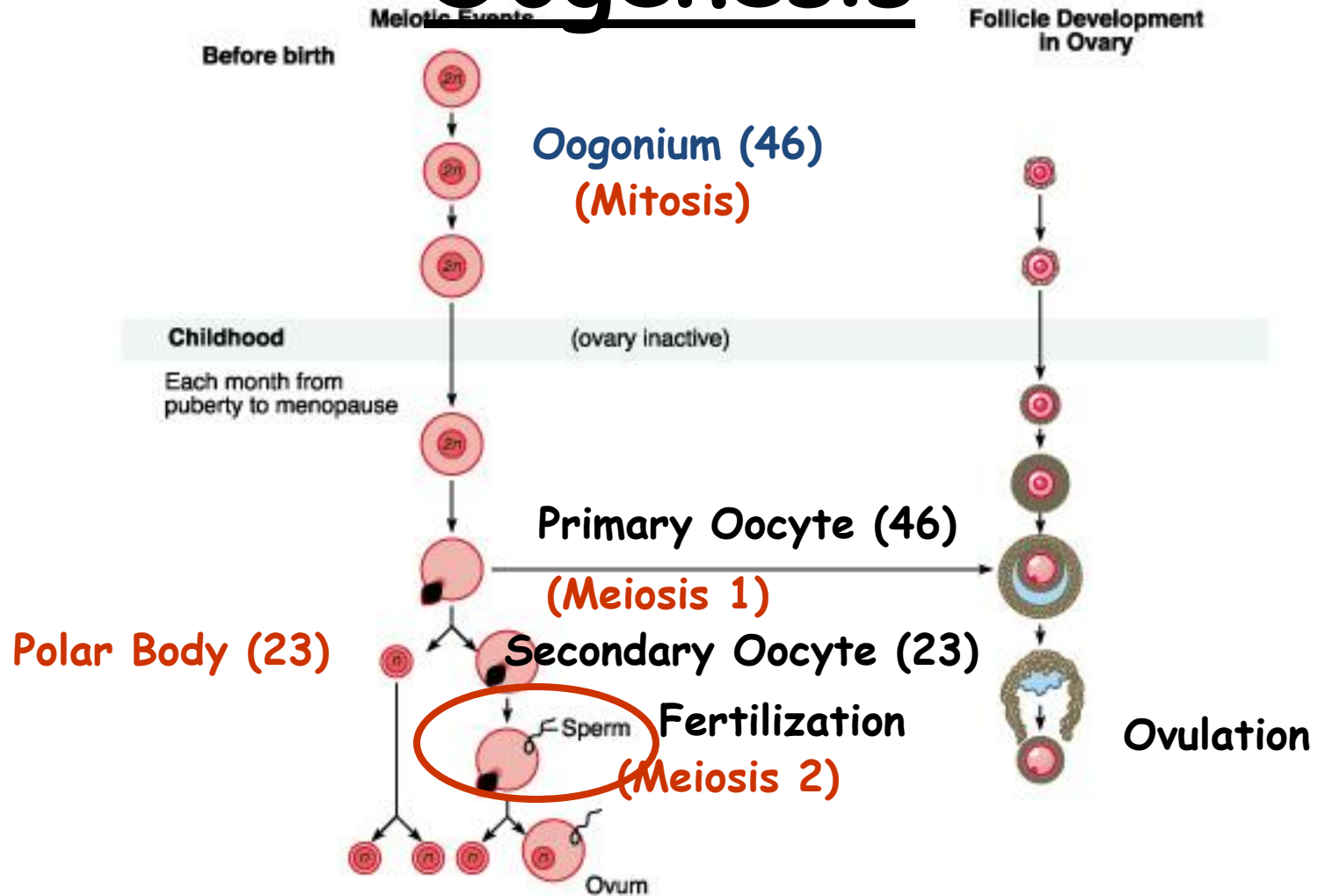
Spermatozoa (23)



Oogenesis



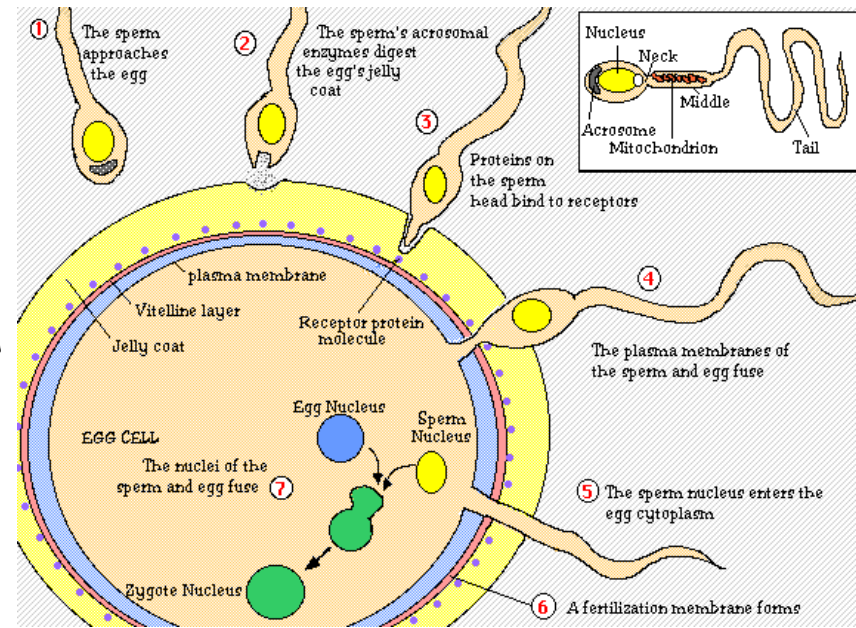
Oogenesis



Fertilization

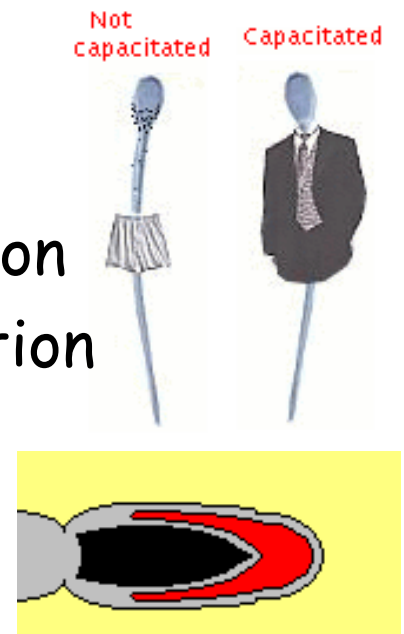
3 Functions

- transmission of genes from parents
- restoration of the diploid number
- initiation of development

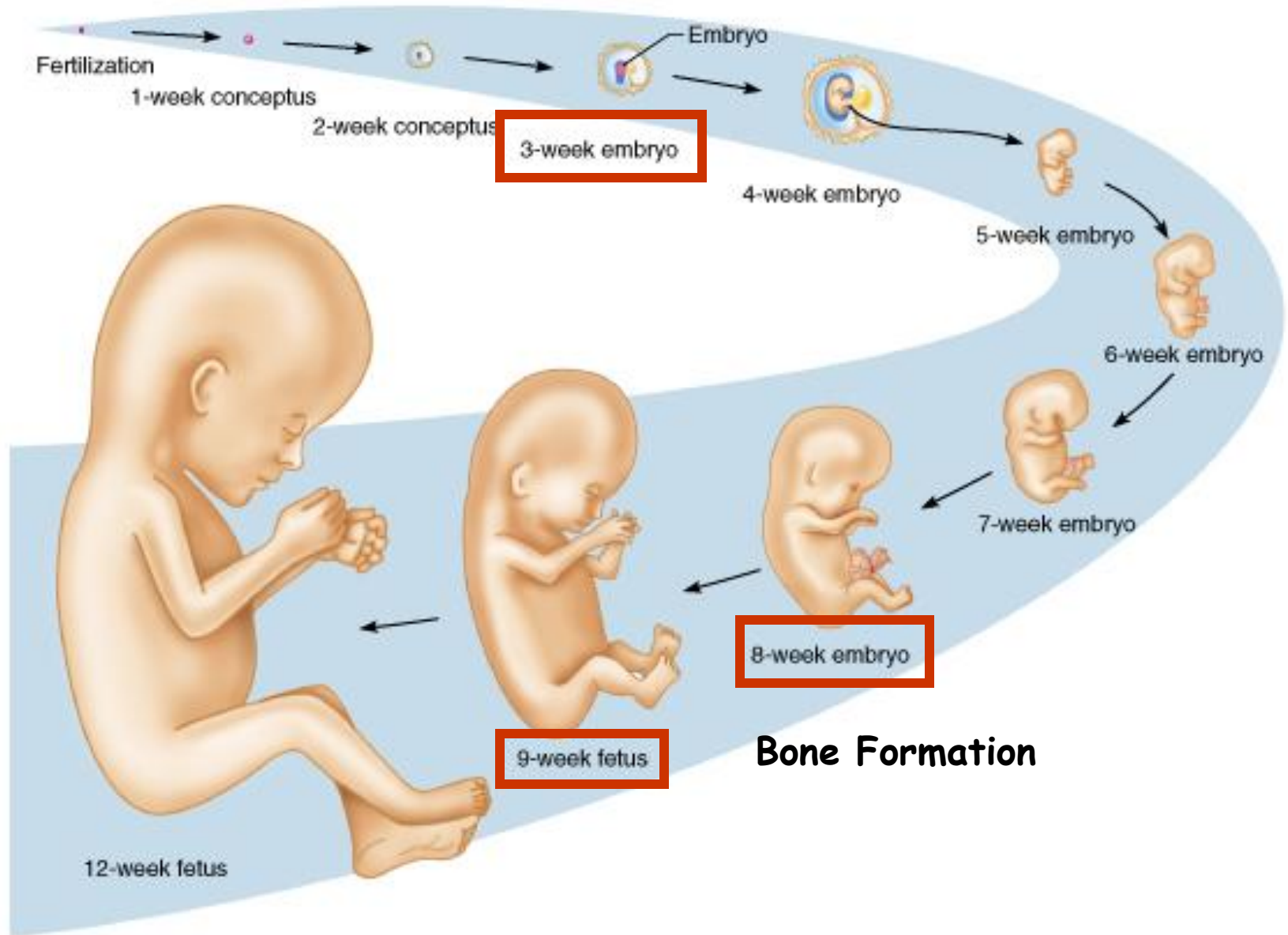


Steps

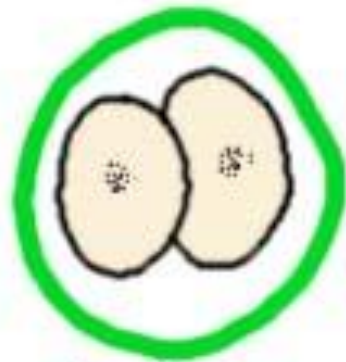
- Capacitation
- Sperm-Zona Pellucida Binding
- Acrosome Reaction & Penetration
- Egg Activation & Cortical Reaction
- Zona Reaction
- Post-fertilization events



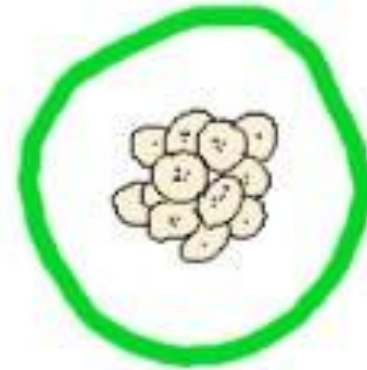
Preembryonic Development



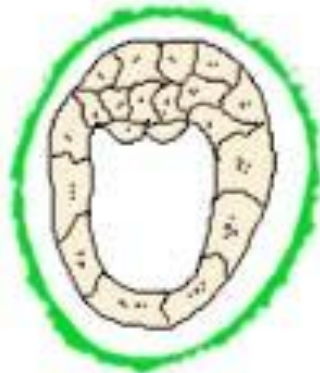
The Embryo Takes Shape



2-cell stage



morula



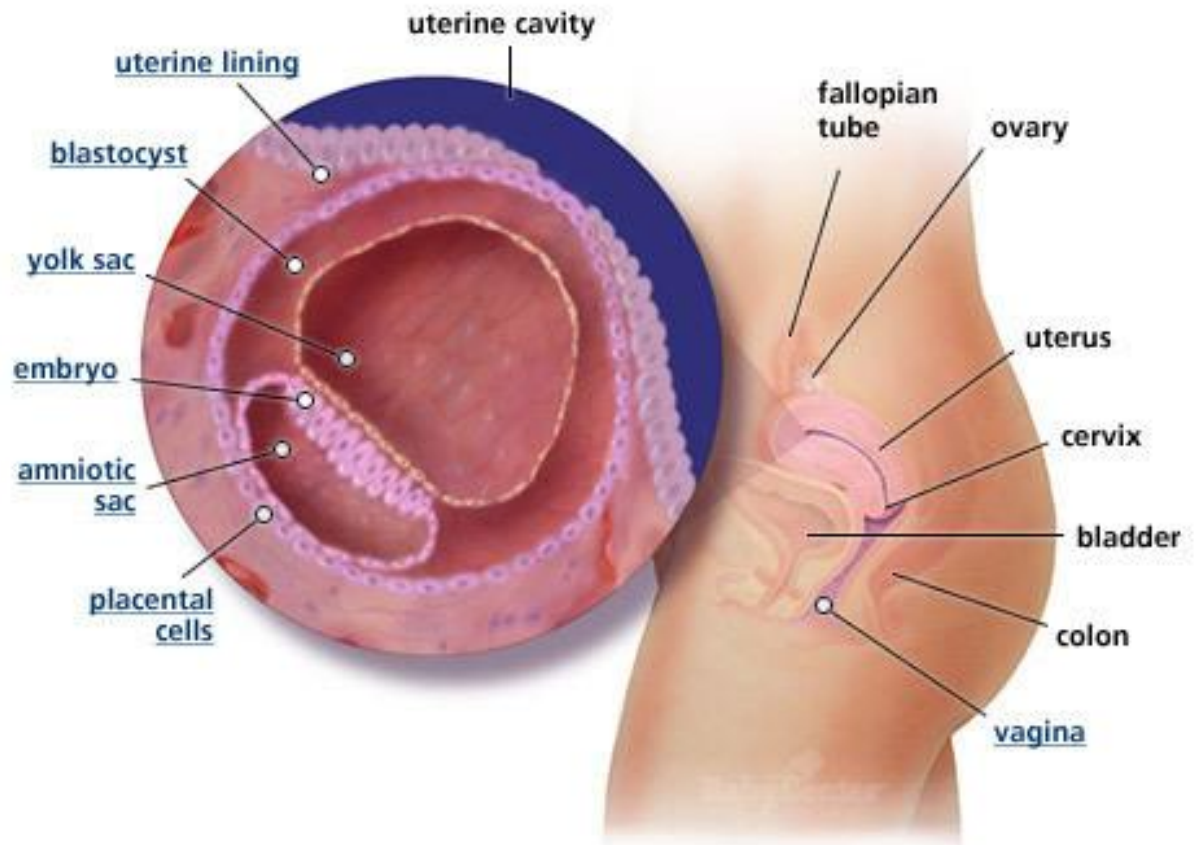
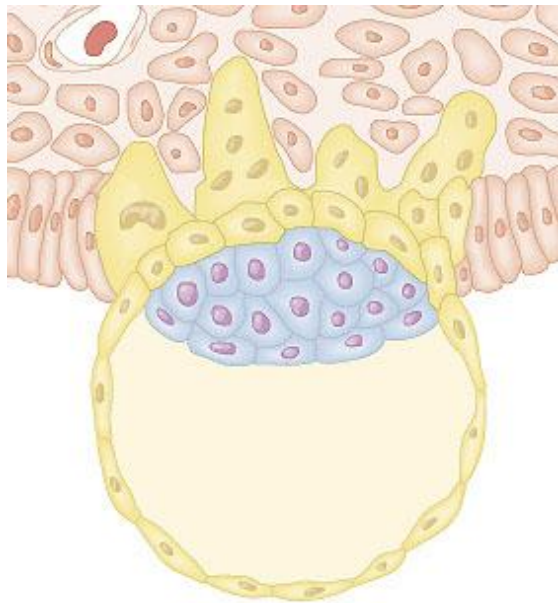
early blastocyst



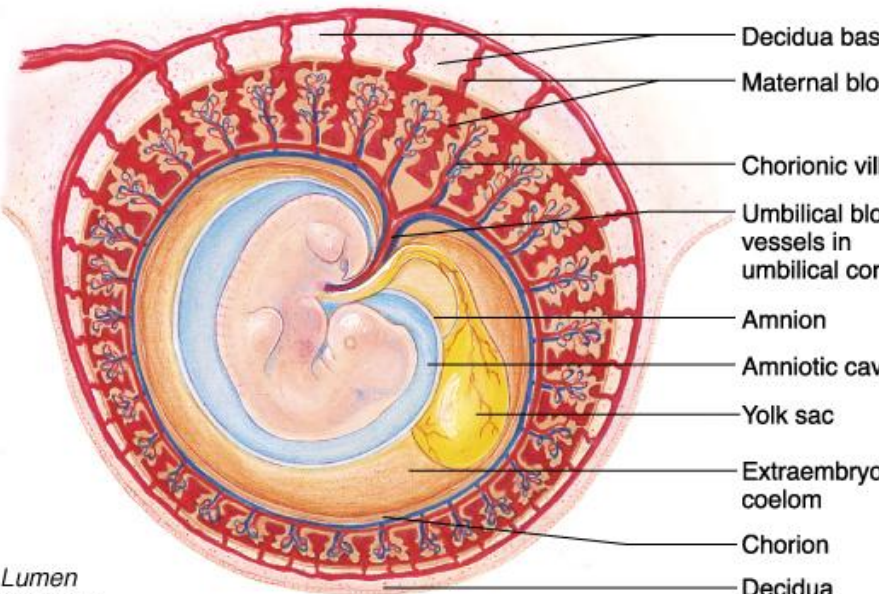
late blastocyst

Chorionic Villi

- Finger-like growths of the trophoblasts into the endometrium to form the placenta.



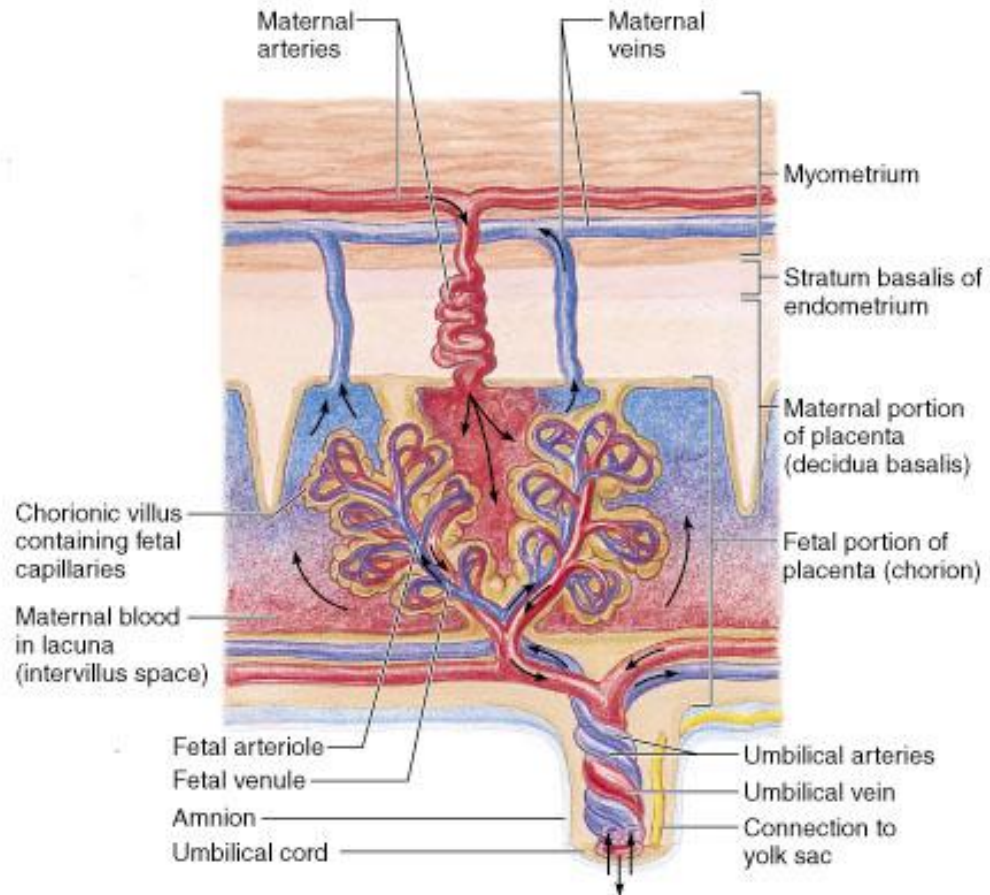
Placental Mammals



Lumen of uterus

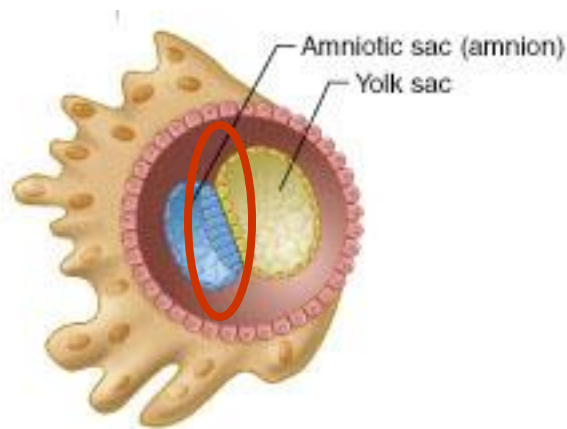
(d) 4 1/2-week embryo

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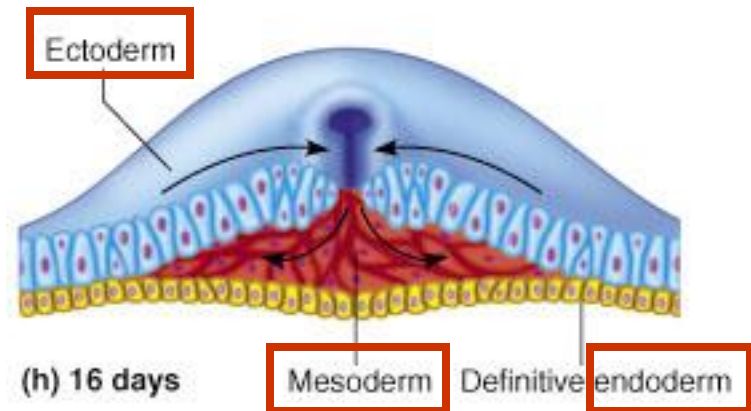


Gastrulation

- Preembryo becomes embryo as three primary germ layers form.



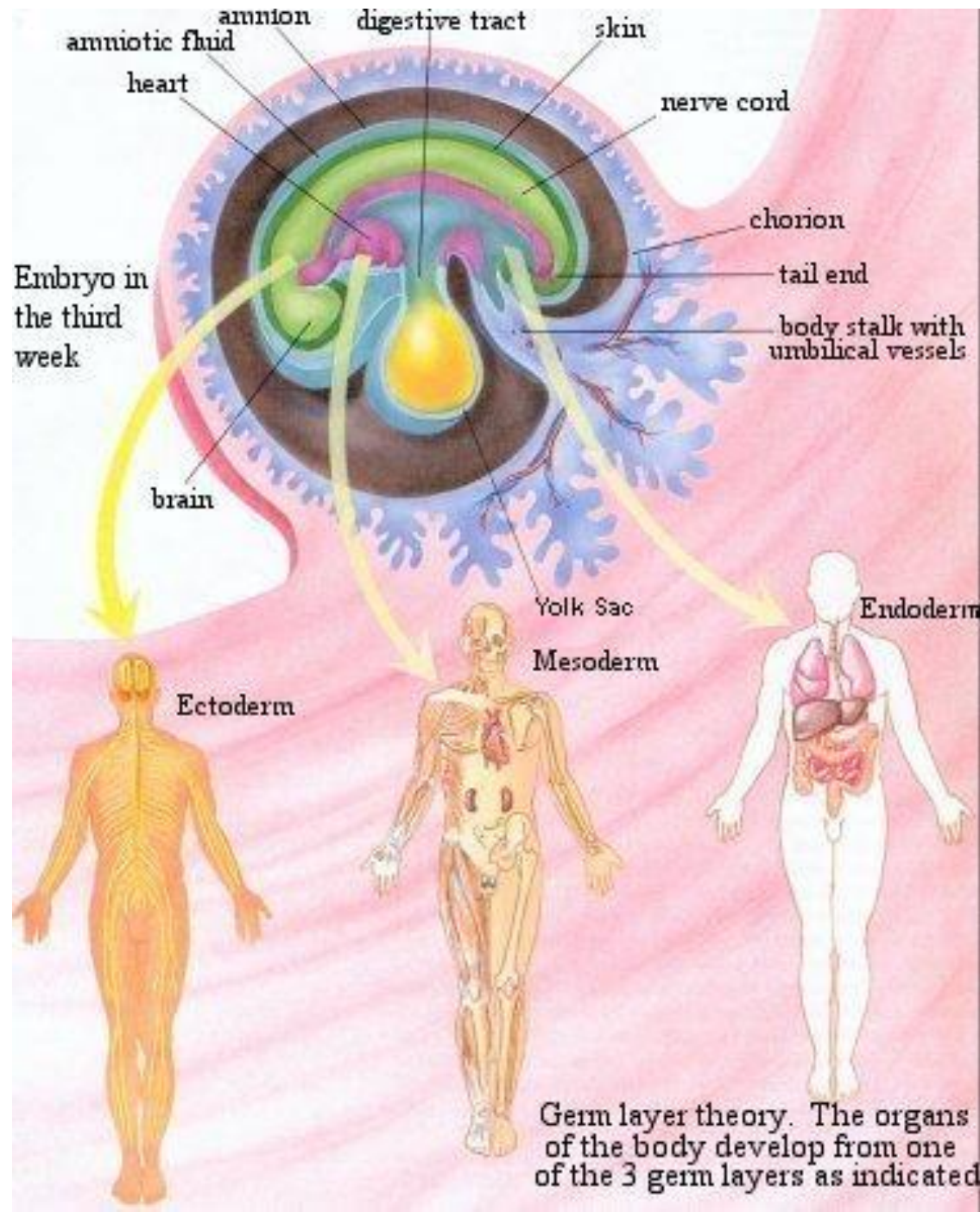
Preembryo



Embryo

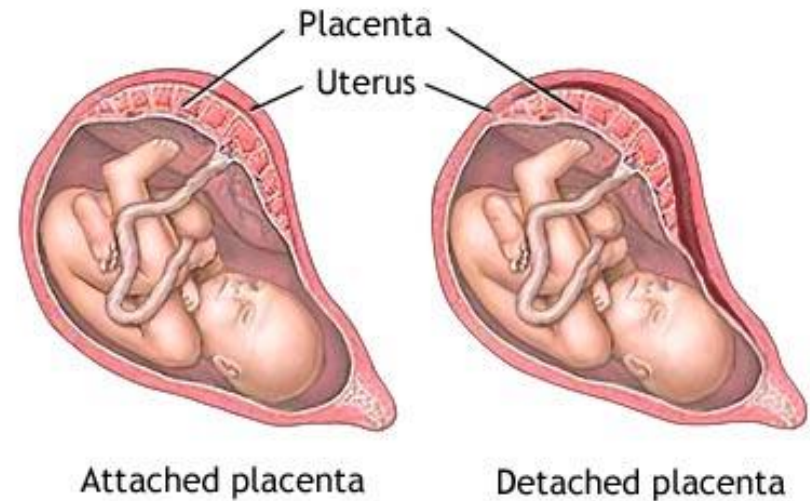
Triploblastic Layers

- Ectoderm
- Mesoderm
 - Fetal Skeletons
- Endoderm



Placenta abruptio

- Any amount of placental separation prior to delivery.
- Causes & Risk Factors:
 - Abdominal trauma
 - Hypertension during pregnancy
 - Diabetes mellitus
 - Cigarette smoking
 - Alcohol use during pregnancy



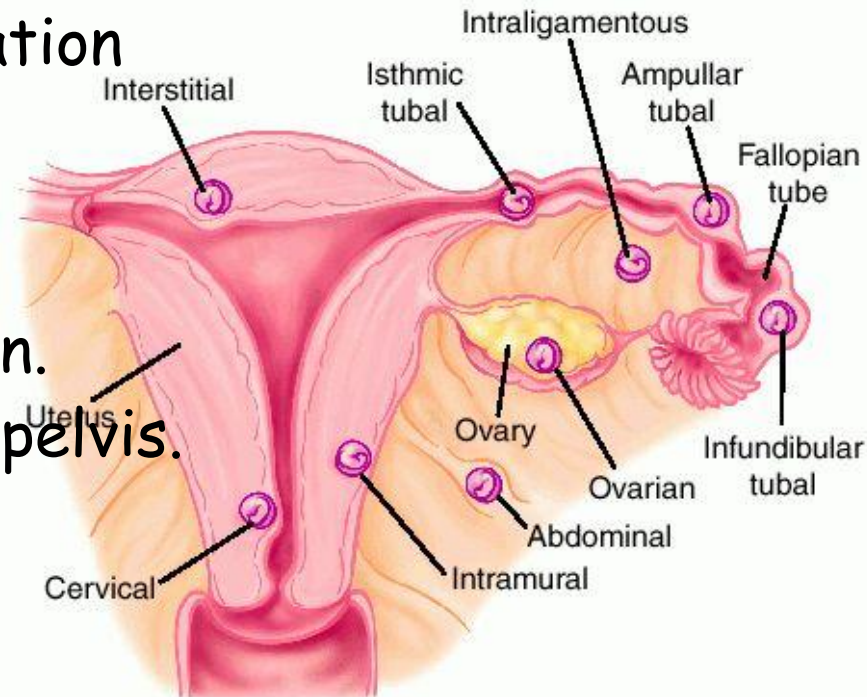
Placenta previa

- Placental growth across or adjacent to opening of cervical canal in the uterus.
- Risk Factors:
 - The number of prior pregnancies
 - Multiple pregnancies (twins/triplets)
 - Prior C-section where scar is close to cervix
- Symptoms:
 - Spotting during 1st & 2nd trimesters
 - Sudden, painless & profuse vaginal bleeding



Ectopic Pregnancy

- Implantation of blastocyst anywhere other than within the uterus.
- Causes & Risk Factors:
 - Physical blockage of uterine tube.
 - Scarring of uterine tube by prior tubal infection (pelvic inflammatory disease).
 - Pregnancy following tubal ligation reversal or despite oral contraceptive use.
- Symptoms:
 - Lower abdominal or pelvic pain.
 - Mild cramping on one side of pelvis.
 - Abnormal vaginal bleeding (spotting).



Parturition

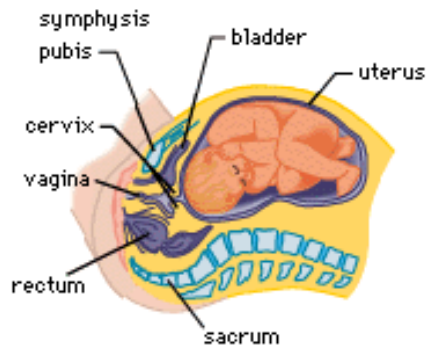
Stage 1 → full cervical dilation

Latent, active, deceleration

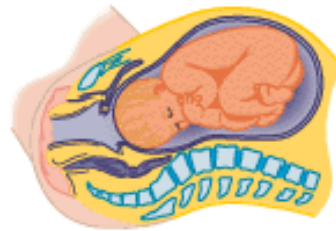
Stage 2 → delivery of infant

Stage 3 → delivery of placenta

ONSET OF LABOUR



FLEXION



INTERNAL ROTATION OF HEAD



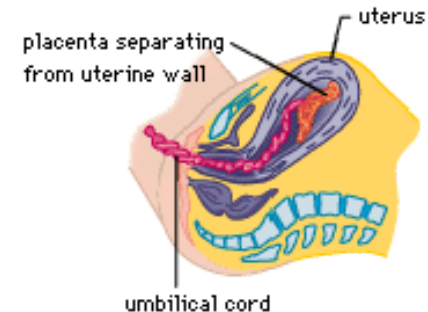
EXTENSION



EXTERNAL ROTATION OF HEAD

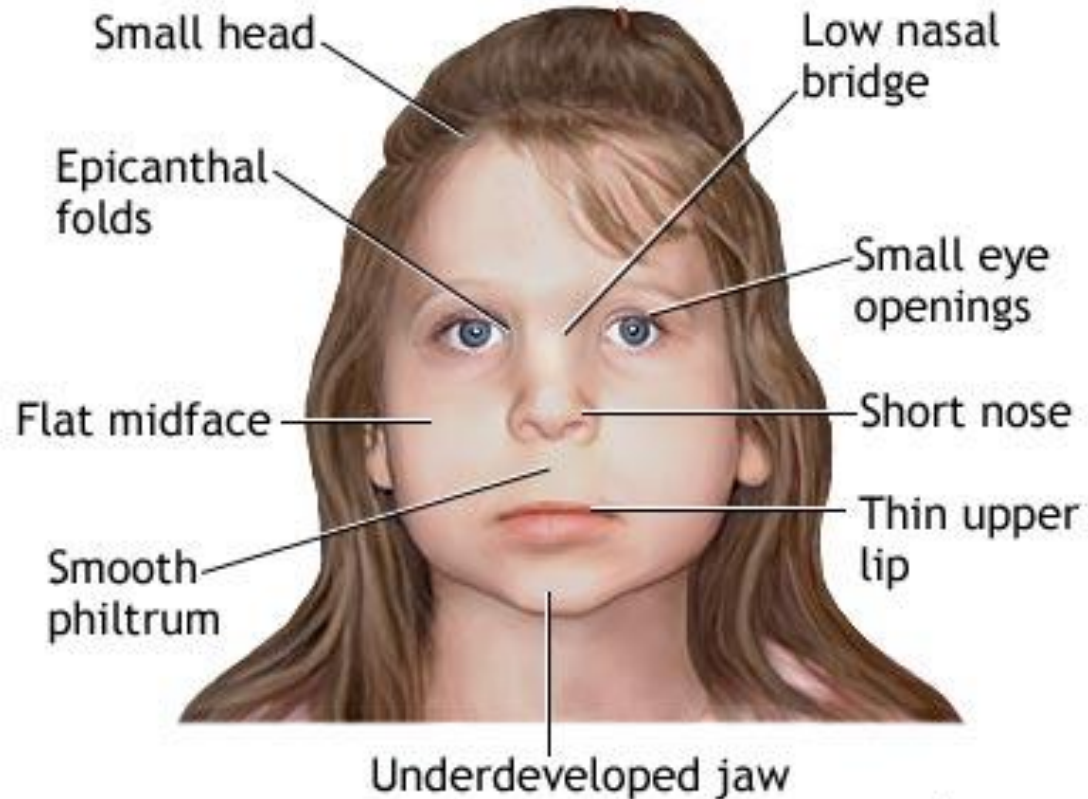


UTERUS IMMEDIATELY AFTER BIRTH



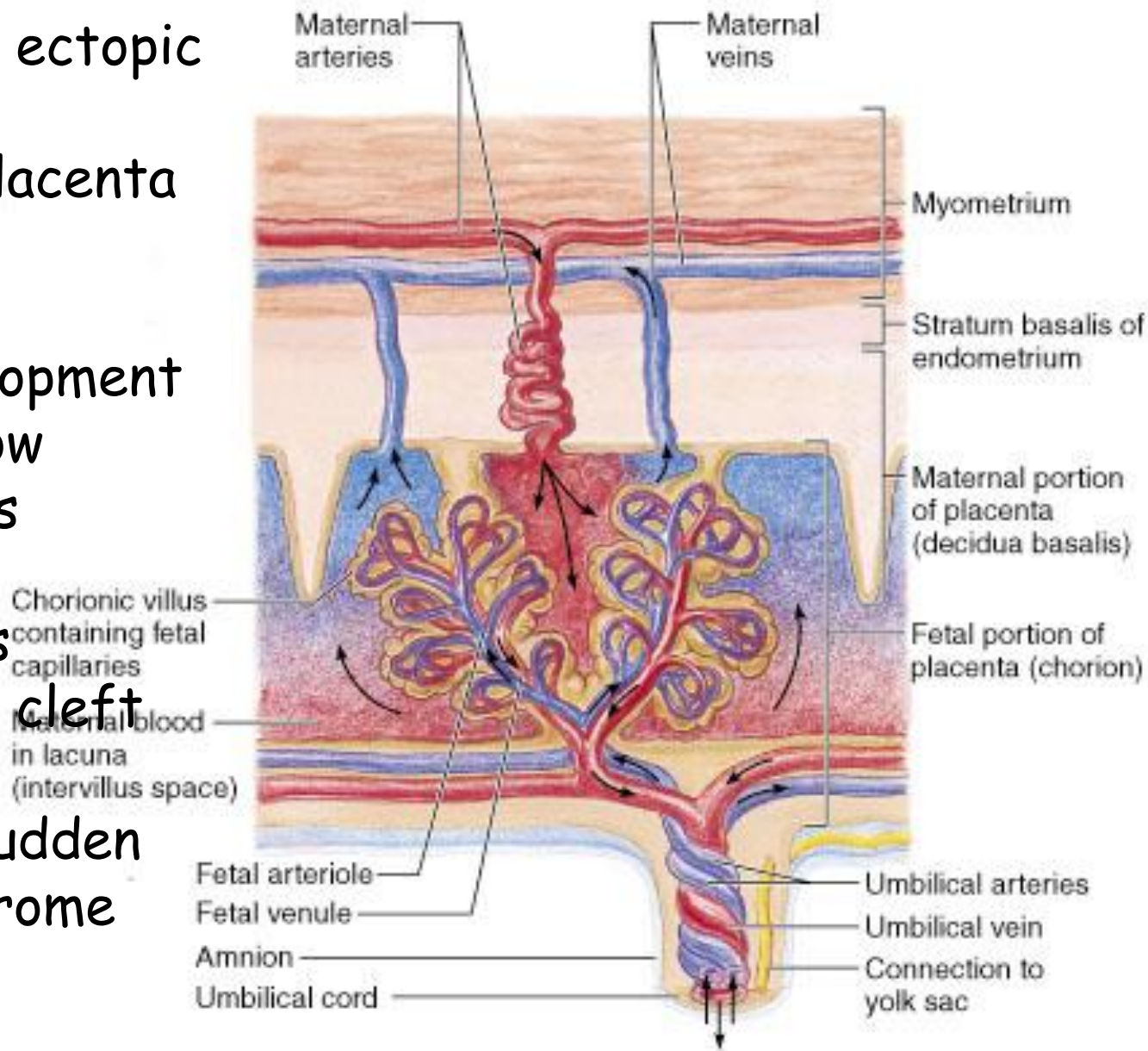
Fetal Alcohol Syndrome

- Prenatal & postnatal growth retardation
- CNS involvement:
 - neurological abnormalities
 - developmental delays
- Alcohol related birth defects
- Mental retardation
- Speech & hearing impairment
- Learning, attention & memory deficits



Placental Function - Smoking

- Increases risk of ectopic pregnancy
- Doubles risk of placenta previa & abruptio placenta
- Slows fetal development
- Doubles risk of low birthweight babies
- Increases risk of preterm deliveries
- Increases risk of cleft palate & lip
- Doubles risk of sudden infant death syndrome (SIDS)



Resources

- [Human Anatomy Reproduction Animations](#)
- [NOVA Online "Life's Greatest Miracle"](#)
- [Craniopagus parasiticus Video](#)
- [Male Reproductive Histology](#)
- [Female Reproductive Histology](#)
- [The Biology of Sex](#)
- [Animal Fertilization & Cleavage](#)
- [A&P Lessons](#)
- [3D Medical Animations](#)
- [Fetal Development Timeline](#)
- [Egg & Sperm Anatomy](#)
- [Reproductive System Information](#)