

REPRODUKSI

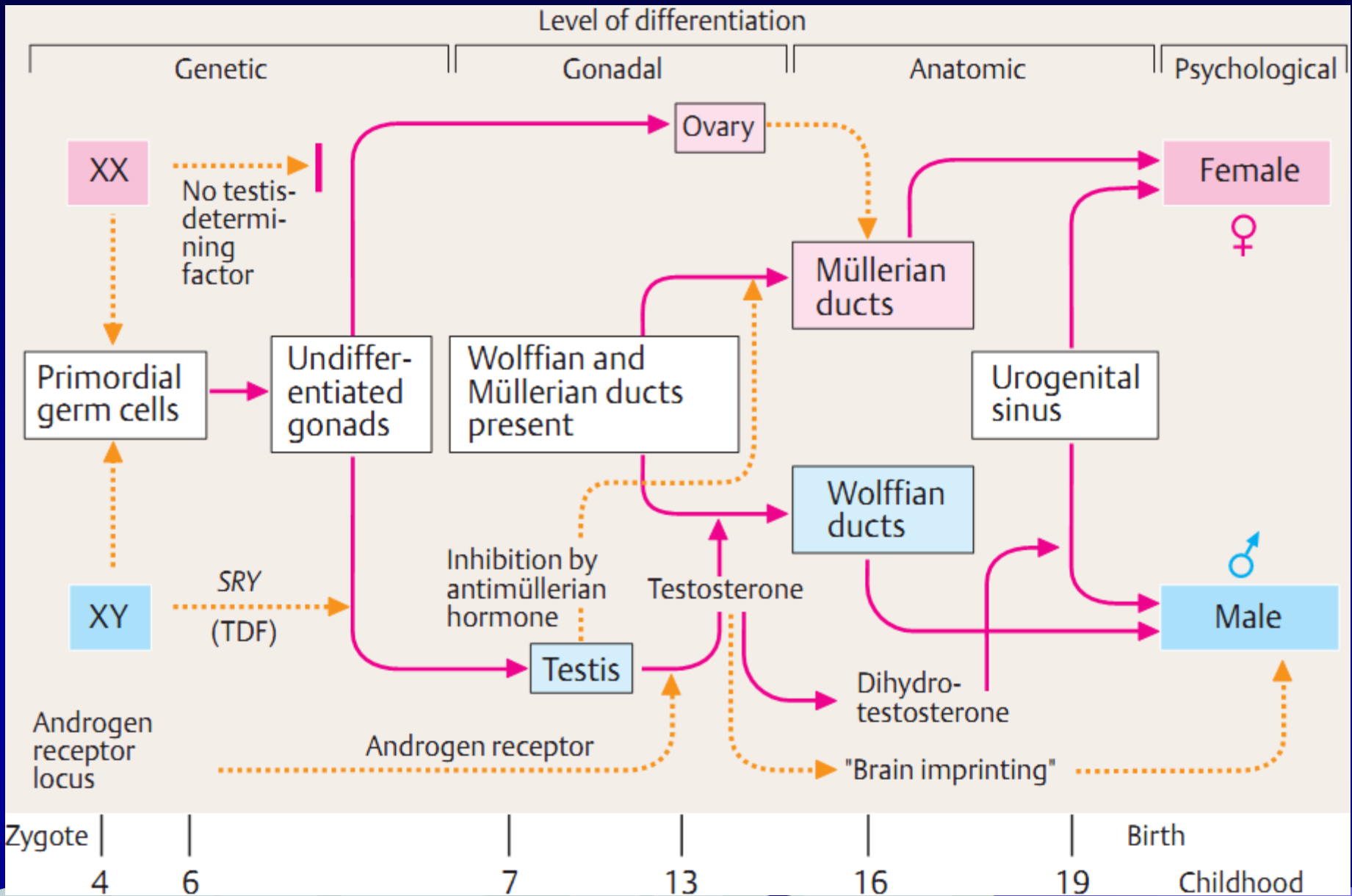
AGUSTINARAHAYUMAGDALEN

**FAKULTAS KEDOKTERAN
UNIVERSITAS MULAWARMAN**

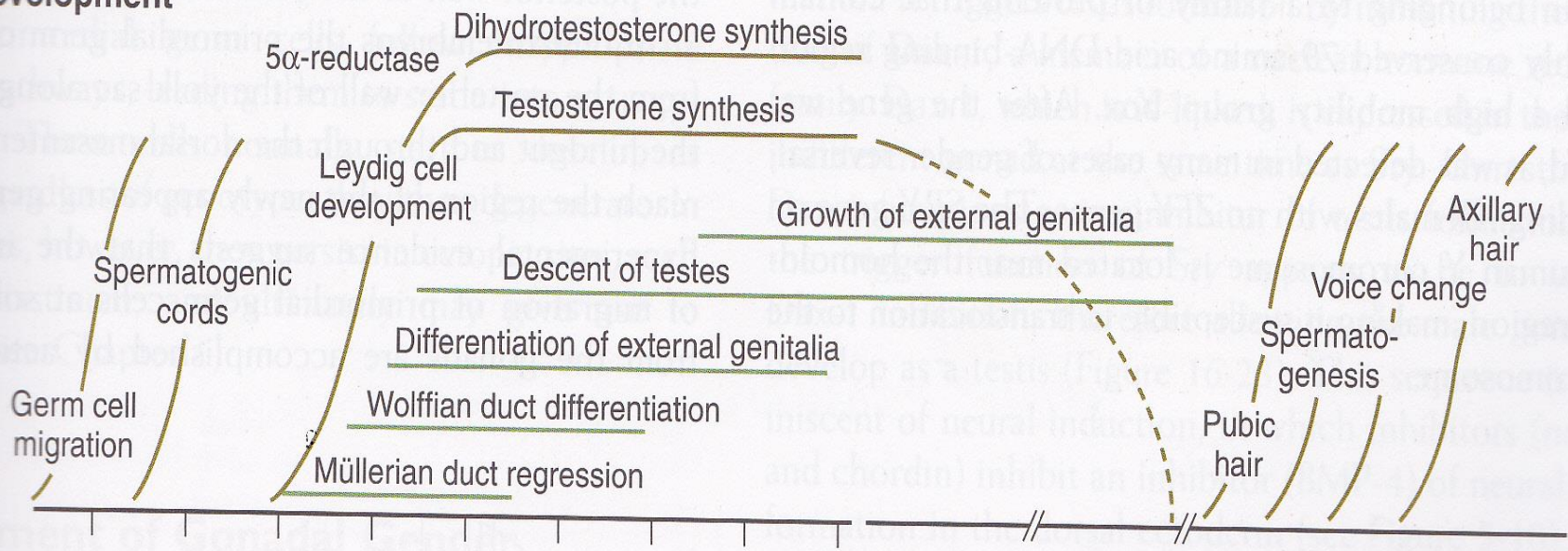


Siklus Hidup Manusia

- Fetus
 - Germinal (fertilisasi – 2 minggu)
 - Embriyonal (2–8 minggu)
 - Fetal (8 – 37/40 minggu)
- Bayi
 - Perinatal (0 – 7 hari)
 - Neonatal (7–1 bulan)
 - Infant (1 – 2 tahun)
- Anak-anak (2 – 10/13 tahun)
- Remaja
 - Pubertas (11-12 tahun)
 - proses pencapaian maturasi fisik dan fungsi seksual
- Dewasa
 - tercapainya maturasi fisik, emosi, perilaku
- Tua
 - menopause/ senescence : terjadi saat kadar hormon seks menurun, fungsi tubuh menurun



Male development



Female development

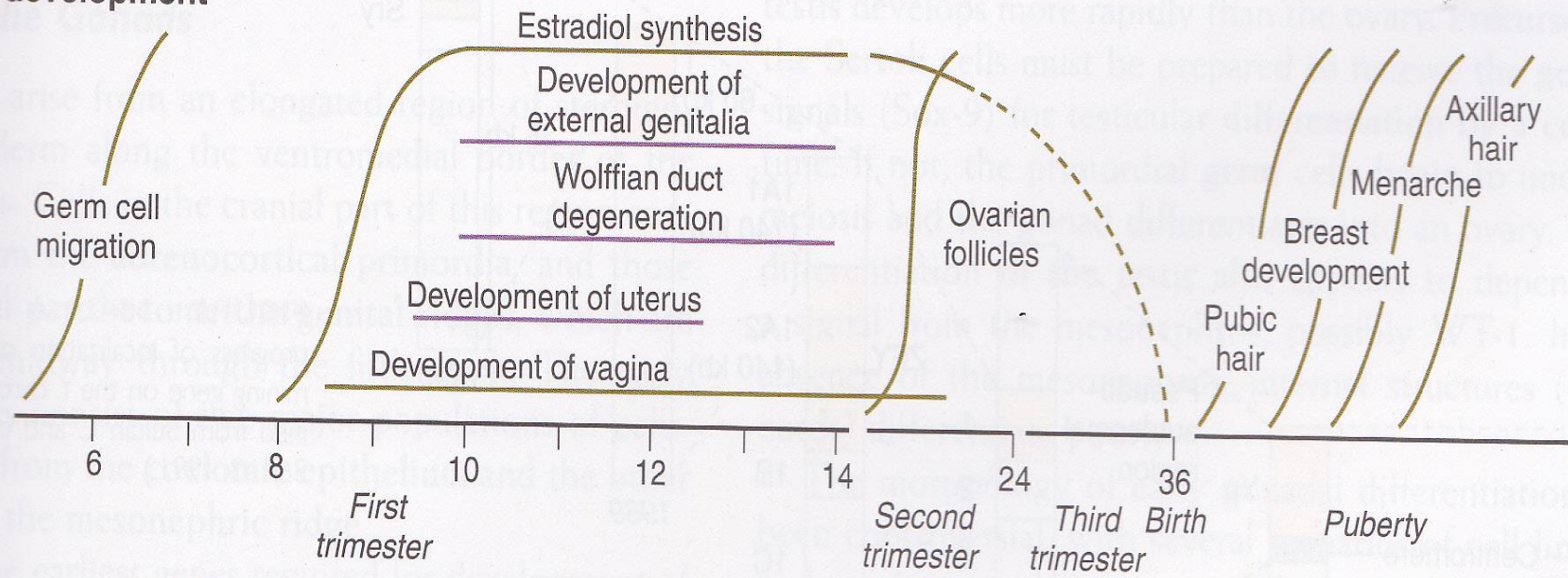
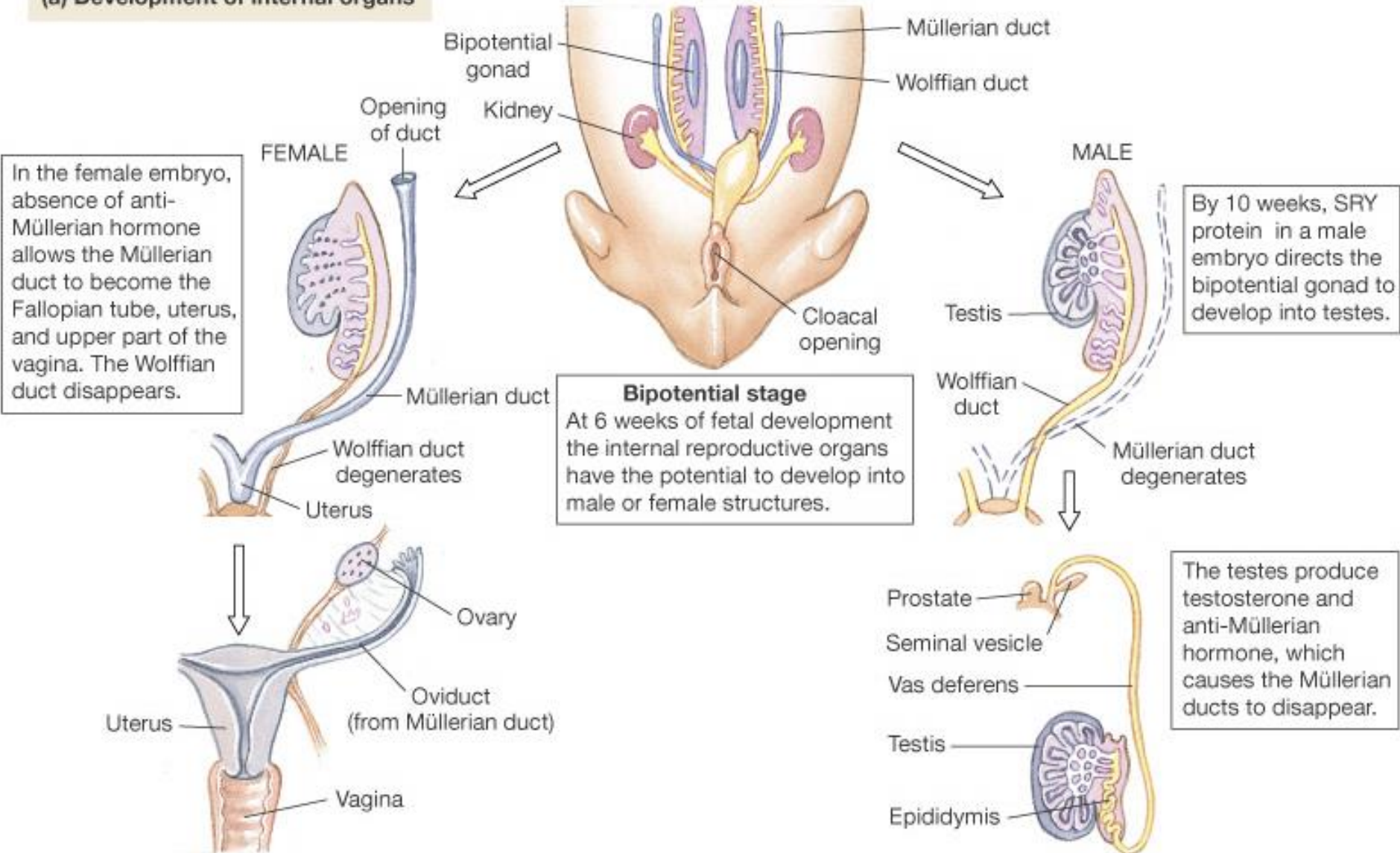
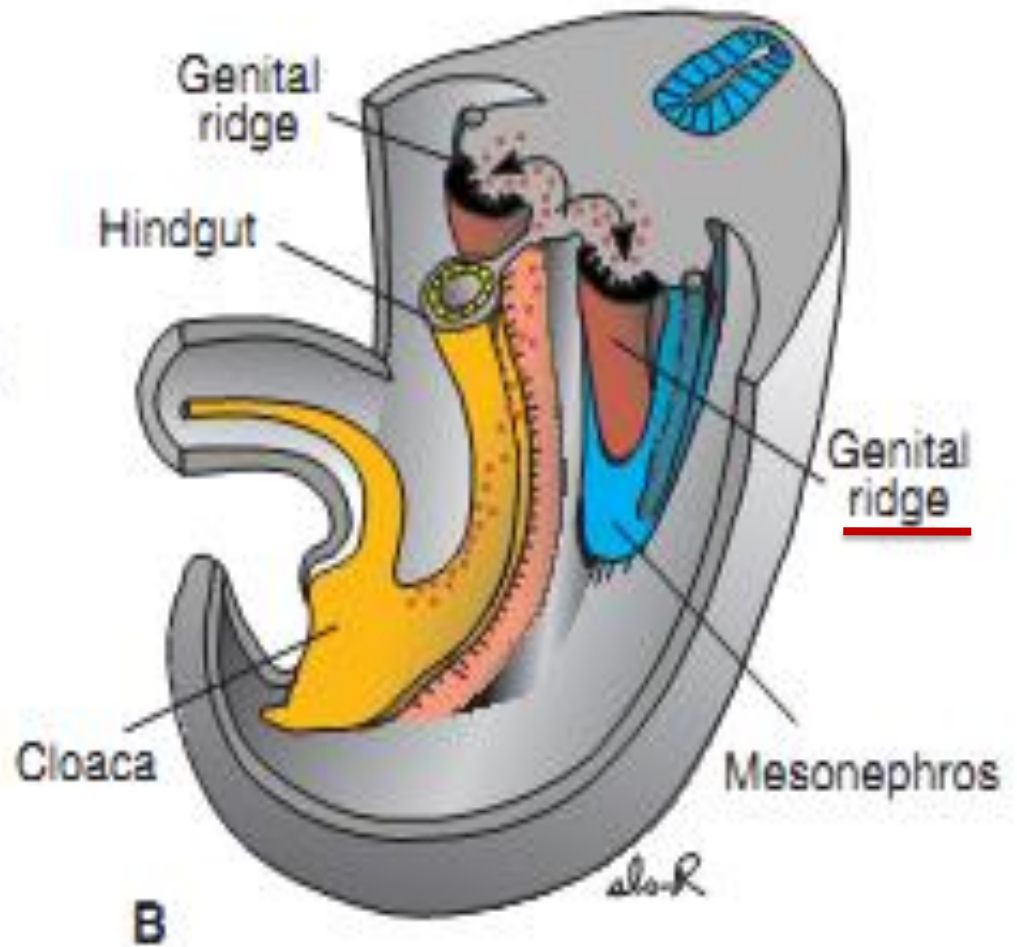
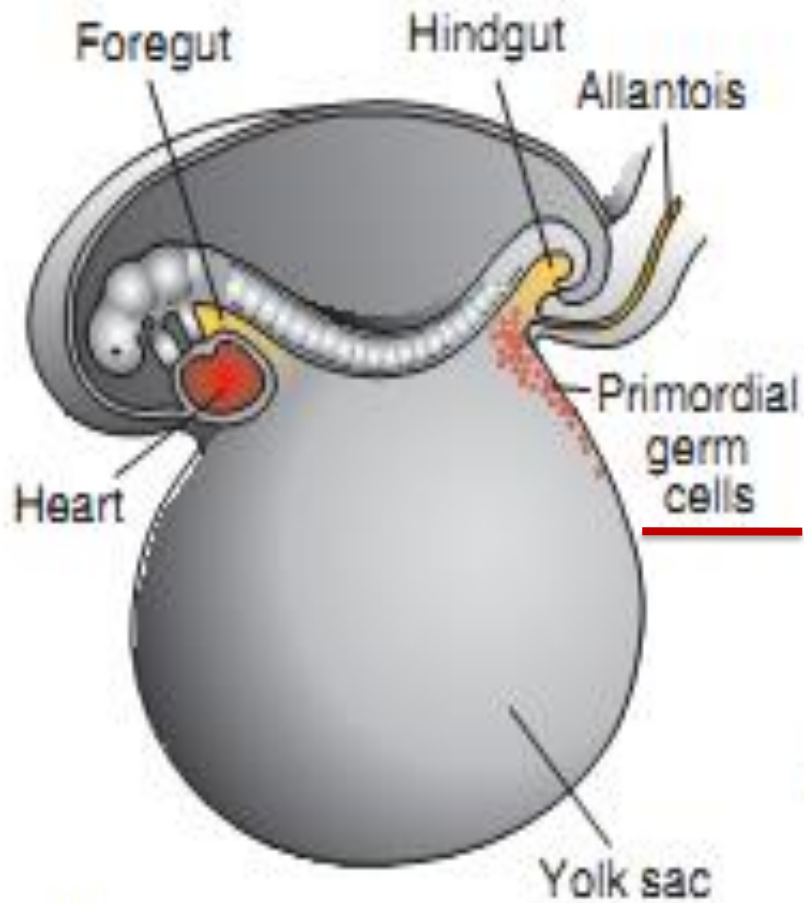


FIGURE 16-20 Major events in the sexual differentiation of male and female human embryos.

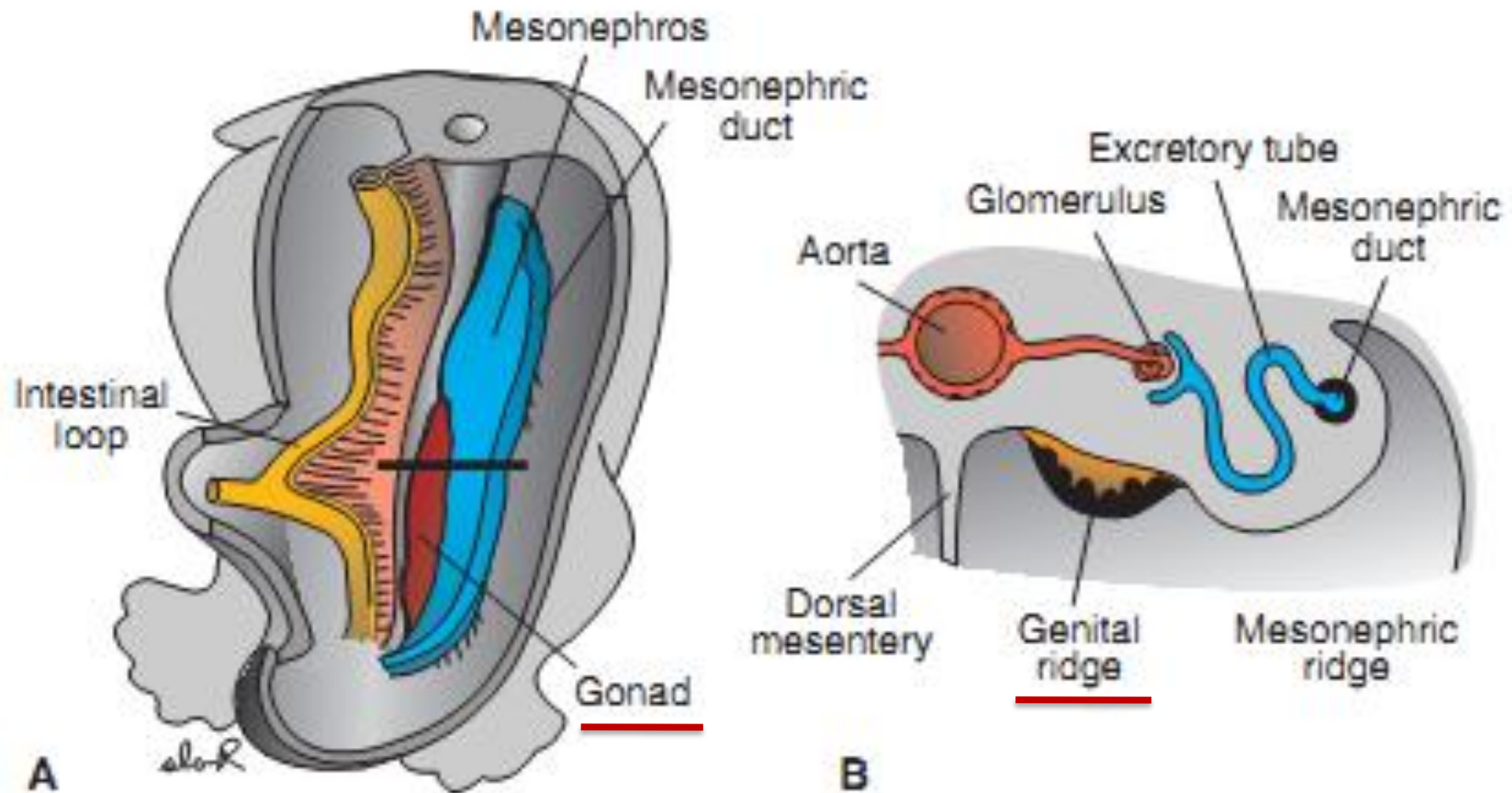
Sexual Differentiation: Internal Embryonic Development

(a) Development of internal organs





MINGGU 3 EMBRYO



MINGGU 4 EMBRYO

In genetic males, the testis-determining factor gene in the sex-determining region (*SRY*) of the Y chromosome is expressed in the sex cord cells, resulting in the production of SRY protein. Genetic females lack this gene and do not produce SRY protein.

SRY Protein

In response to SRY protein, the cells of the medullary sex cords differentiate into Sertoli cells and secrete antimüllerian hormone (AMH), whereas the cells of the cortical sex cords degenerate.

AMH

Signal resulting from the expression of SRY protein causes mesenchymal cells in the gonadal ridge to differentiate into Leydig cells, which secrete testosterone.

AMH induces degeneration of the paramesonephric (müllerian) ducts.

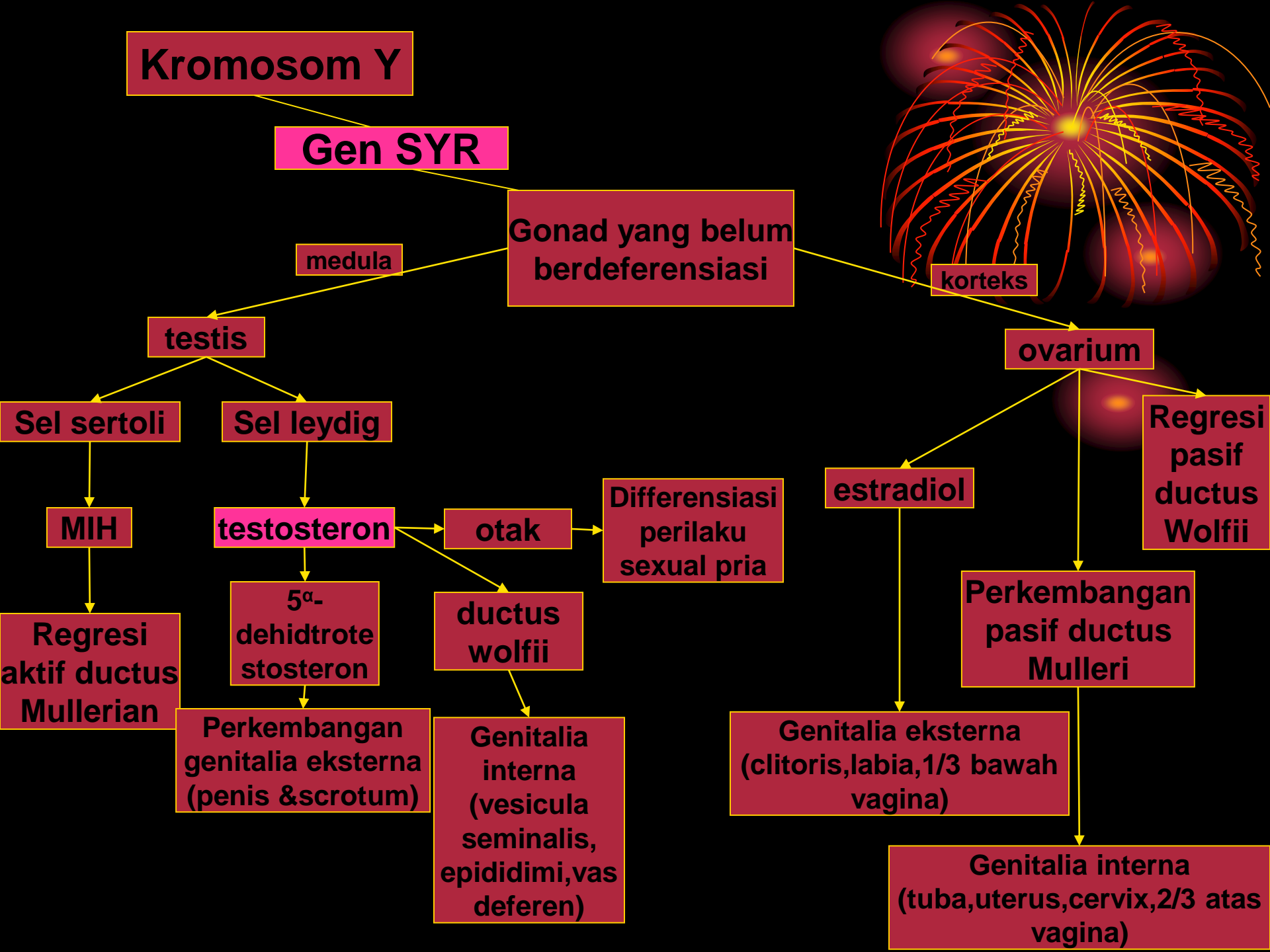
Testosterone

Dihydrotestosterone

During fetal life, testosterone induces the male differentiation of many structures, including the genital duct system and the brain.

During fetal life, conversion of testosterone to dihydrotestosterone within the relevant target tissues causes the indifferent external genitalia to differentiate into a penis and scrotum and also induces the development or differentiation of some other male structures, such as the prostate.

The testosterone surge at puberty causes the seminiferous tubules to canalize, mature, and commence spermatogenesis, and induces the other pubertal changes in primary and secondary sexual characteristics.



Male

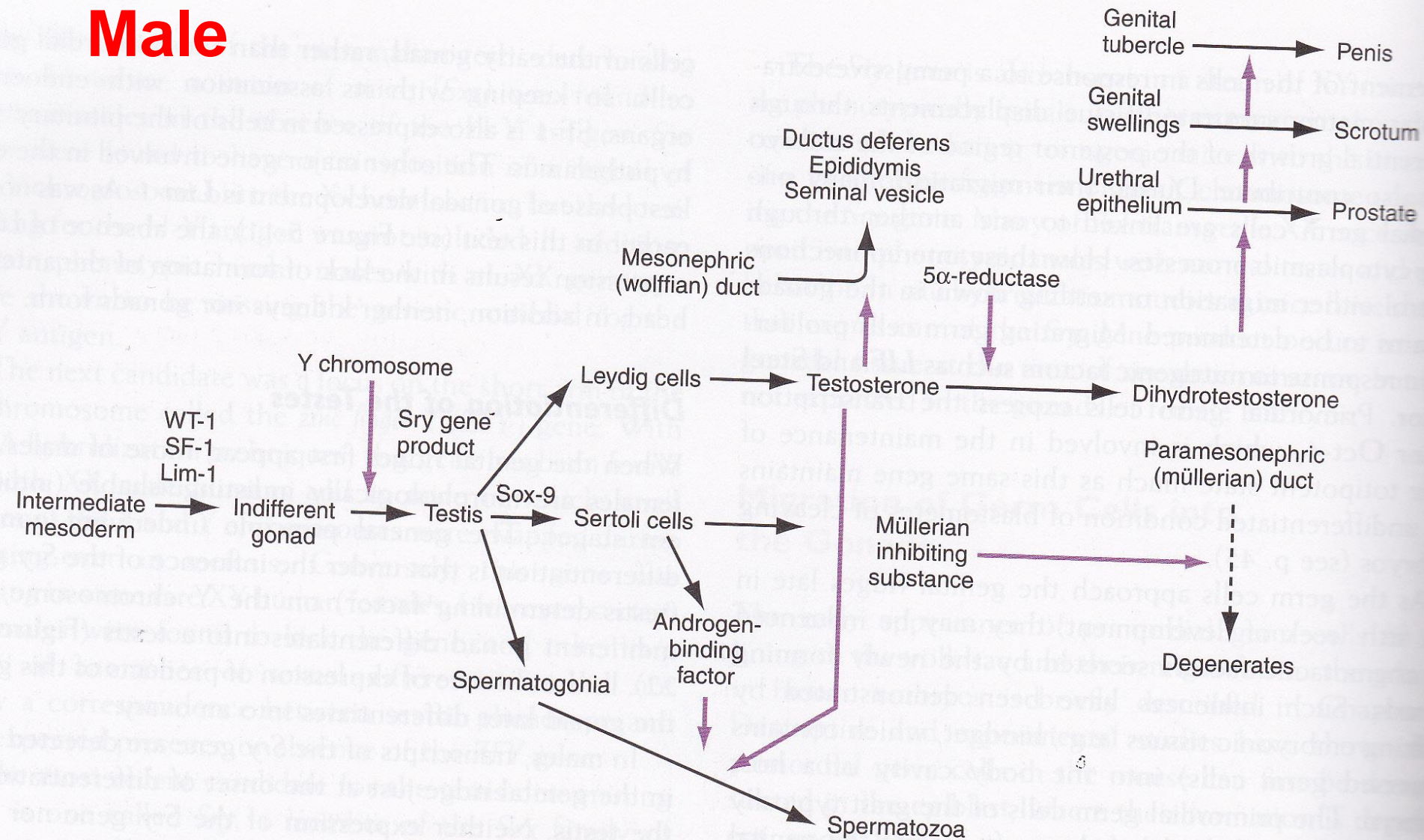
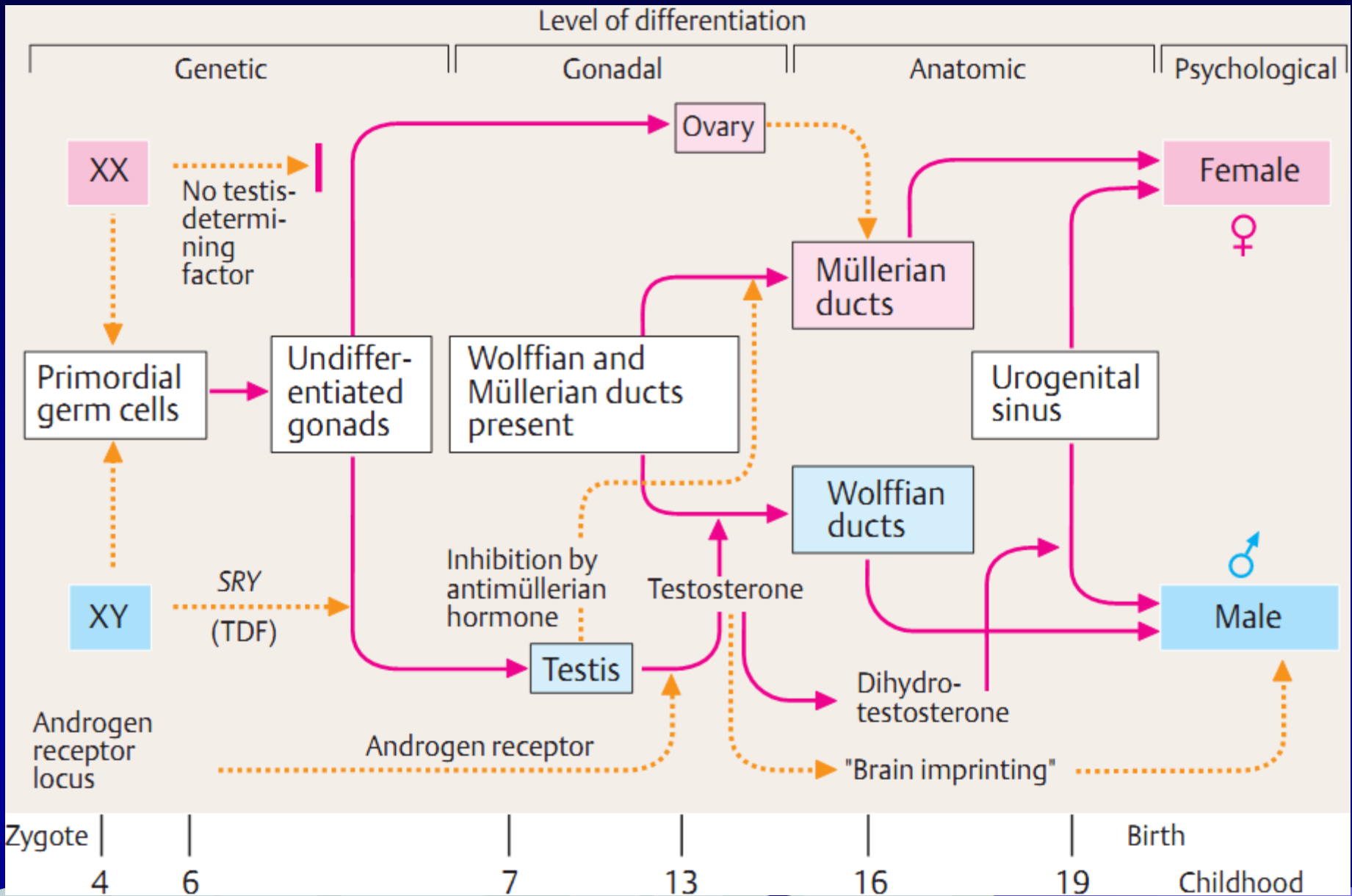


FIGURE 16-22 Differentiation of the male phenotype.



GONAD DEFERENSIASI

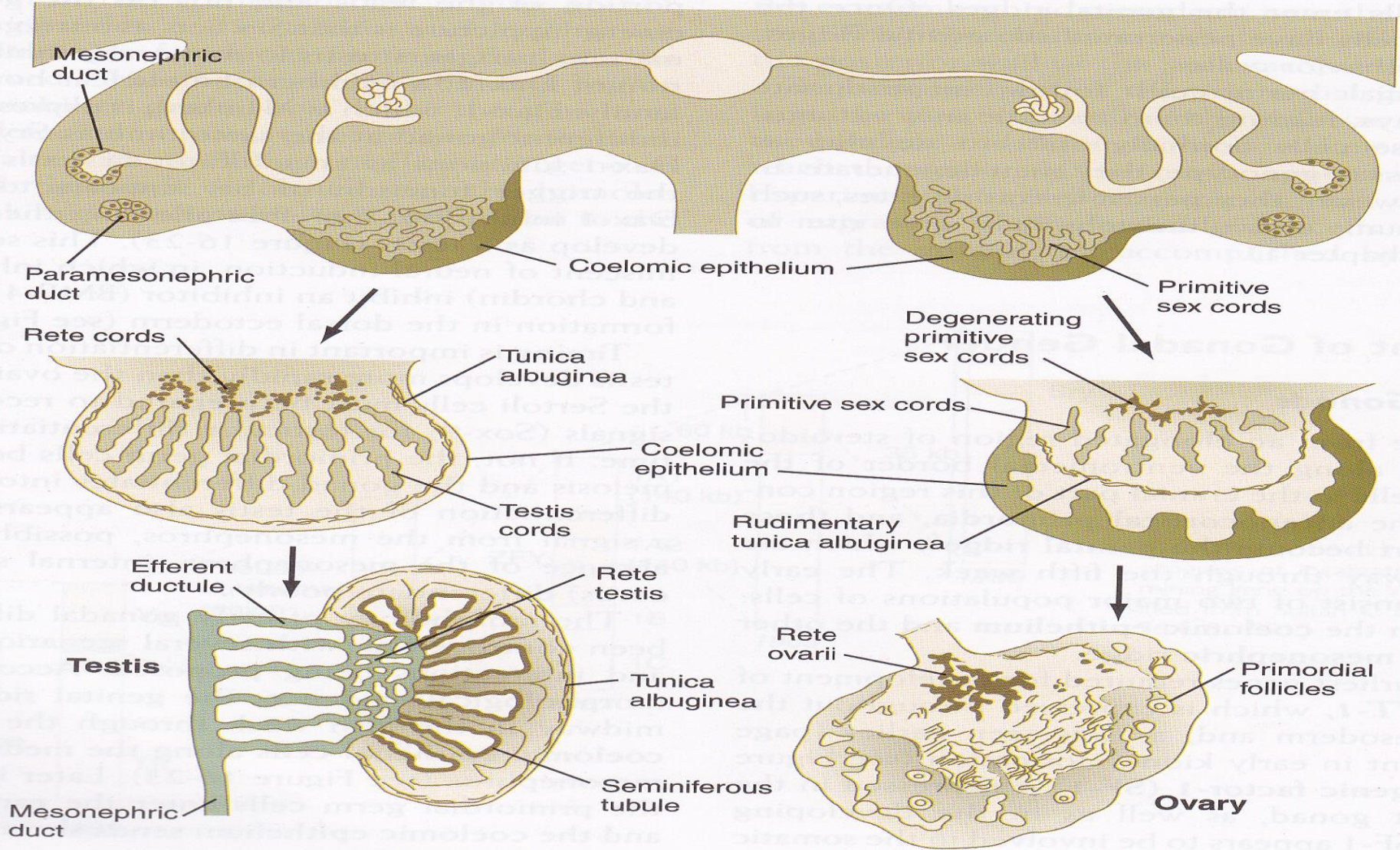


FIGURE 16-23 Morphology of gonadal differentiation.

6 - 8 mgg

44 + XY

Y influence

44 + XX

Absence of Y

Indifferent gonad

Testis

Ovary

Medullary cords develop

Medullary cords degenerate

No cortical cords

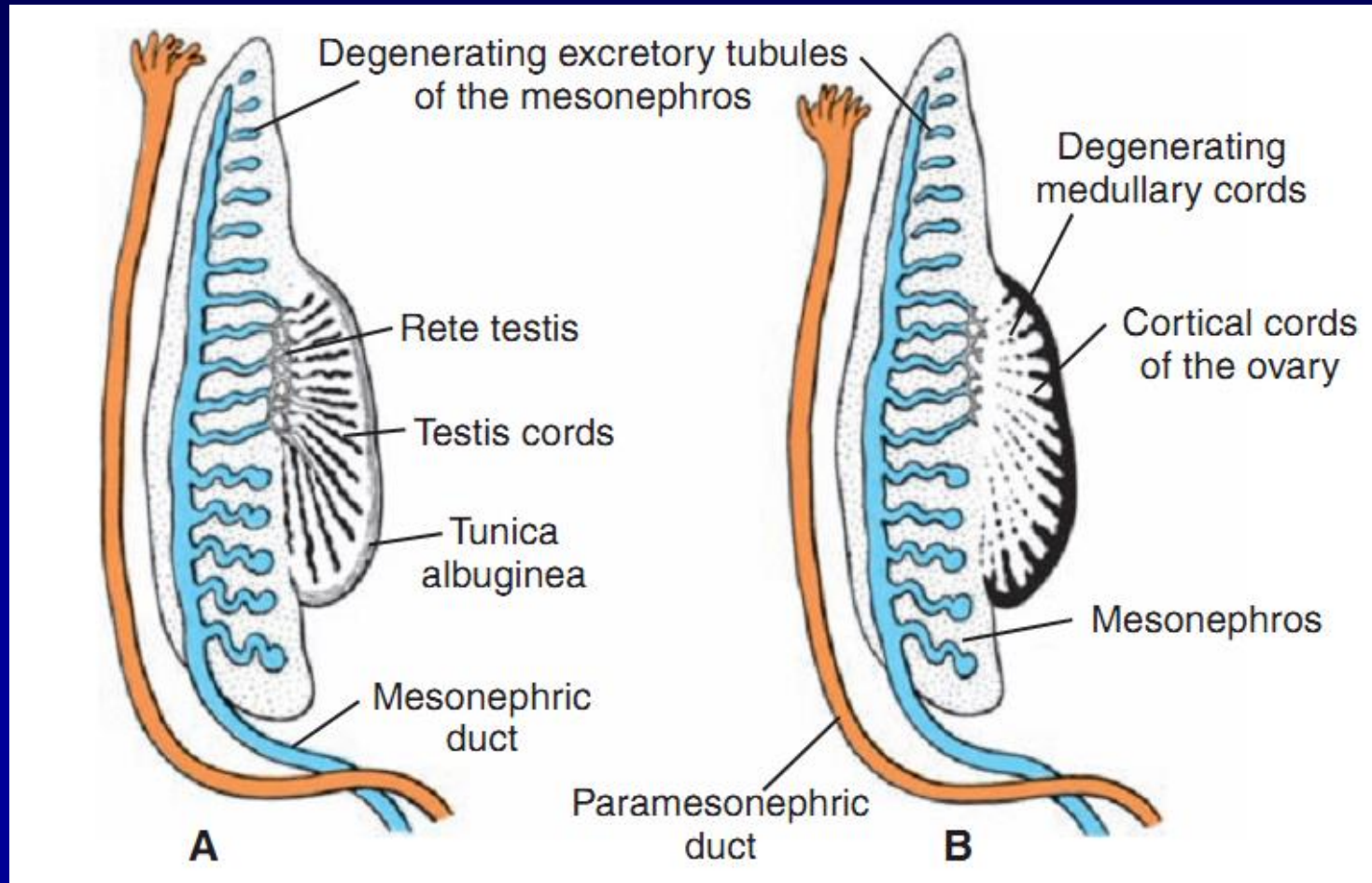
Cortical cords develop

Thick tunica albuginea

No tunica albuginea

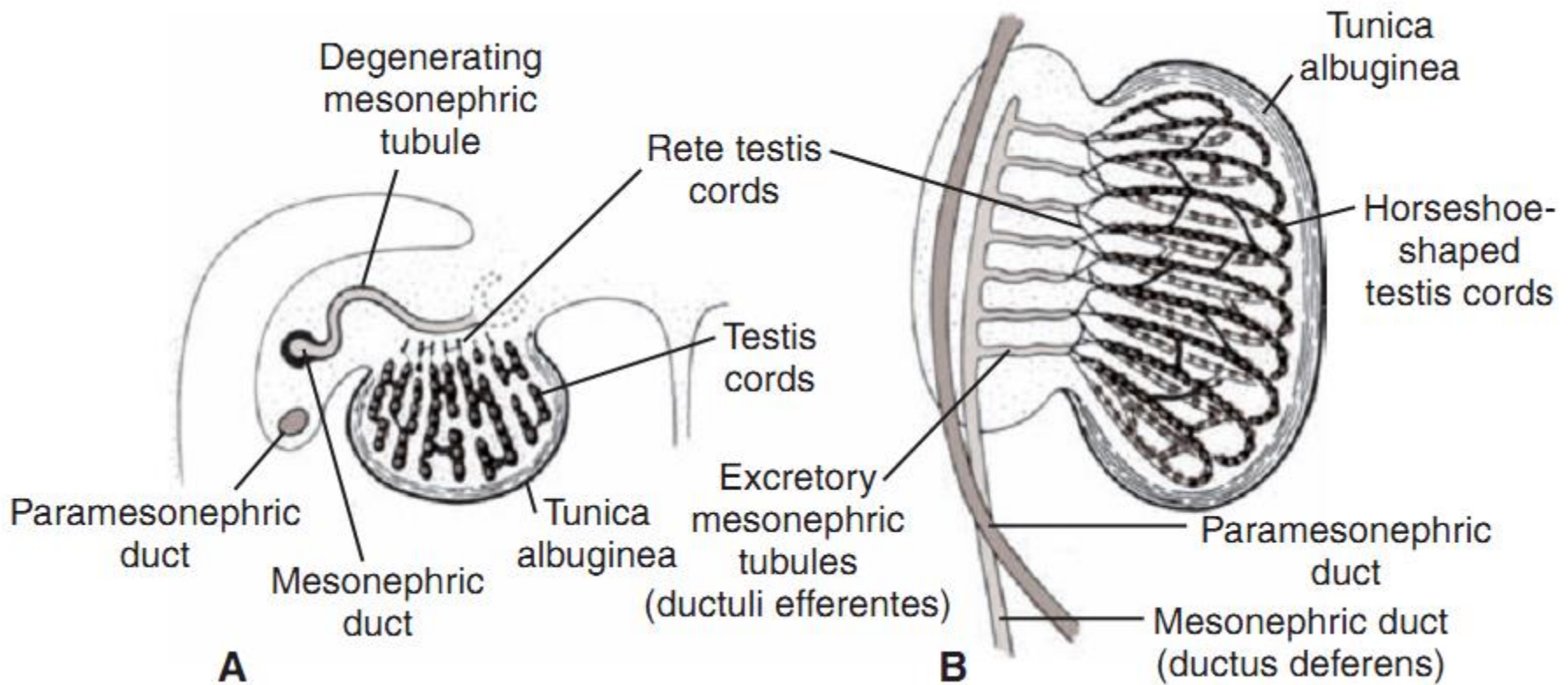


PERTUMBUHAN DUCTUS GENETALIA



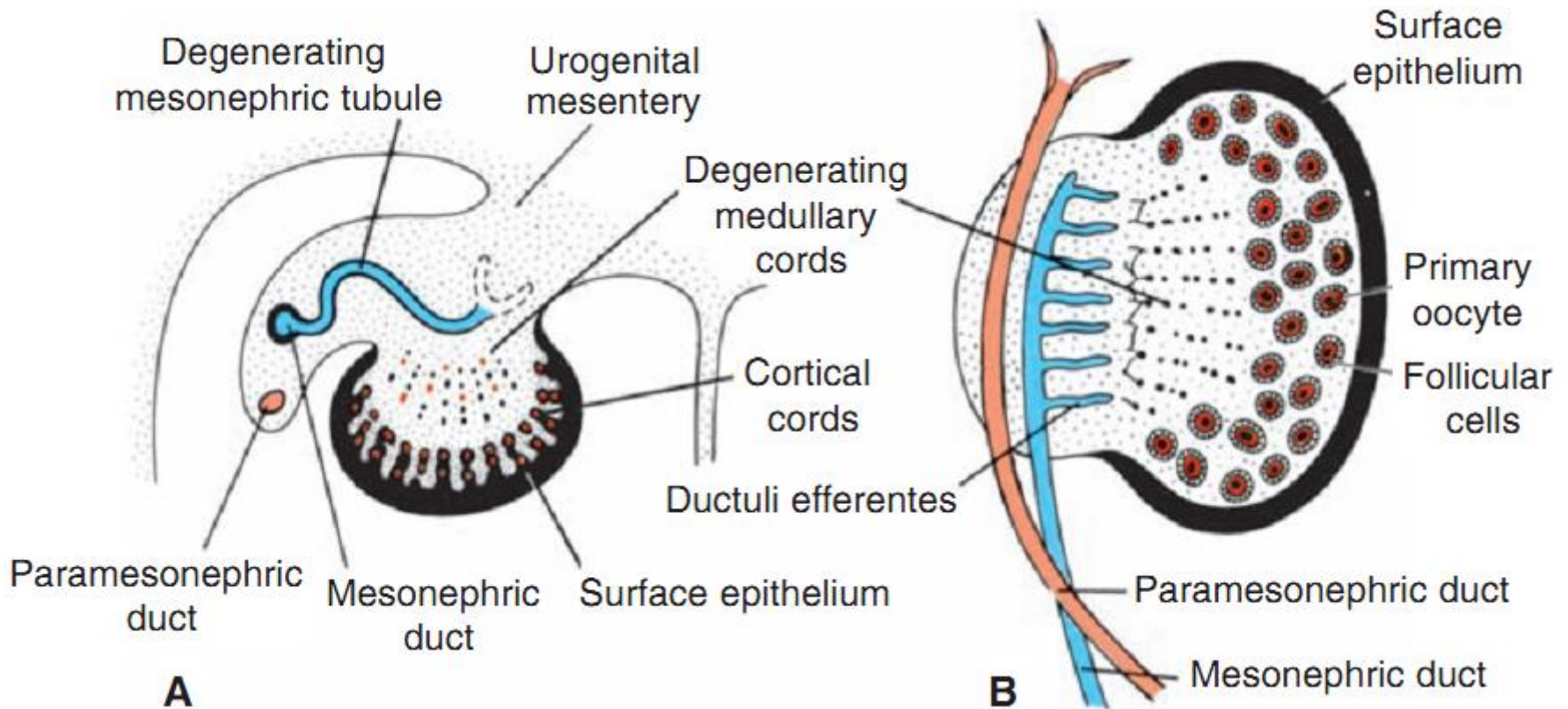
MINGGU 6 EMBRYO

Male

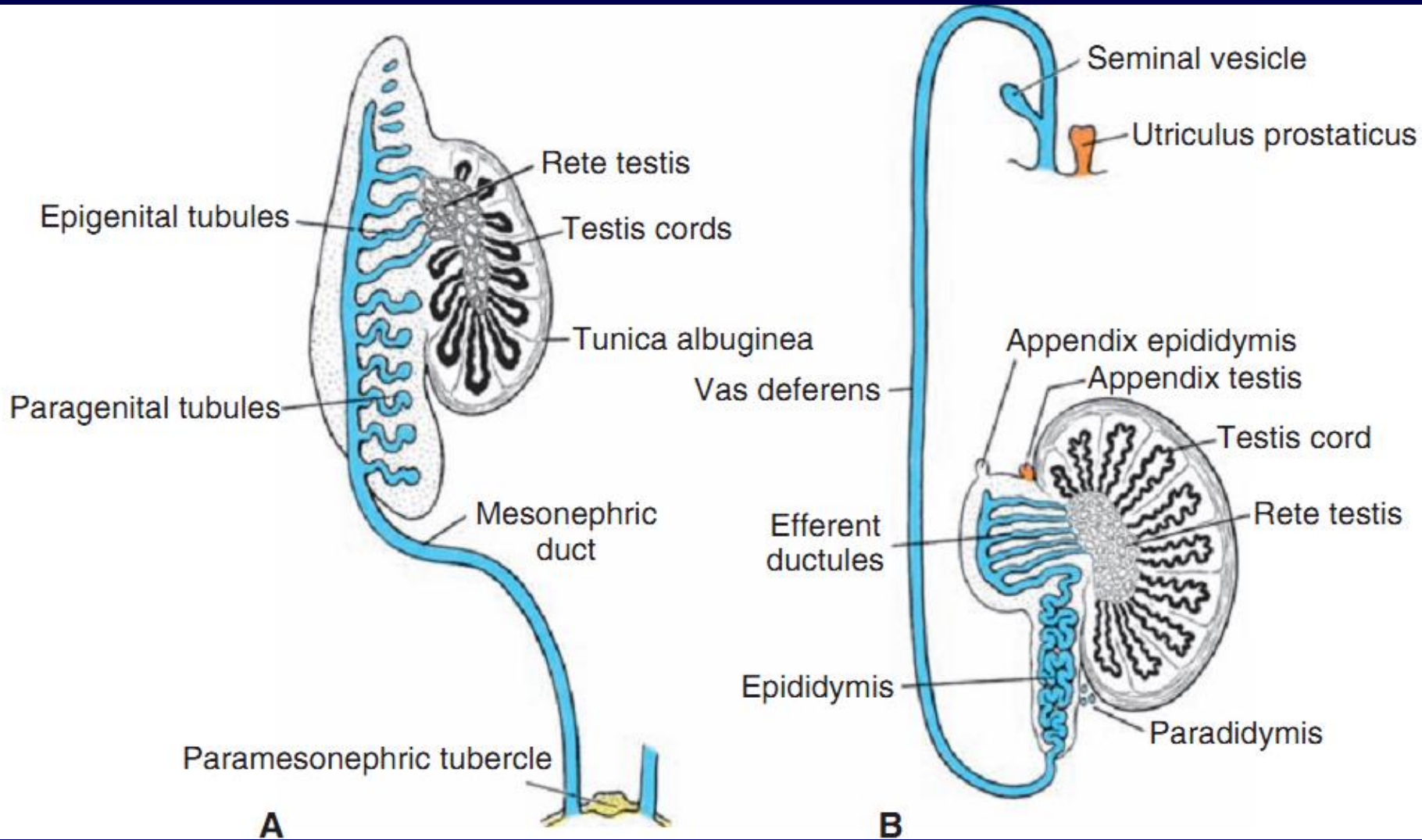


MINGGU 8 EMBRYO

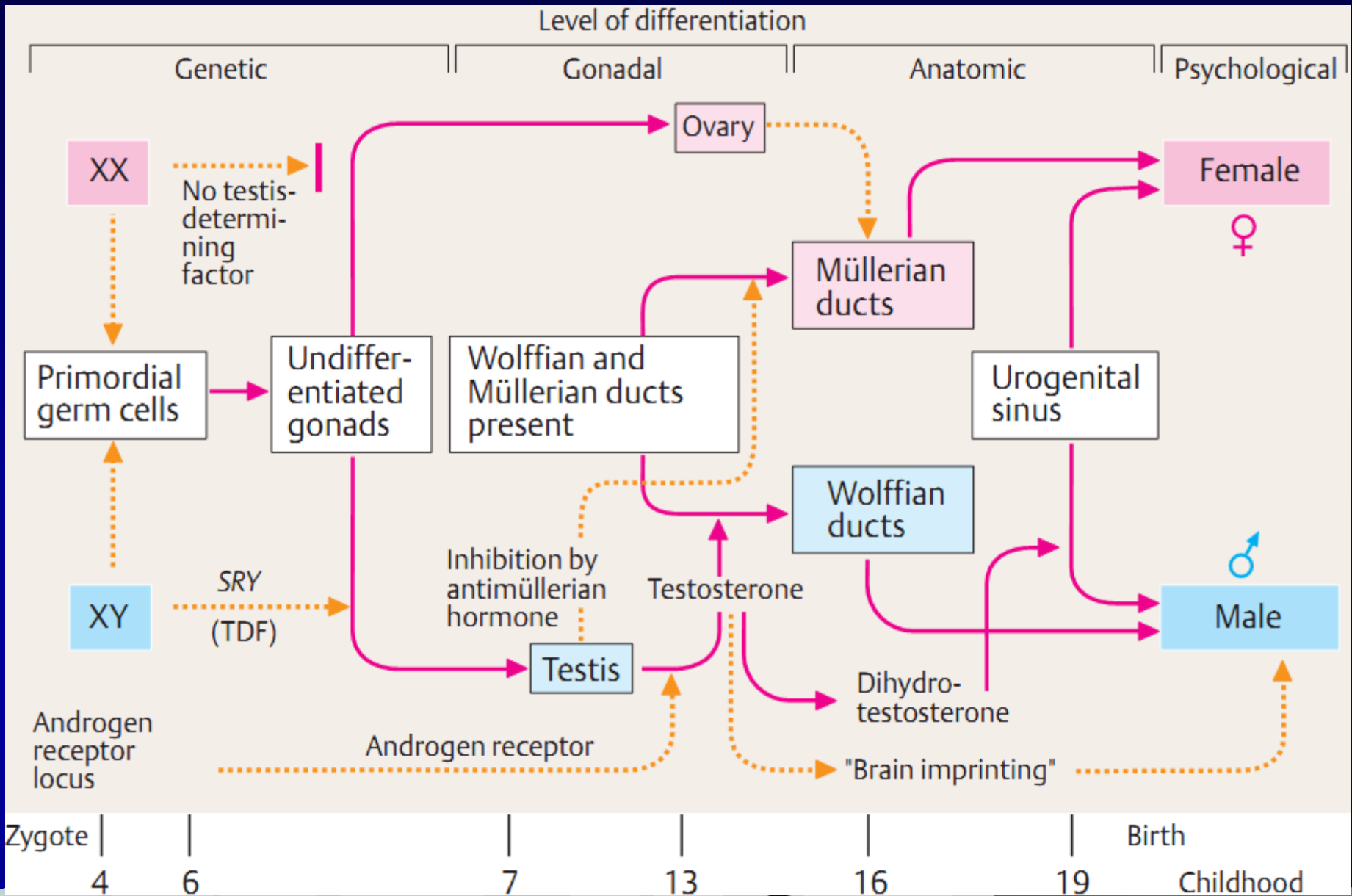
Female



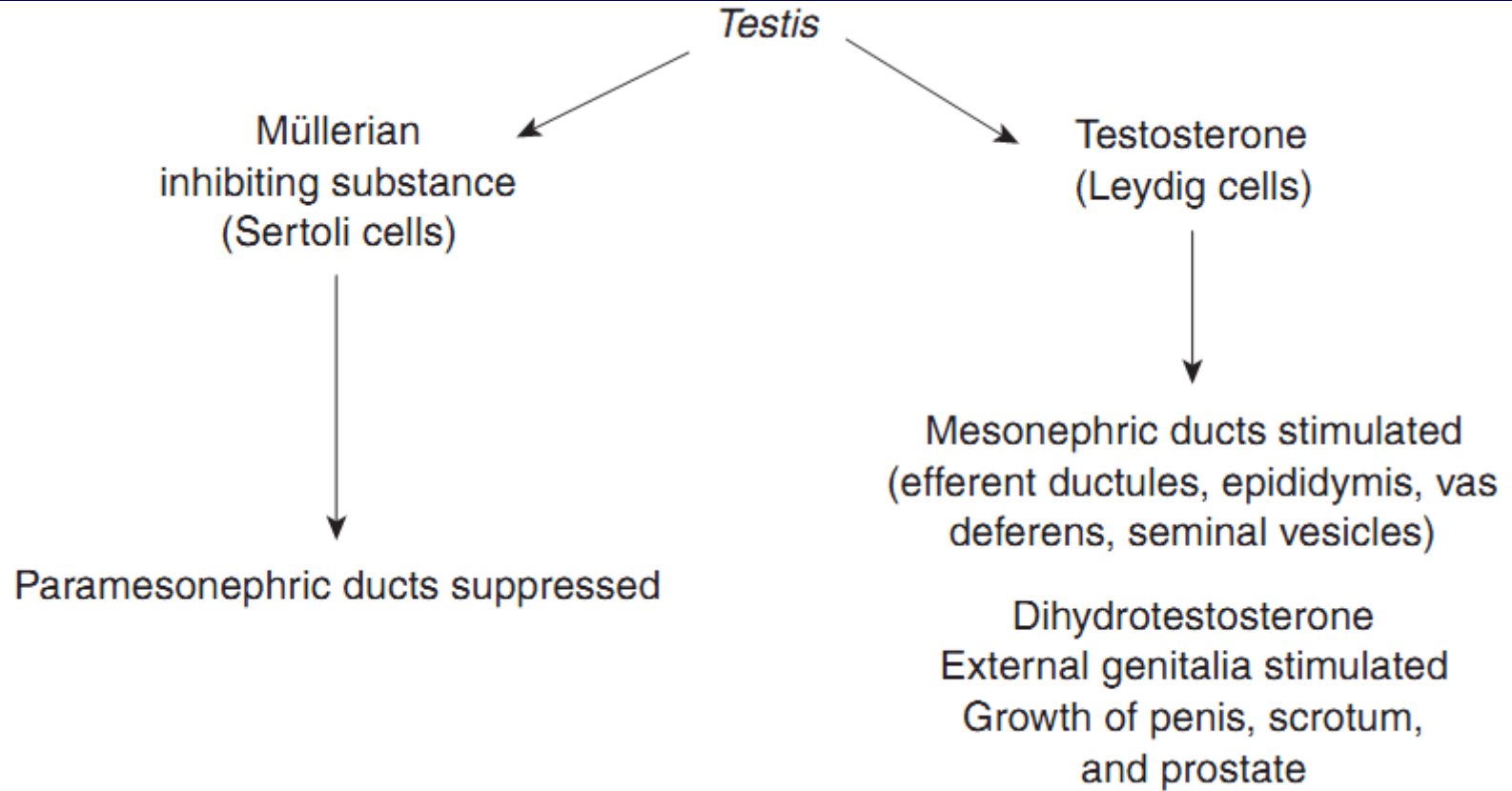
MINGGU 8 EMBRYO

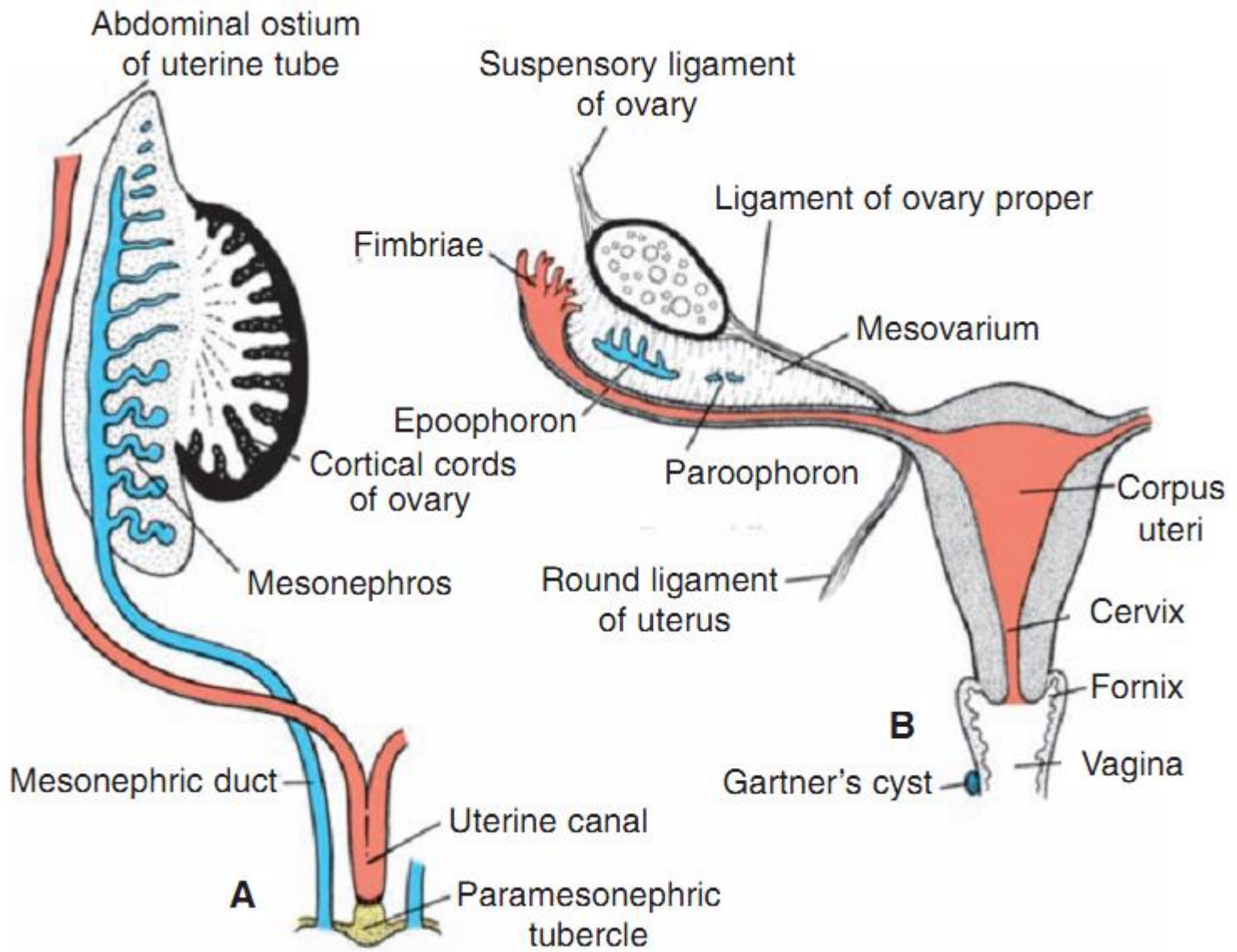


BULAN KE-2 EMBRYO



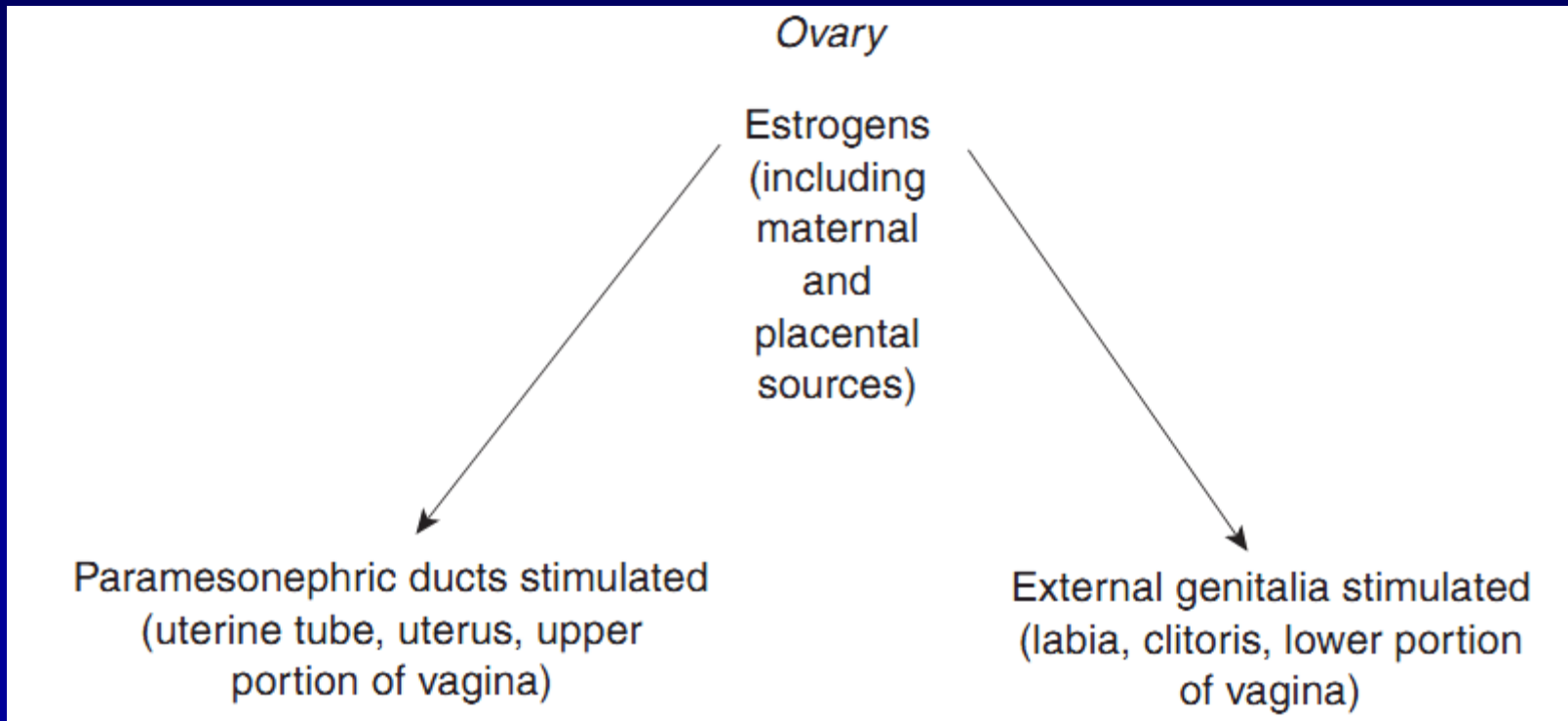
Male





BULAN KE-2 EMBRYO

Female



Mesonephric (wolffian) duct

Paramesonephric (müllerian) duct

Testis

Ovary

Ductus deferens

Prostatic utricle

Müllerian tubercle

Epididymal duct

Urogenital sinus

Testis

Uterus

Uterine tube

Efferent ductules

Urethra

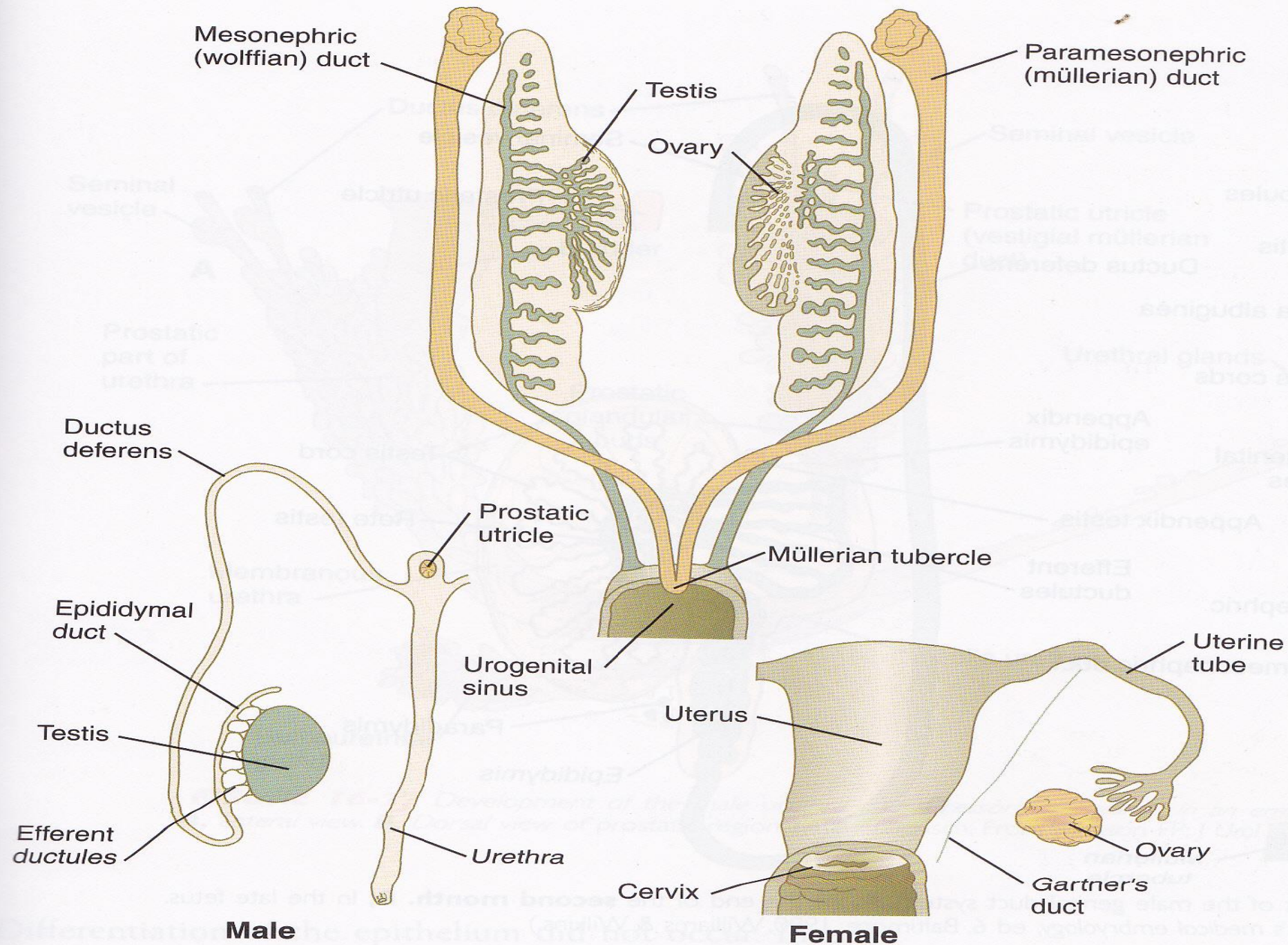
Cervix

Gartner's duct

Ovary

Male

Female



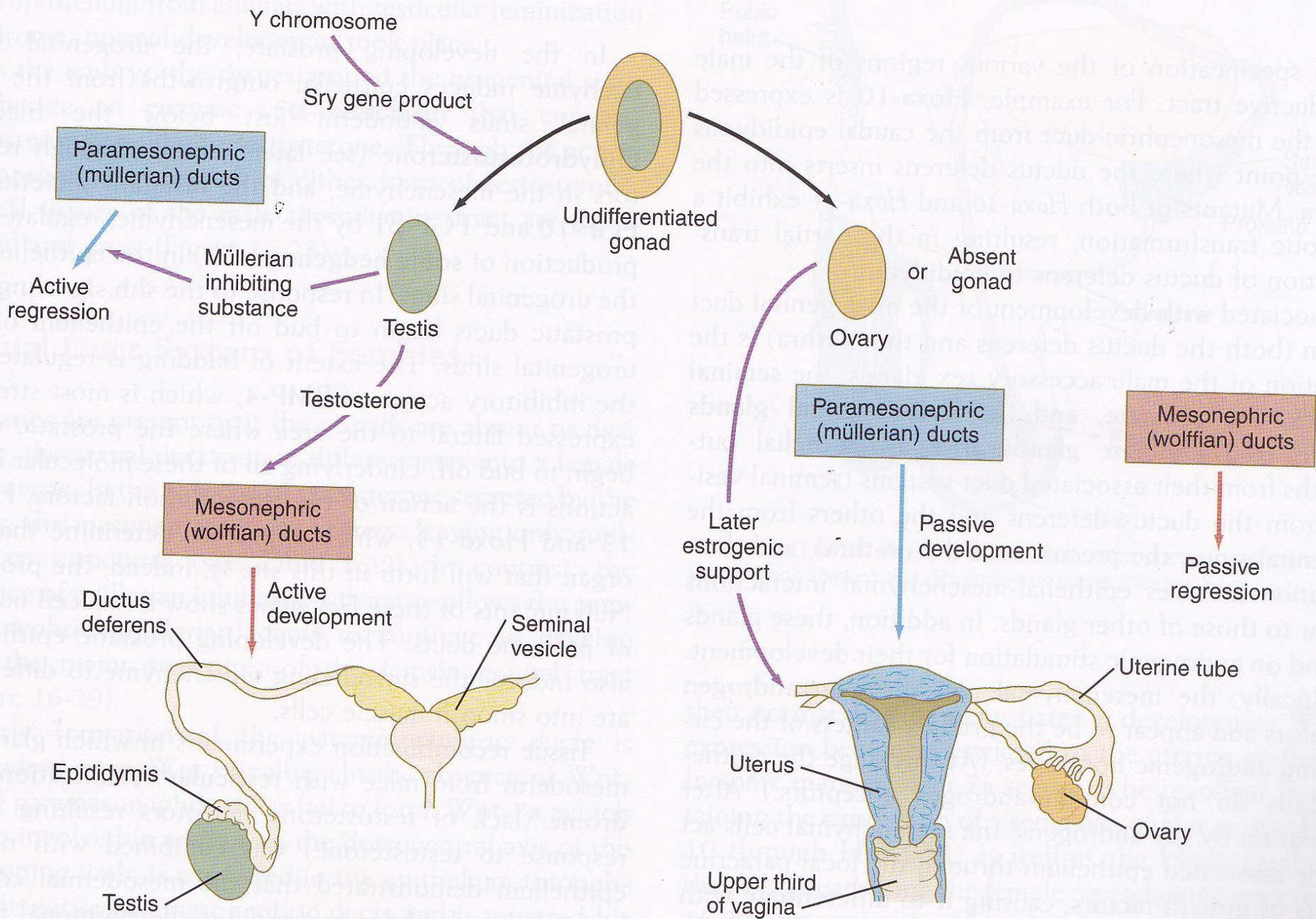


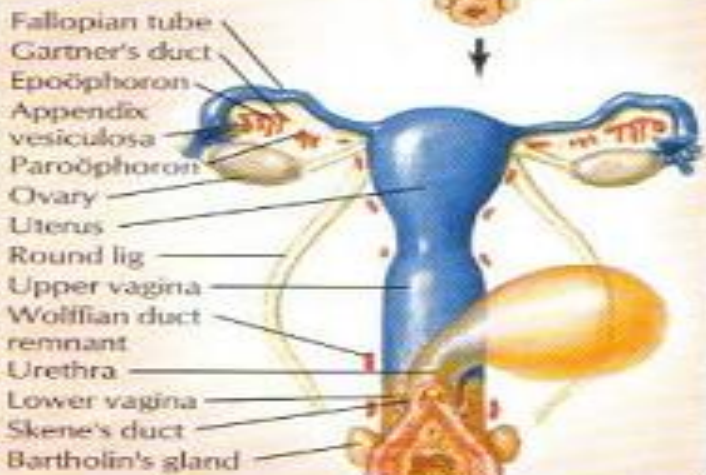
FIGURE 16-25 Factors involved in sexual differentiation of the genital tract. (After Hutson JM and others. In Burger H, deKrester D, eds: *The testis*, ed 2, New York, 1989, Raven, pp 143–179.)

Undifferentiated

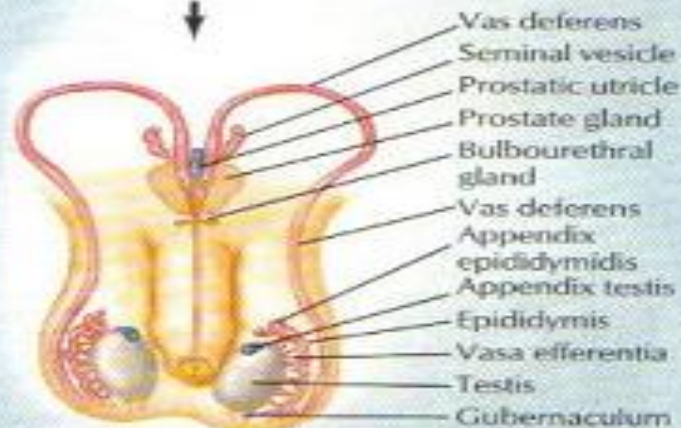
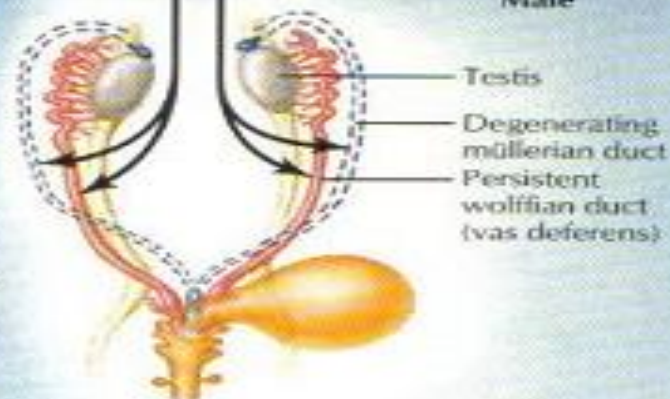


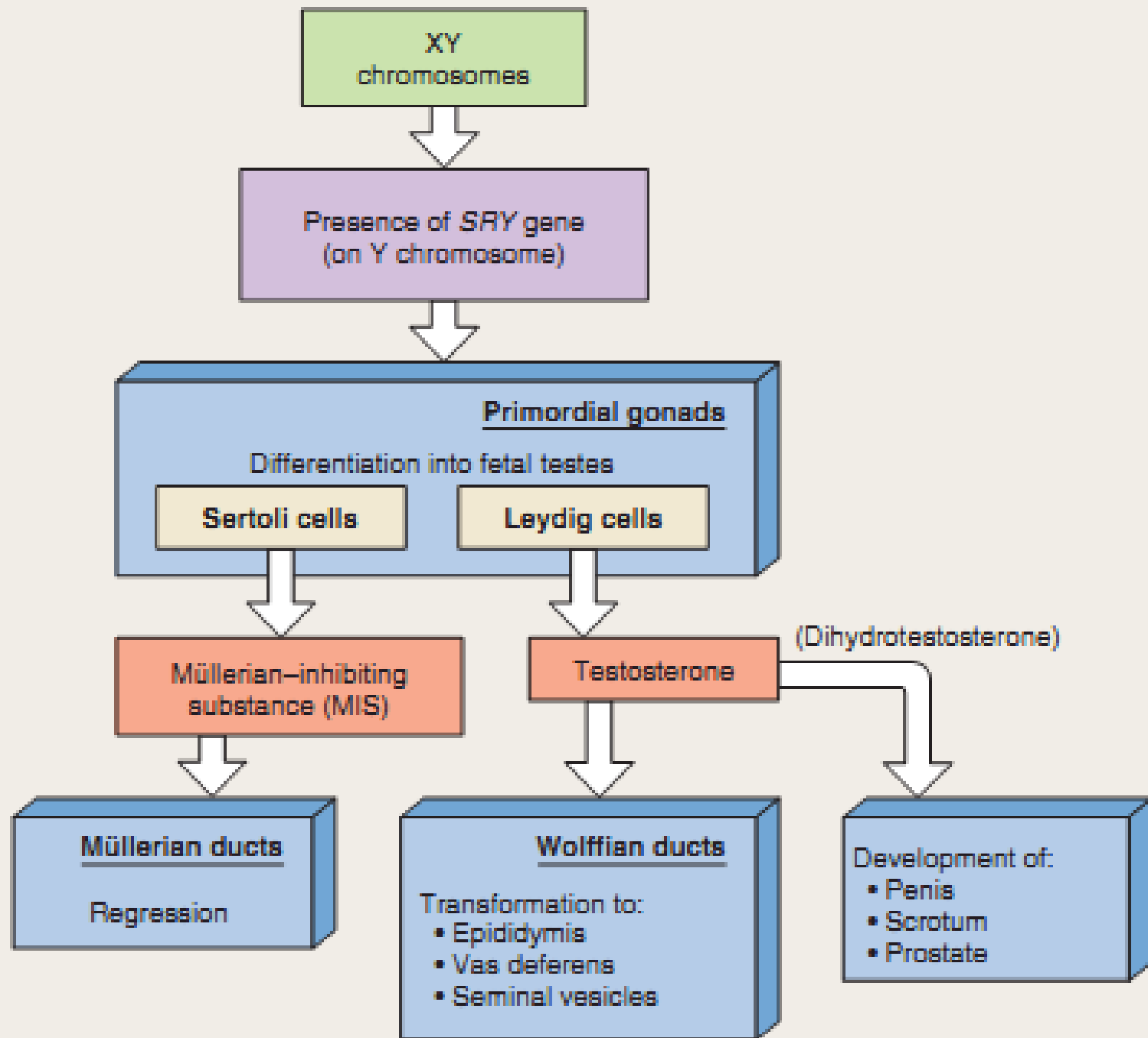
Testosterone from the fetal testes acts locally on the Wolffian ducts causing them to persist and differentiate. Müllerian inhibiting factor, also secreted by the fetal testes, causes degeneration of the Müllerian ducts.

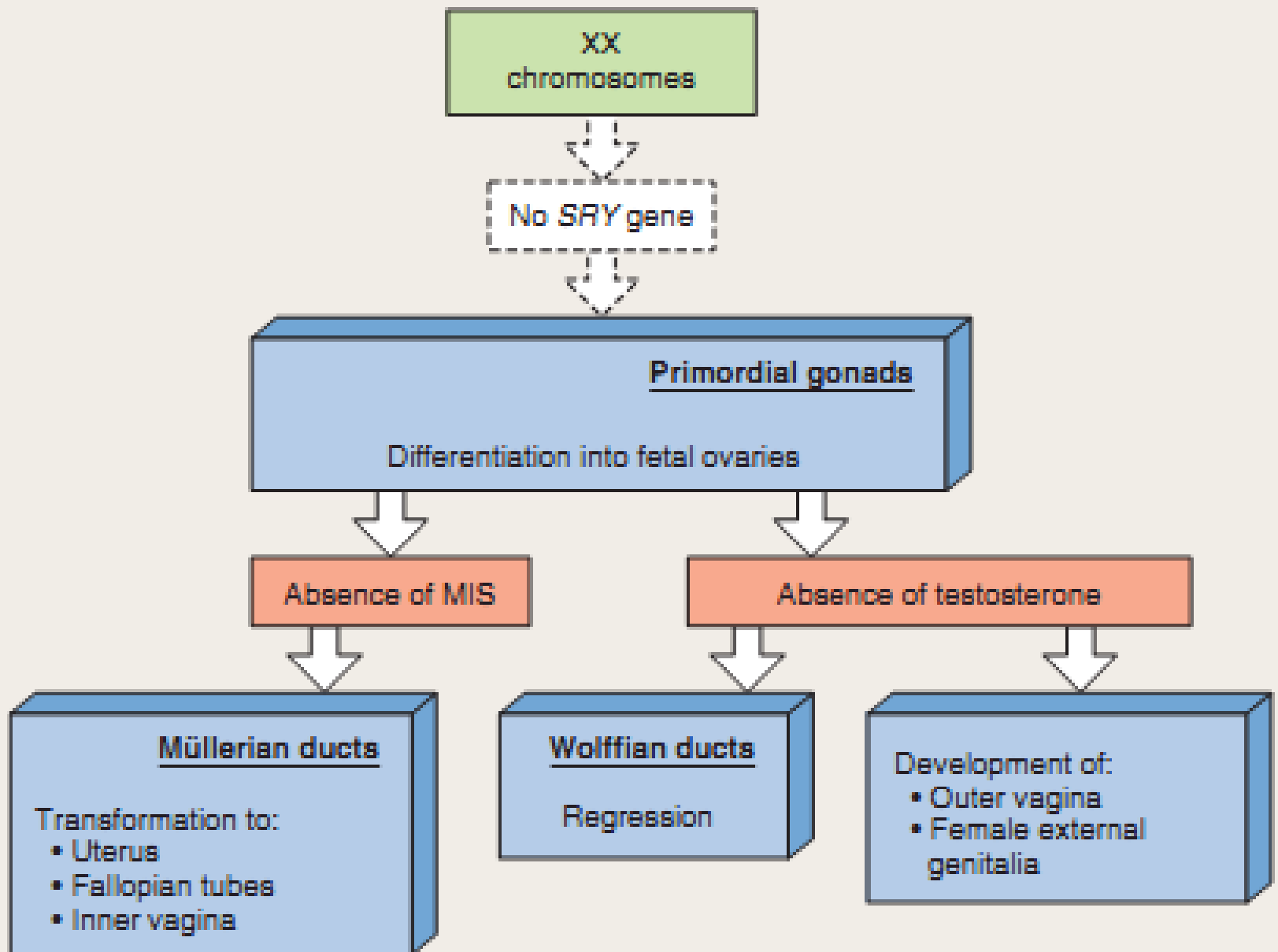
Female

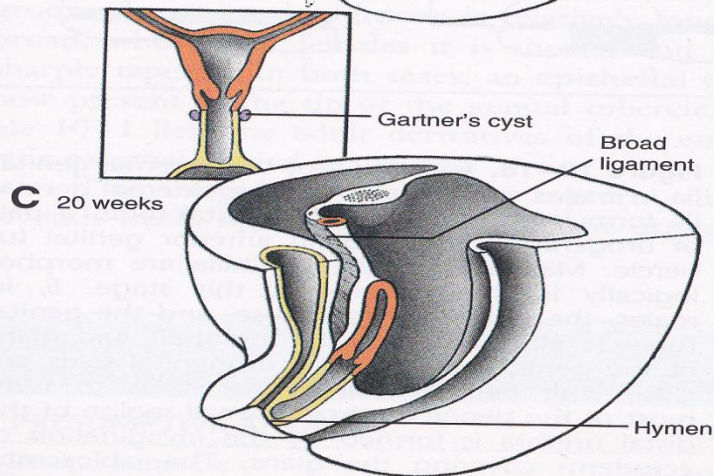
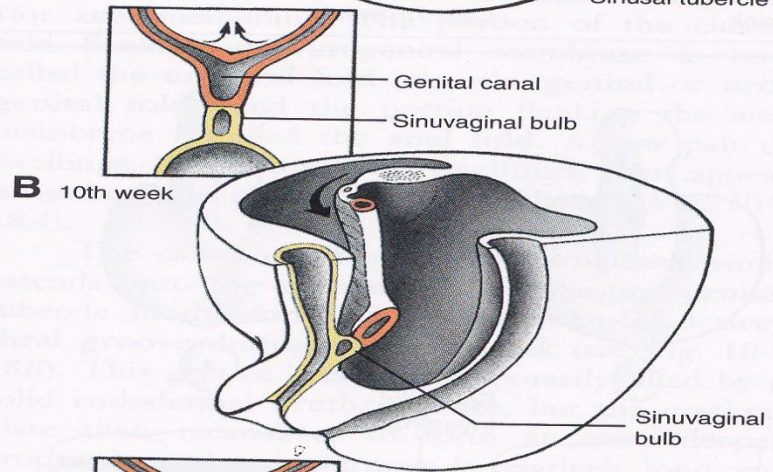
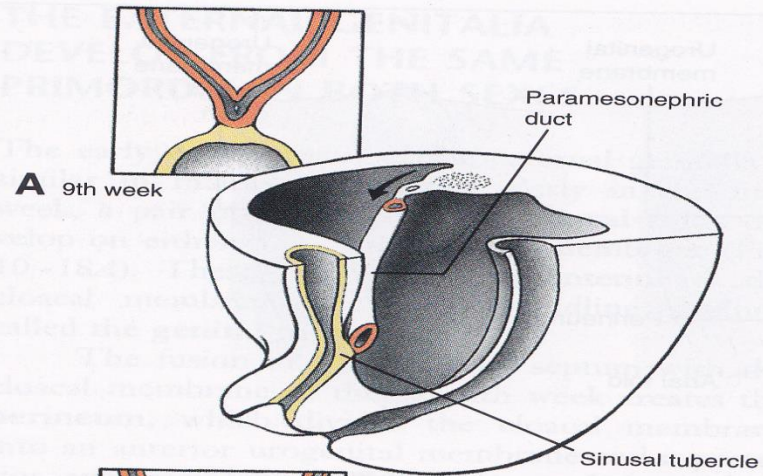


Male









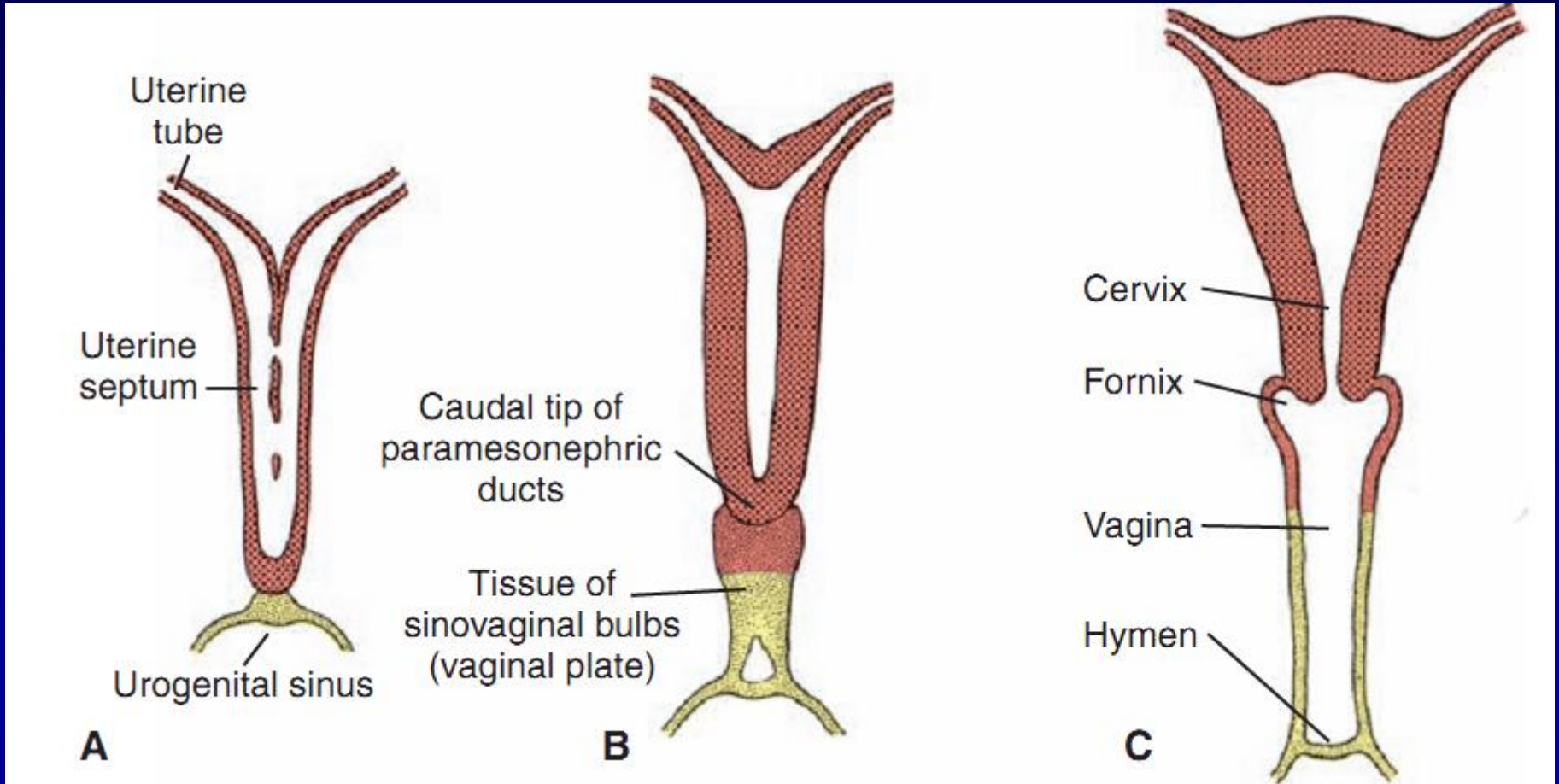
8 mgg

Female

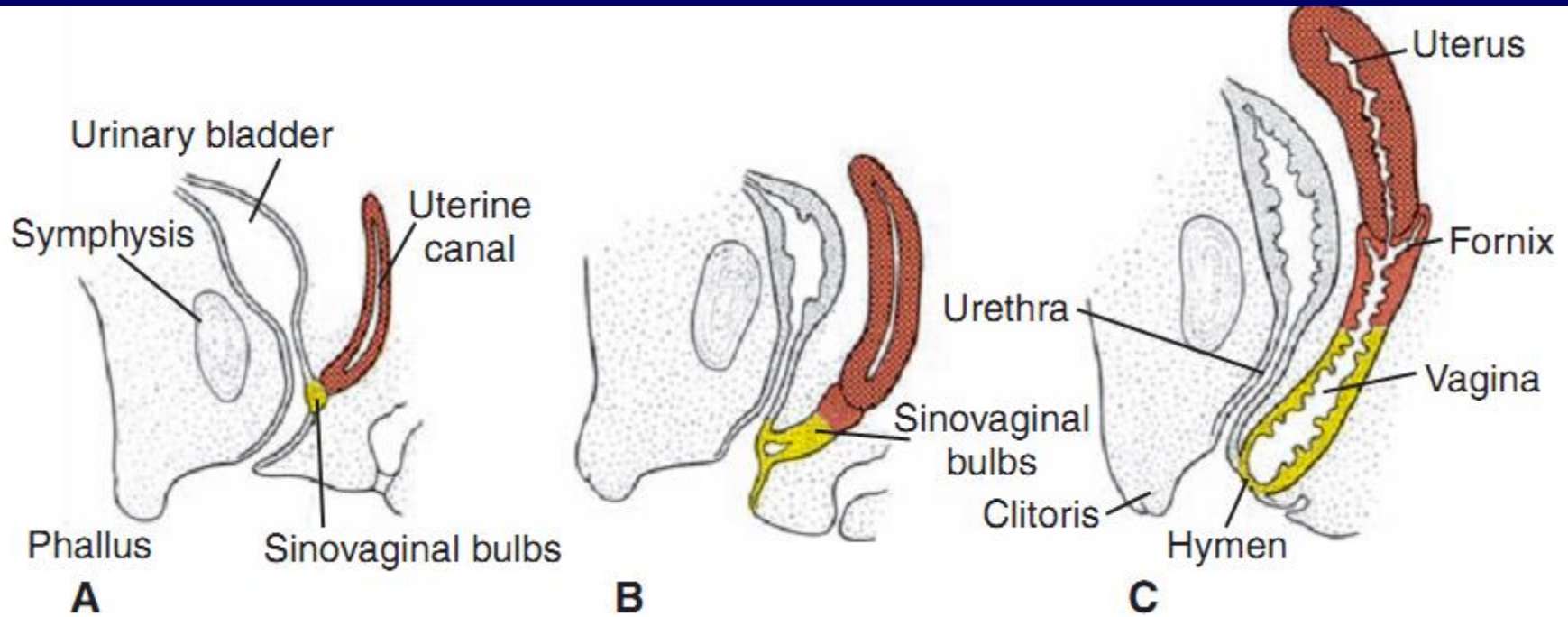
10 mgg

20 mgg

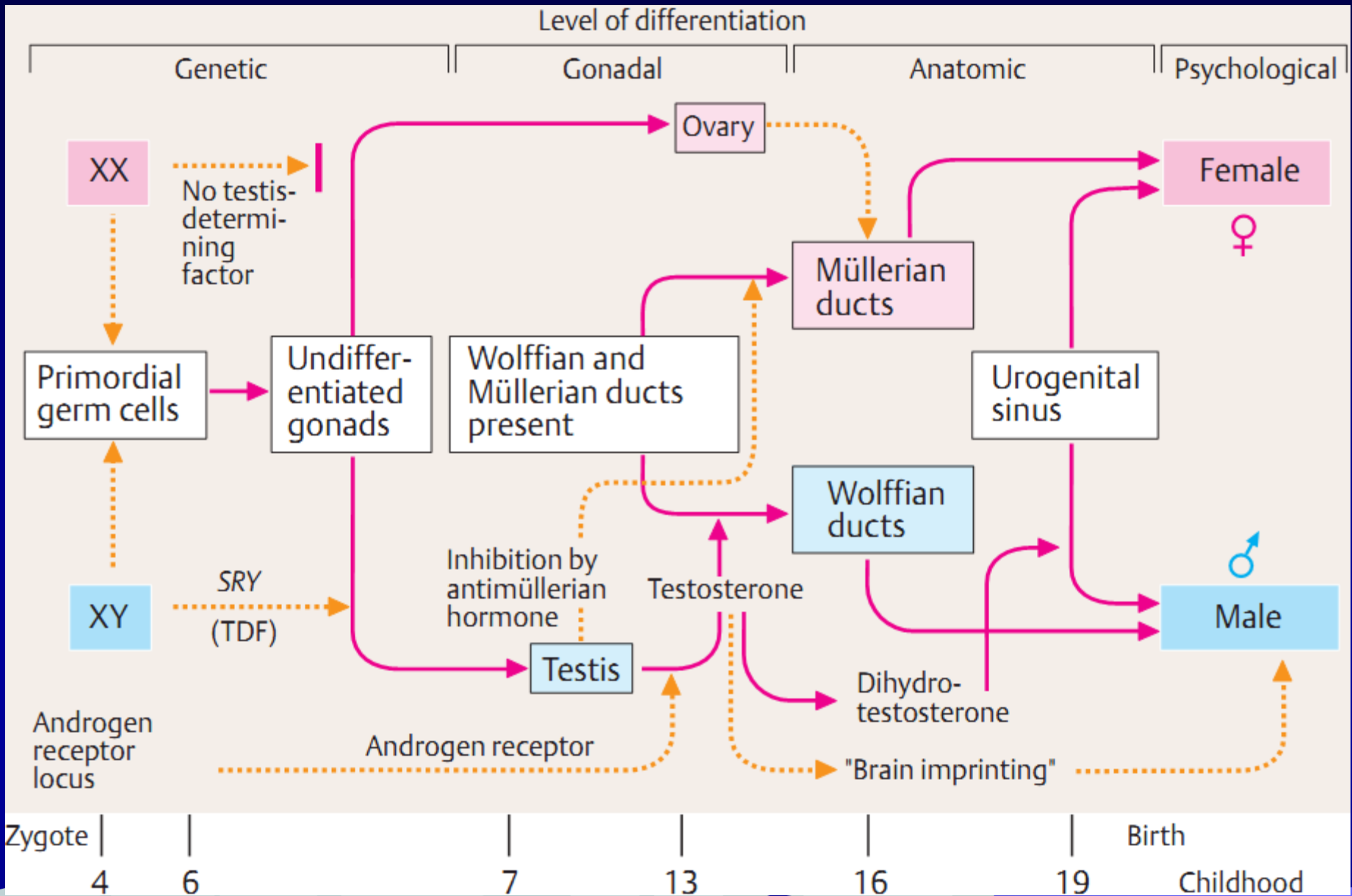
Female



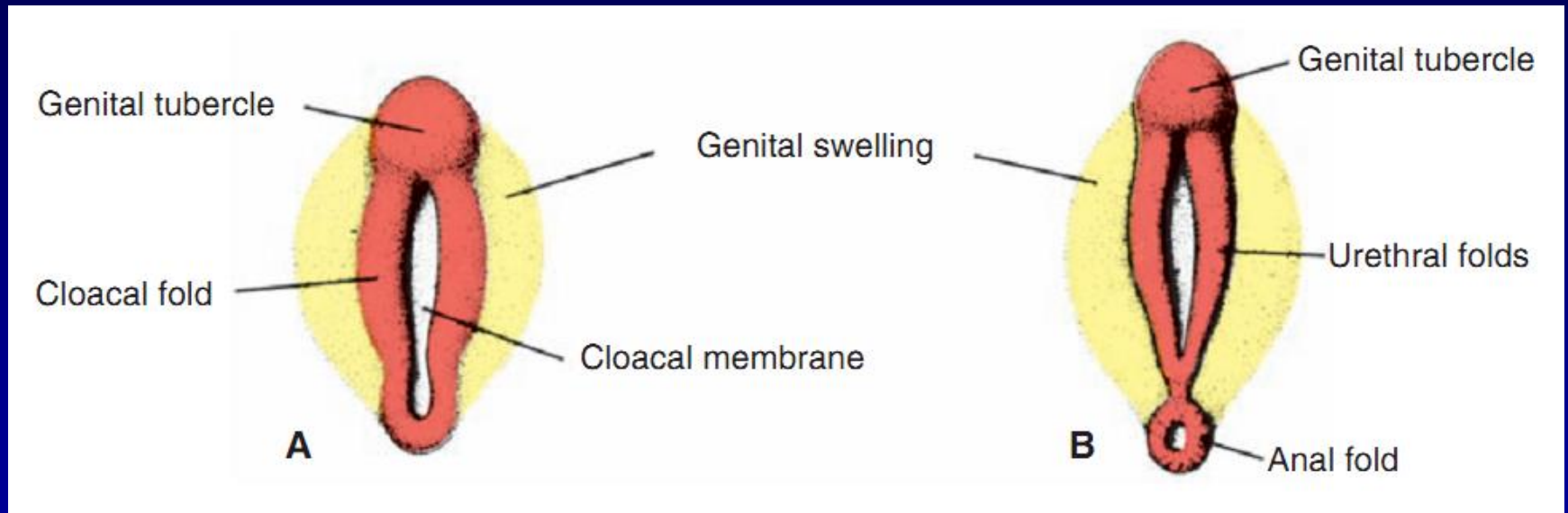
EMBRYO MINGGU 9 – AKHIR BLN 3 - LAHIR



EMBRYO MINGGU 9 – AKHIR BLN 3 - LAHIR



PERKEMBANGAN GENETALIA EXTERNAL



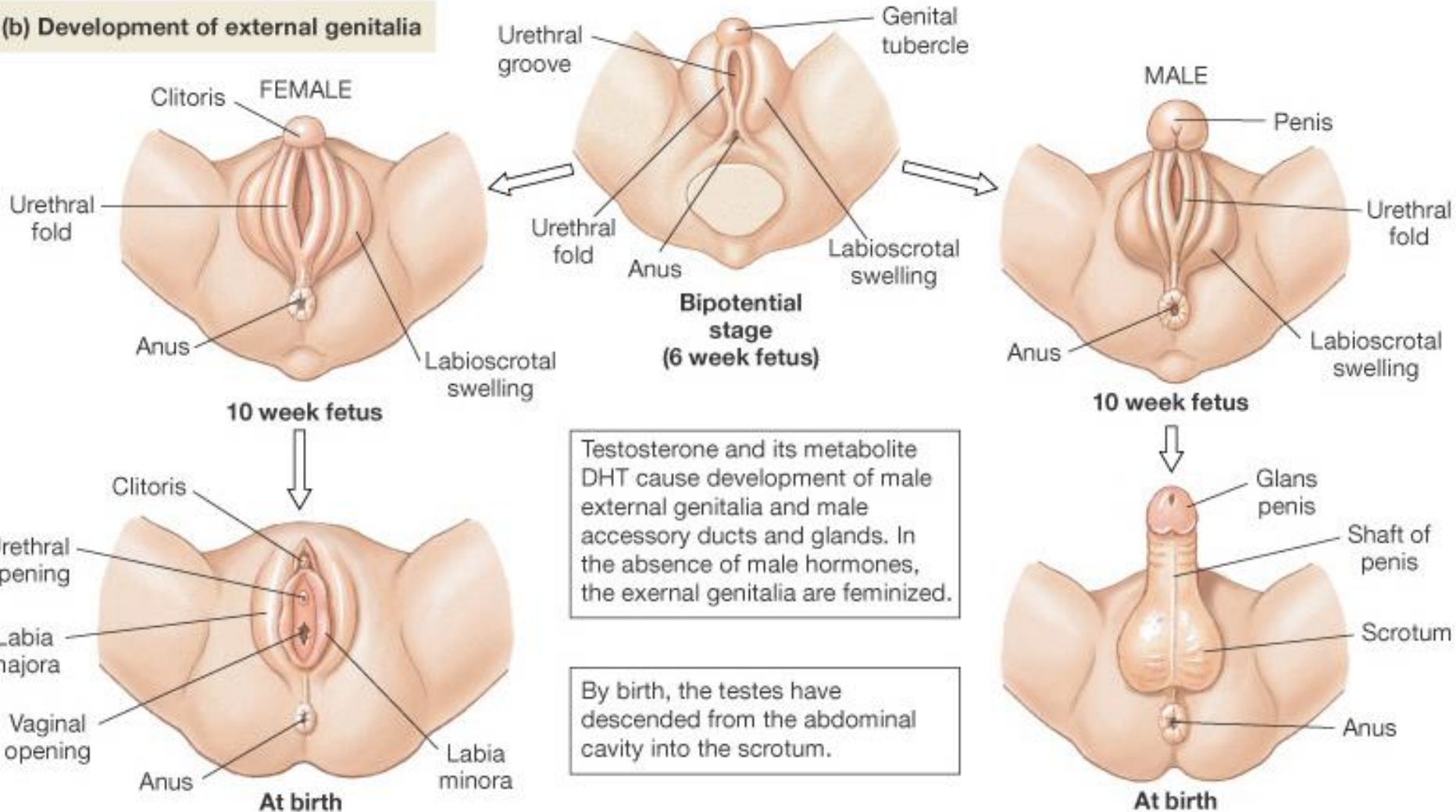
EMBRYO MINGGU 4 – MINGGU 6



EMBRYO MINGGU 7

Sexual Differentiation: External Genitalia

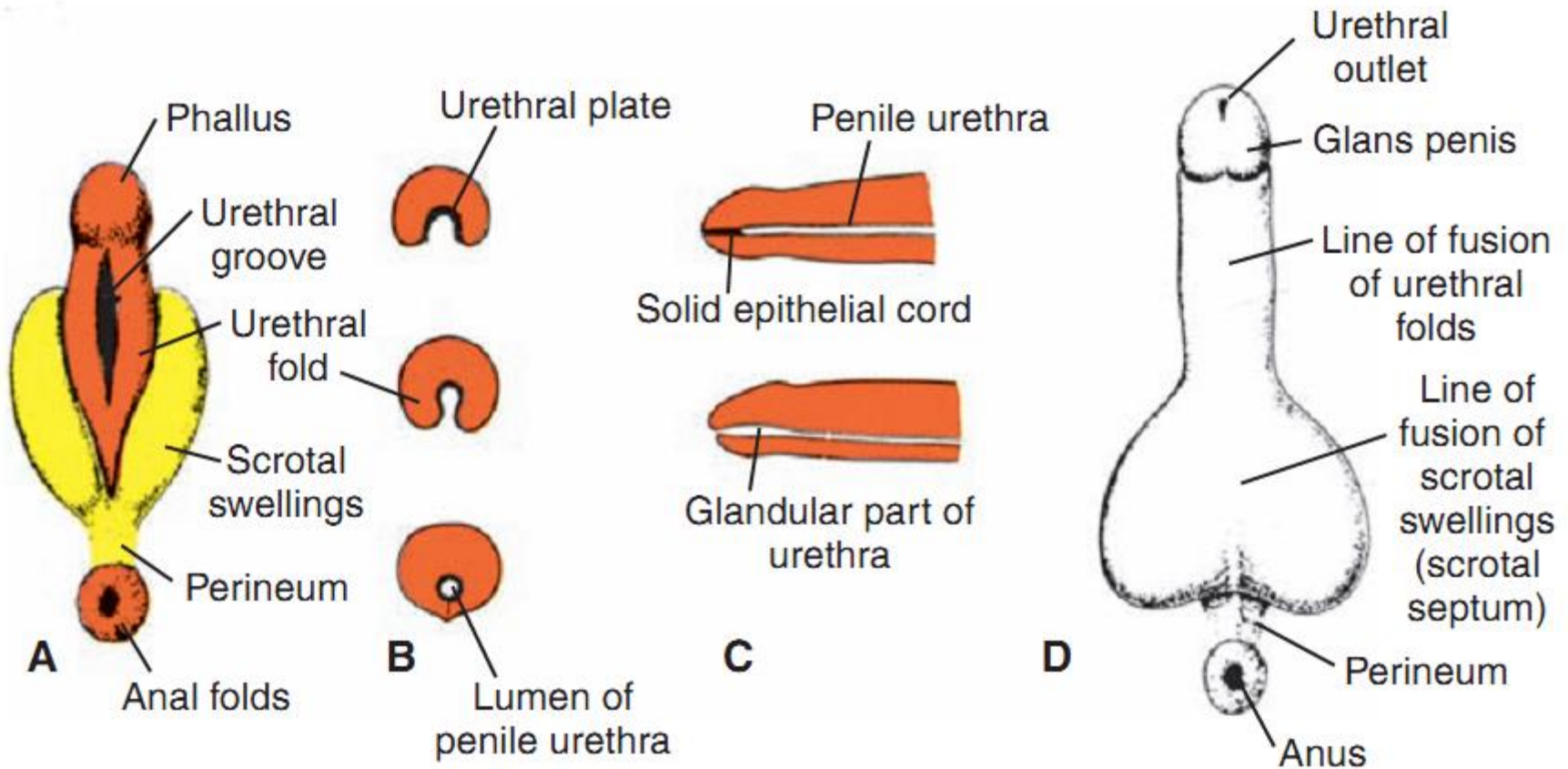
(b) Development of external genitalia



Janin

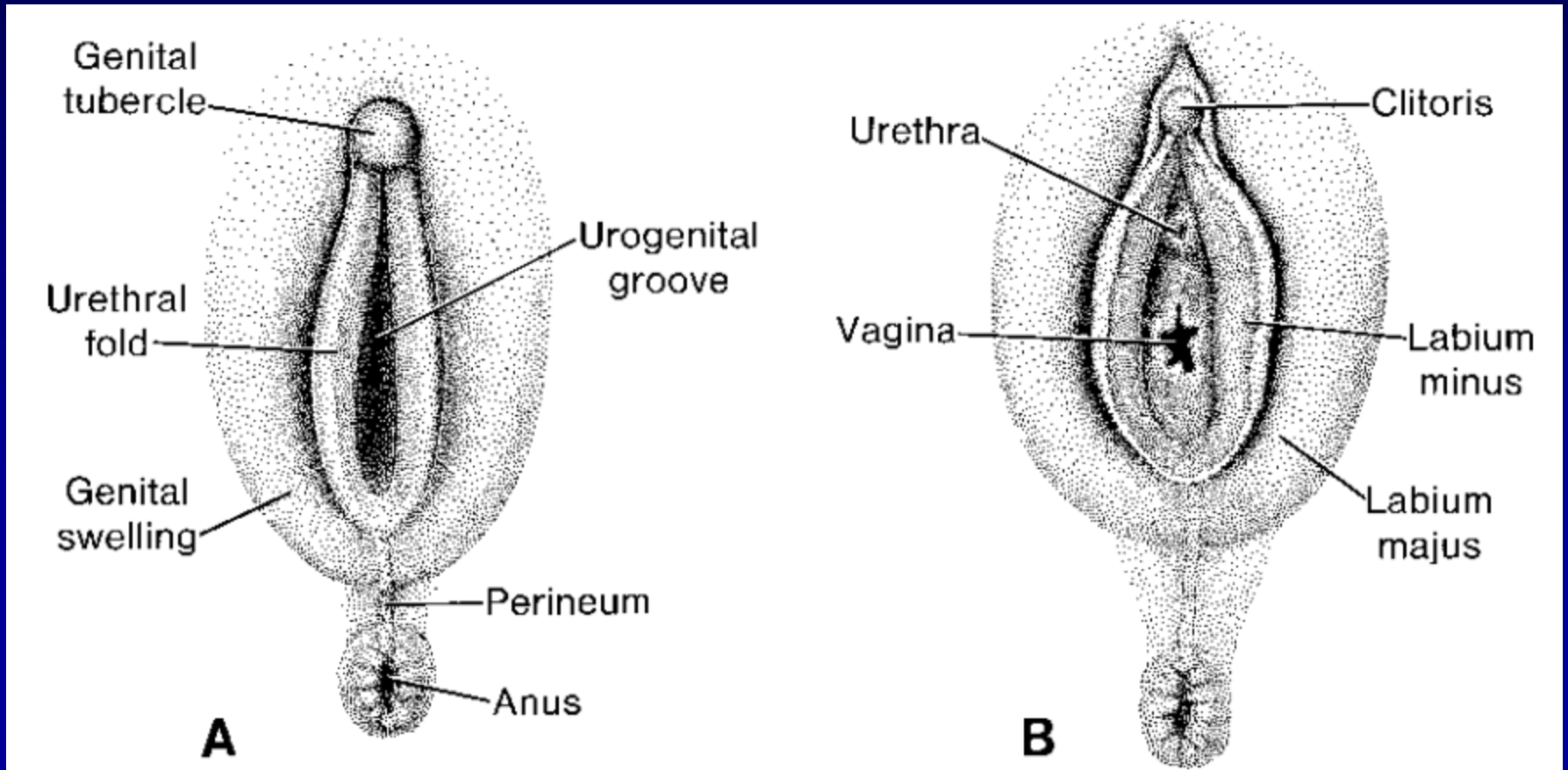
- Jaringan Bipotential (janin 6mgg – 10mgg): genital tubercle, urethral folds, urethral groove and labioscrotal swellings
- Lahir
 - Urethral fold → penis ♂ labia ♀
 - Genital swelling → scrotum ♂ labia ♀
 - Genital tubercle → glans penis ♂; clitoris ♀
- 1 bulan sebelum lahir testis sudah turun ke dalam scrotum
- Saat lahir testis aktif tergantung GnRH hipotalamus yang merangsang produksi FSH dan LH hipofise secara pulsatil dalam jumlah optimal untuk mencetuskan PUBERTAS

Male

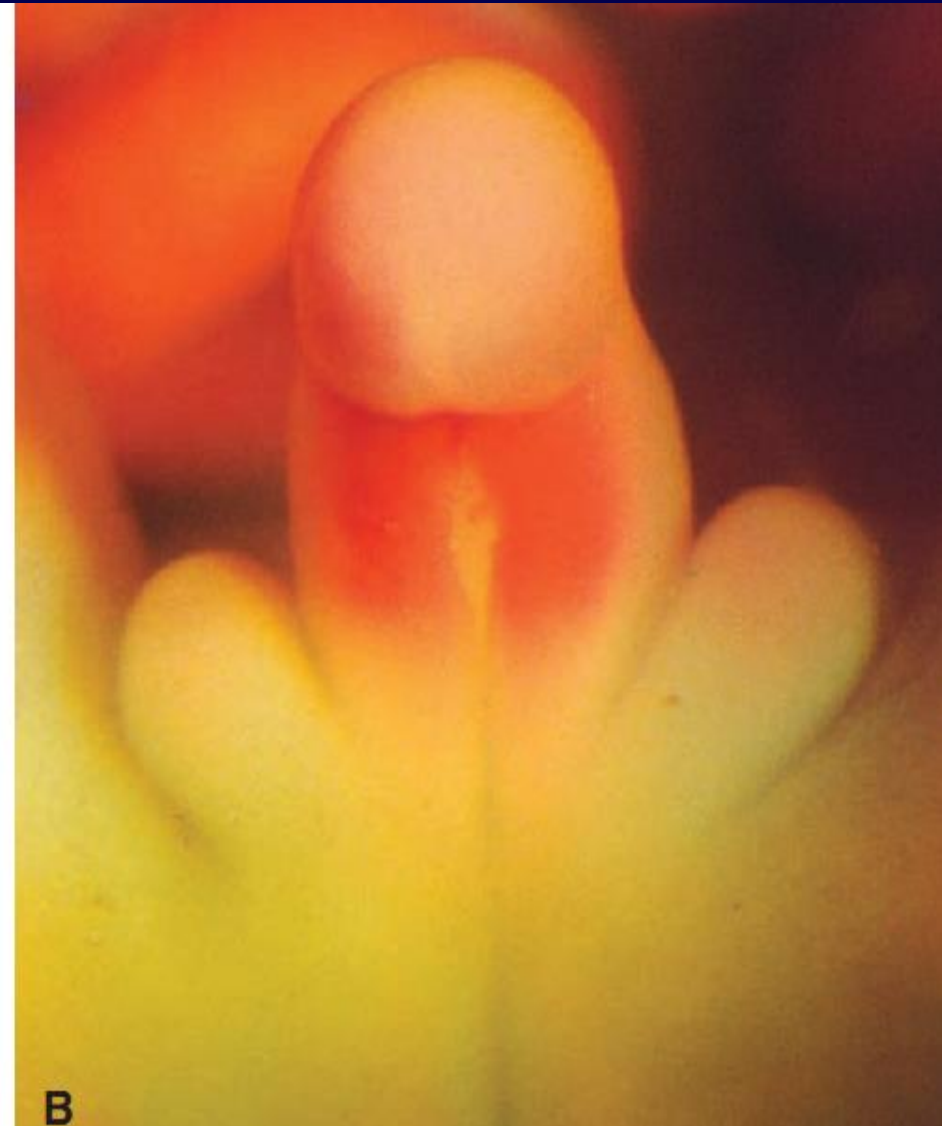
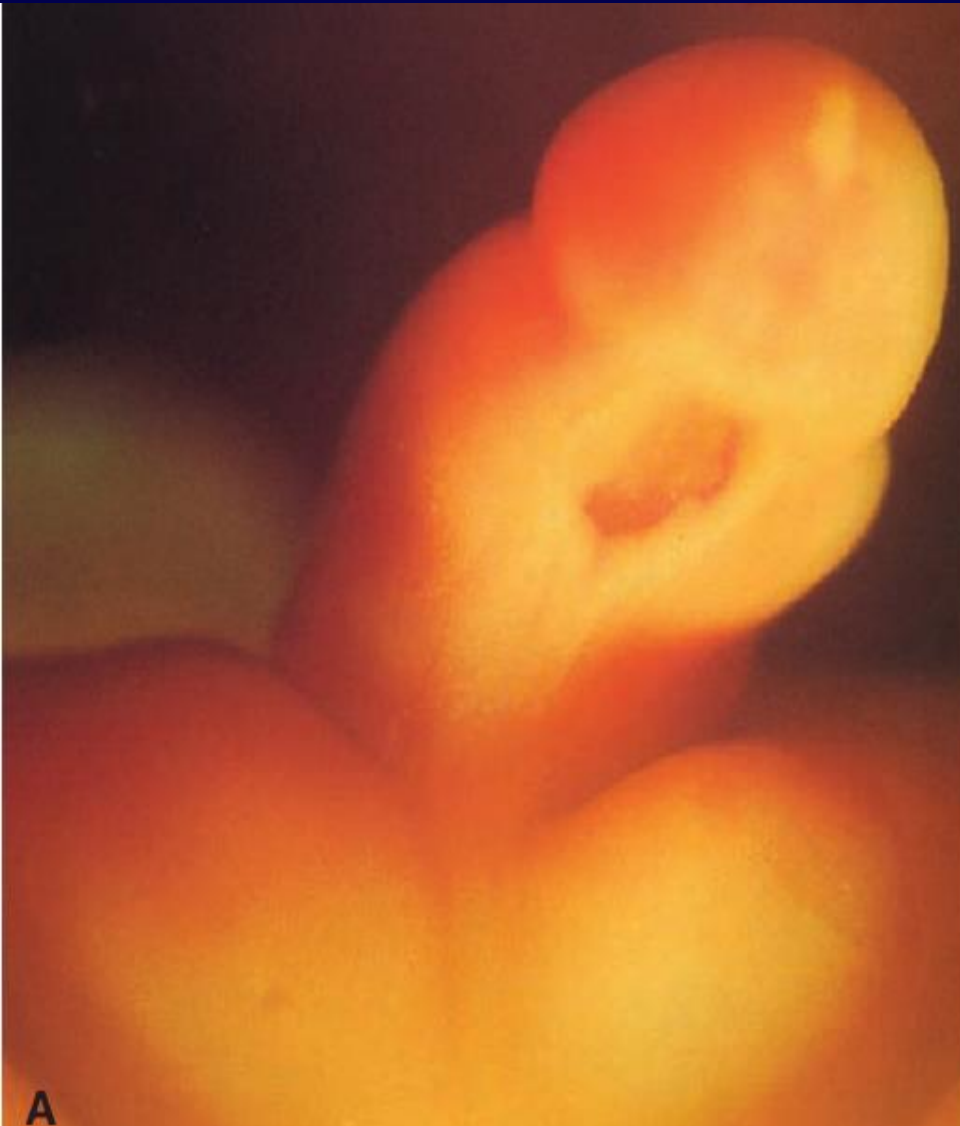


EMBRYO MINGGU 10 - LAHIR

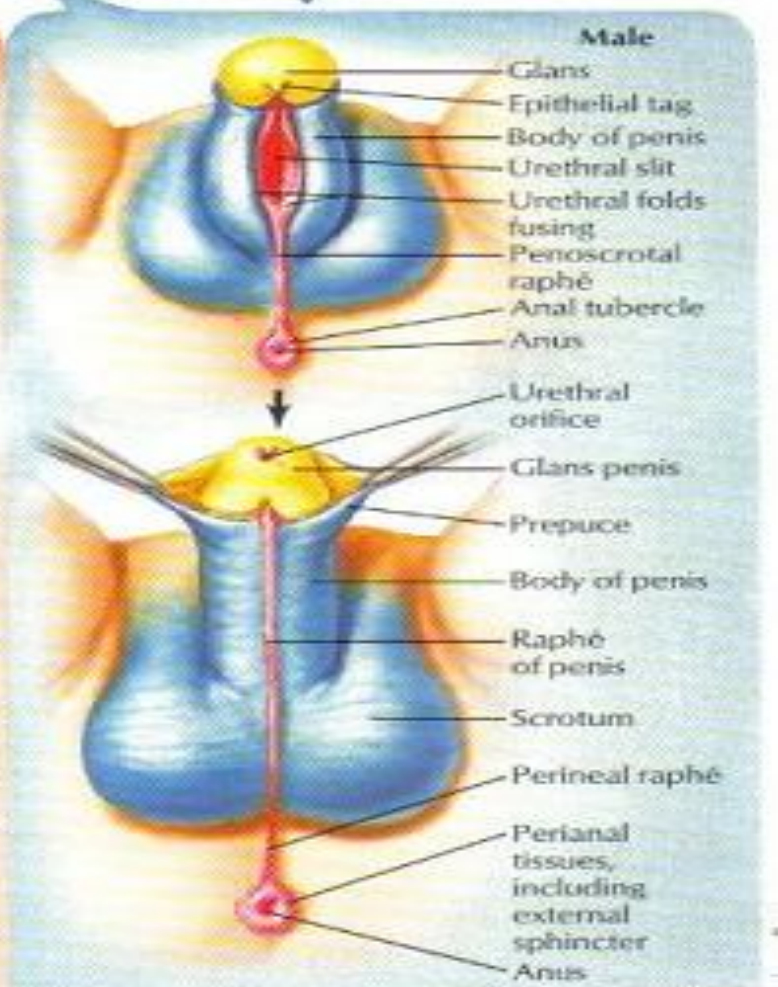
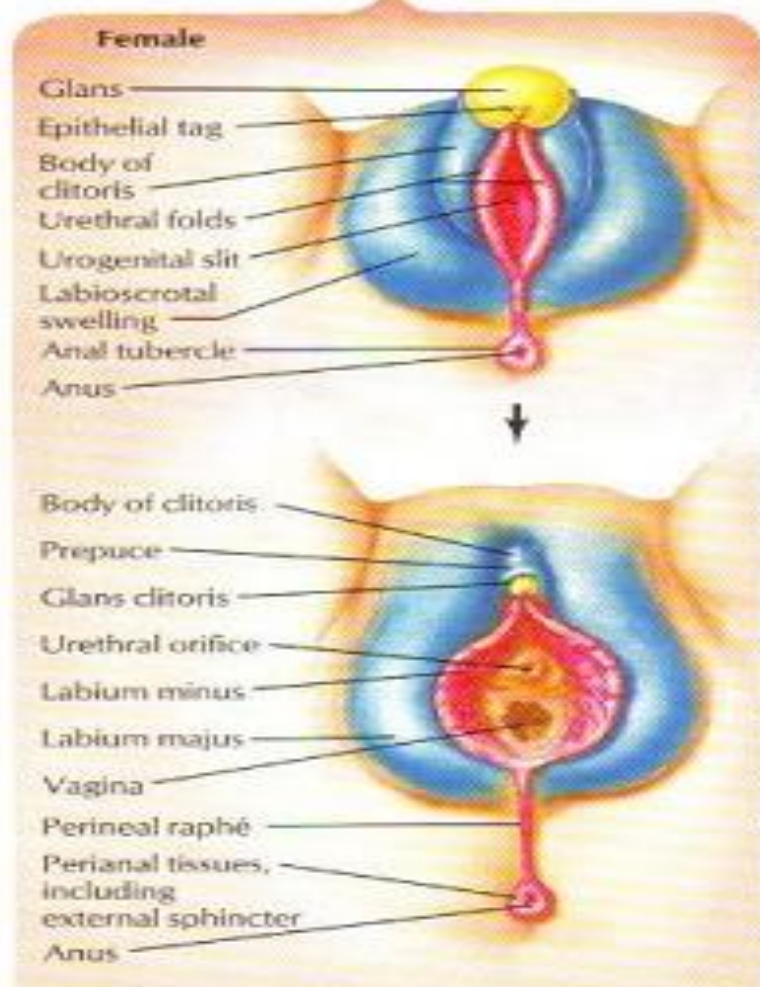
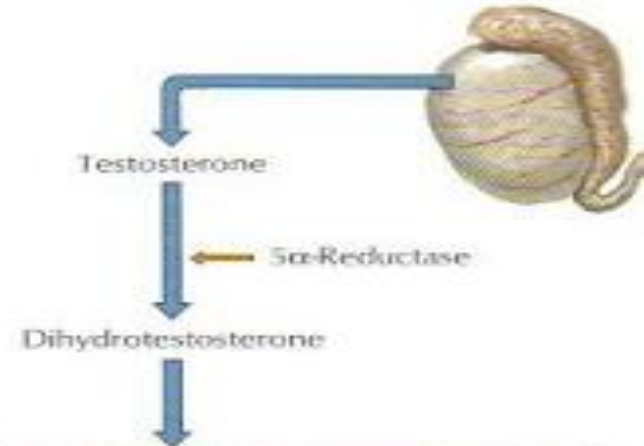
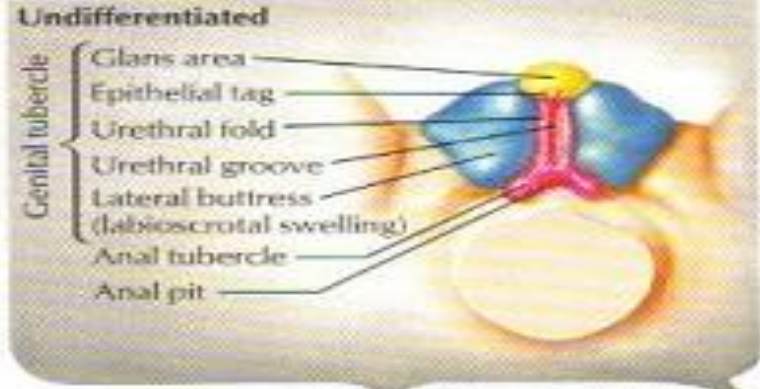
Female



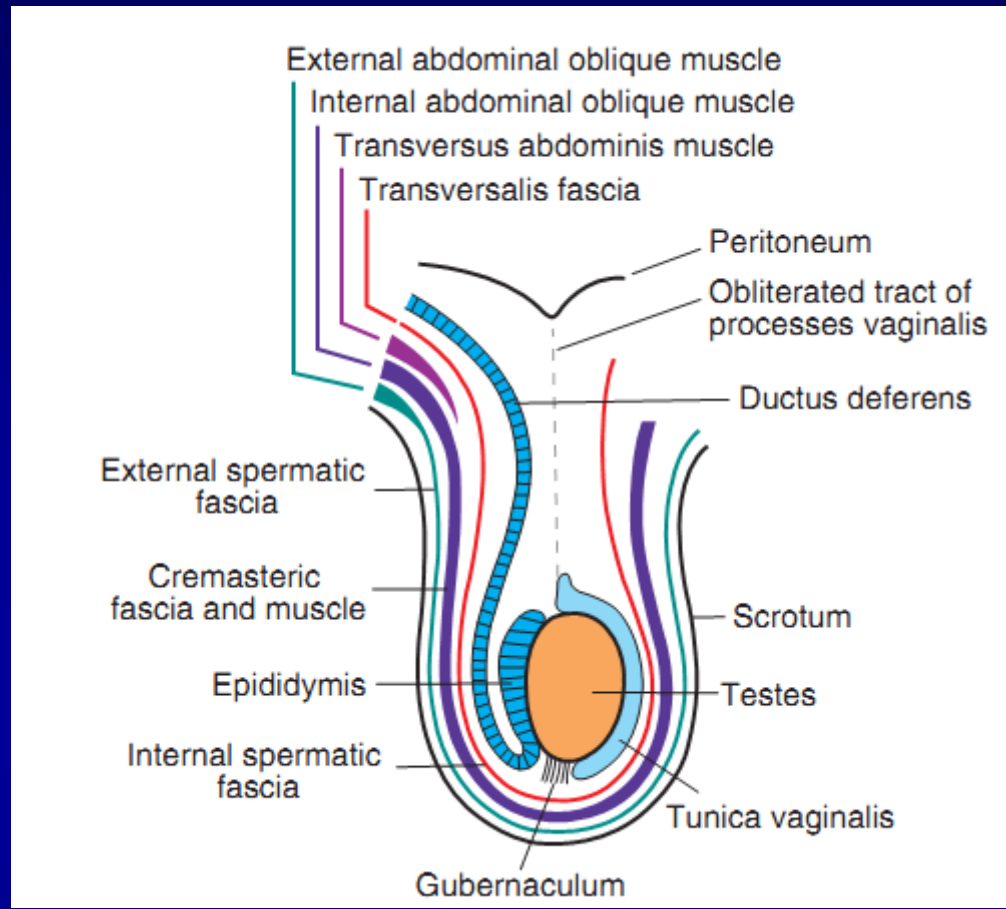
EMBRYO BULAN 5 - LAHIR

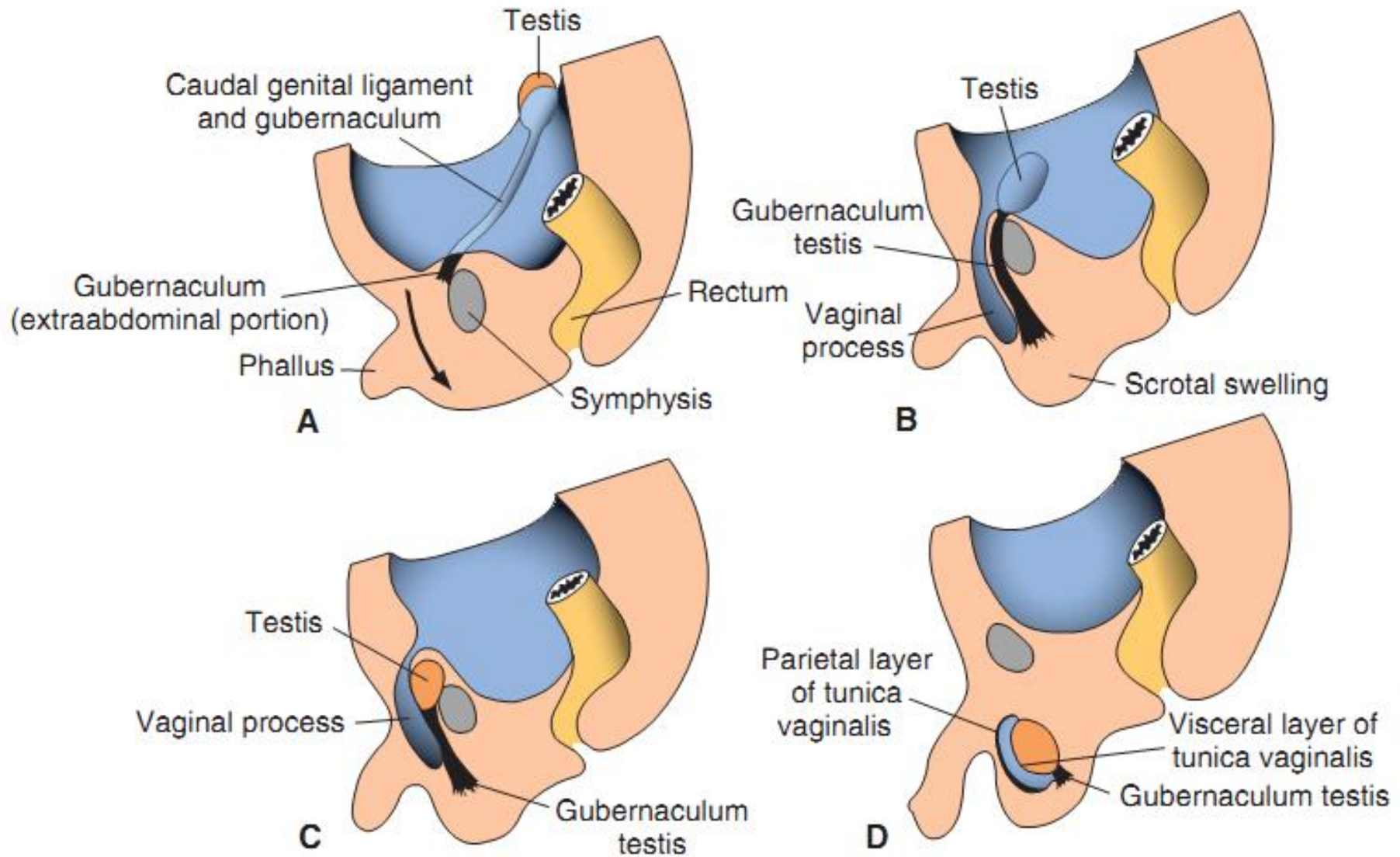


EMBRYO LAKI-LAKI MINGGU 11 & PEREMPUAN MINGGU 12



DESCENT OF THE TESTES





EMBRYO BULAN 2 – BULAN 3 – BULAN 7 – LAHIR

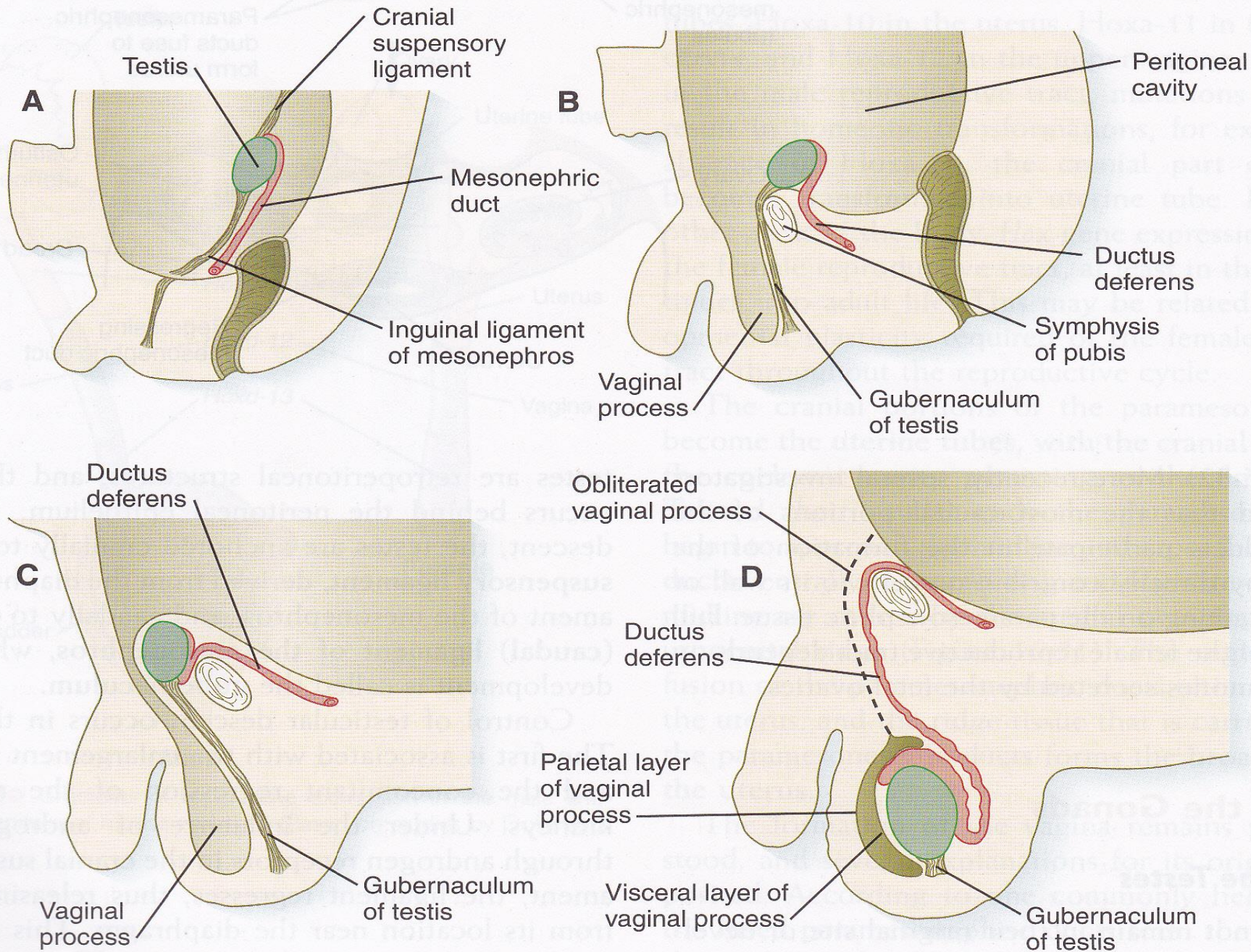


FIGURE 16-33 Descent of the testis in the male fetus. **A**, In the **second month**. **B**, In the **third month**. **C**, In the **seventh month**. **D**, At term.

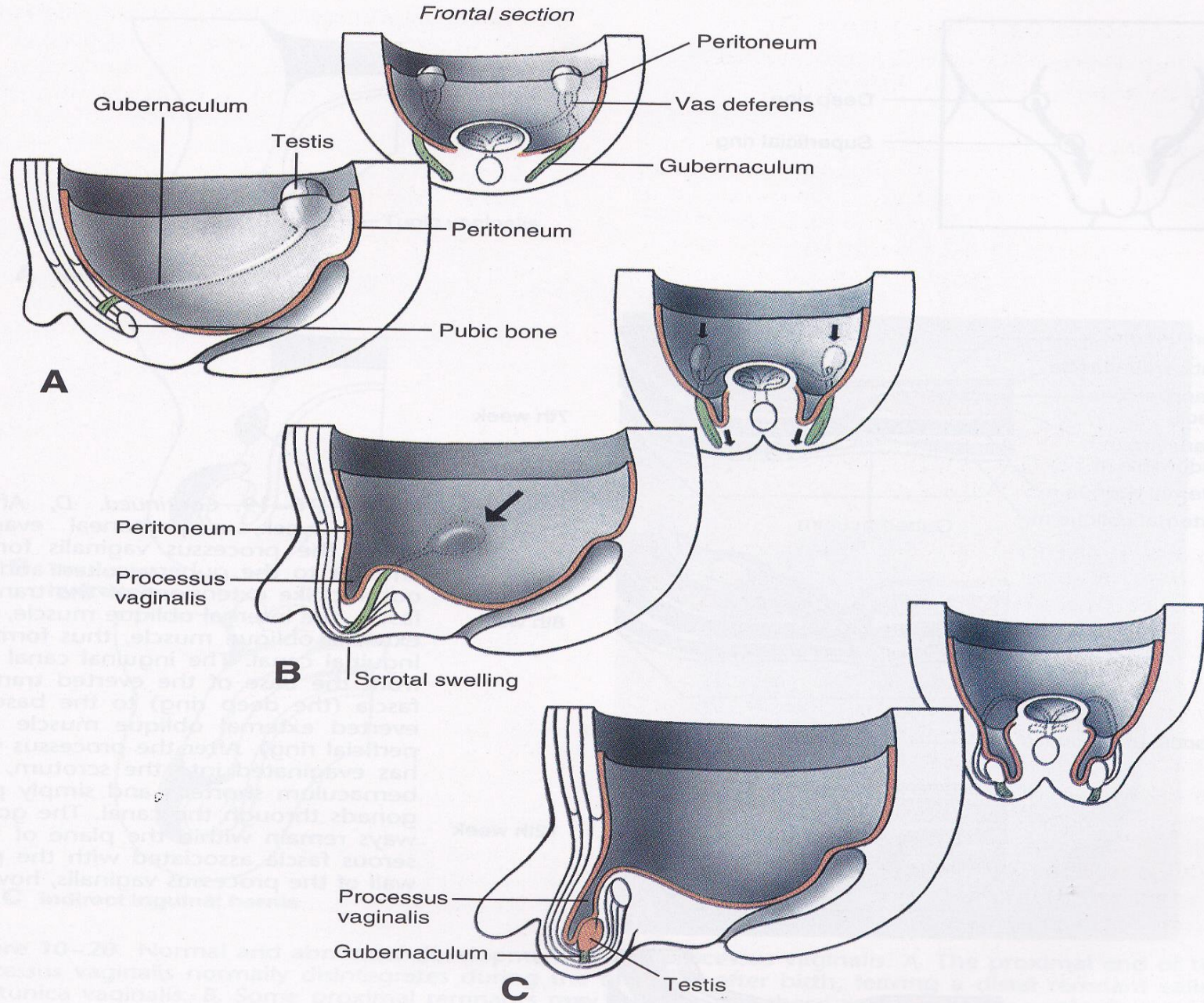


Figure 10-19. Descent of the testes. A-C, Between seventh week and birth, shortening of the gubernaculum testis causes the testes to descend from the 10th thoracic level into the scrotum. The testes pass through the inguinal canal in the anterior abdominal wall.

Illustration continued on following page



FIGURE 16-34 Scanning electron micrograph of the inferior aspect of the indifferent external genitalia of a human embryo at the end of the eighth week of development. (From Jirásek JE: *Atlas of human prenatal morphogenesis*, Amsterdam, 1983, Martinus Nijhoff.)



5 weeks. Limb buds, eyes, the heart, the liver, and rudiments of all other organs have started to develop in the embryo, which is only about 1 cm long.

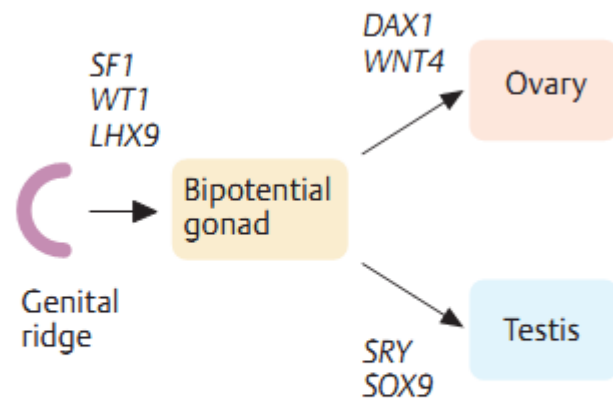
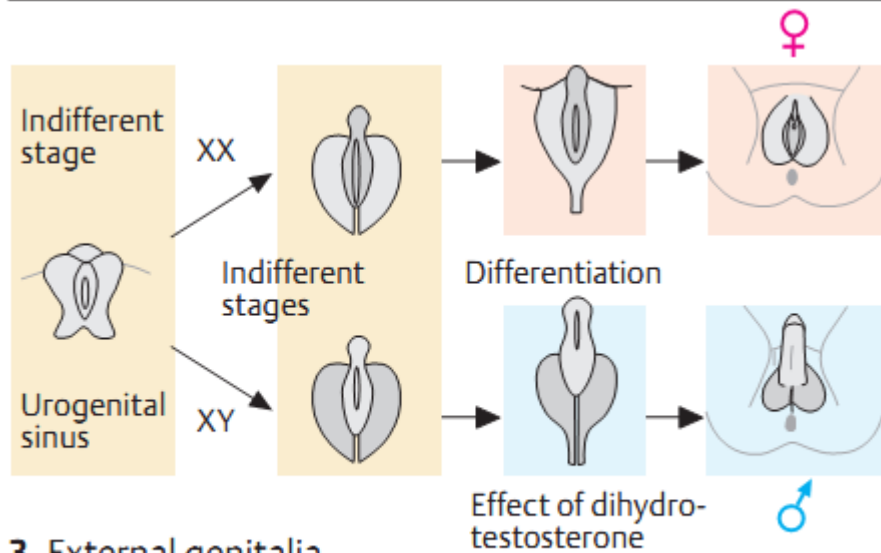
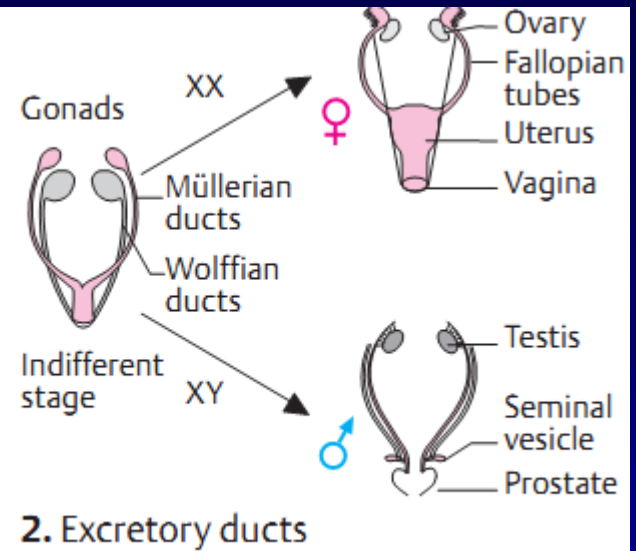
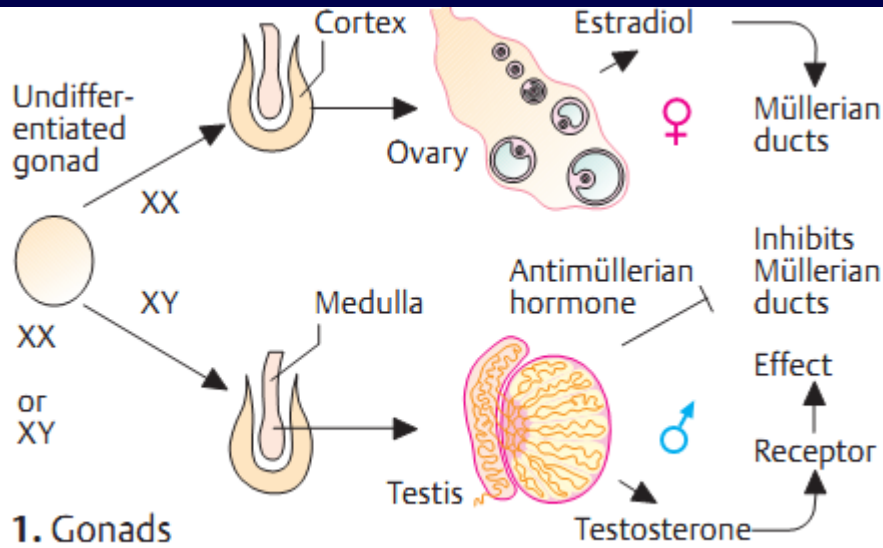


(b) 14 weeks. Growth and development of the offspring, now called a fetus, continue during the second trimester. This fetus is about 6 cm long.



(c) 20 weeks. Growth to nearly 20 cm in length requires adoption of the fetal position (head at knees) due to the limited space available.

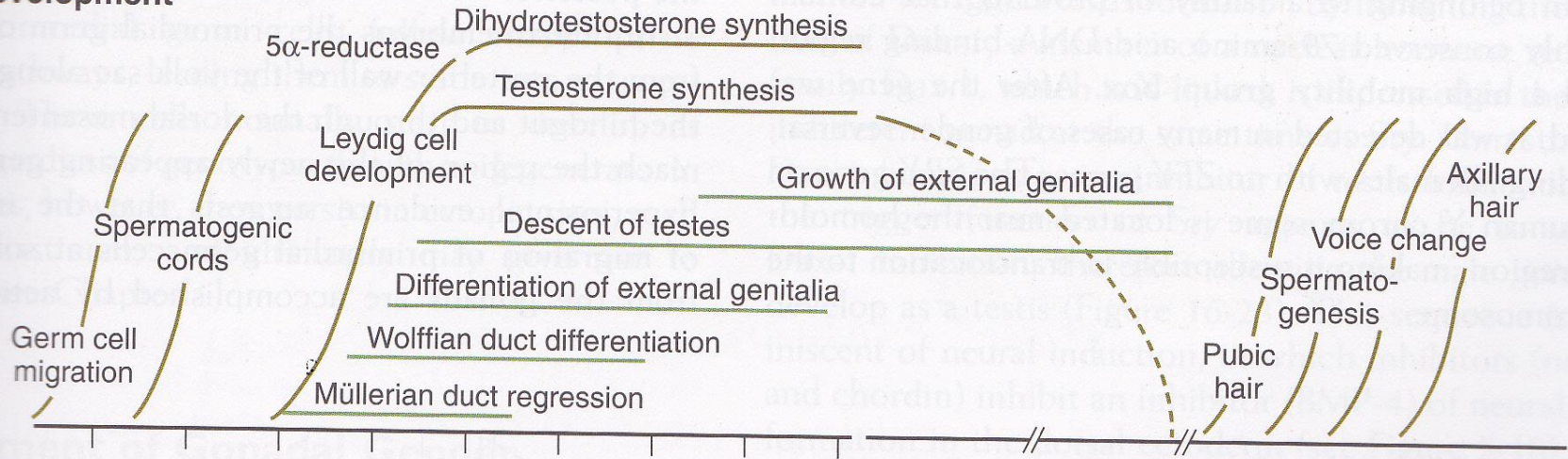




3. External genitalia
A. Gonads and external genitalia

4. Genes required for gonad development

Male development



Female development

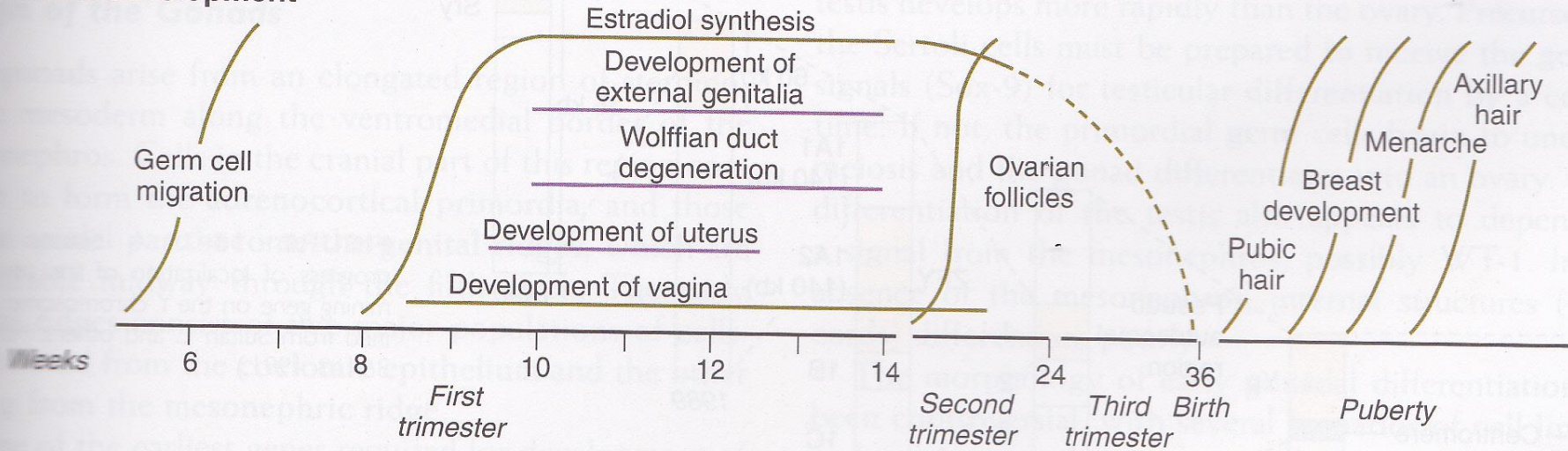
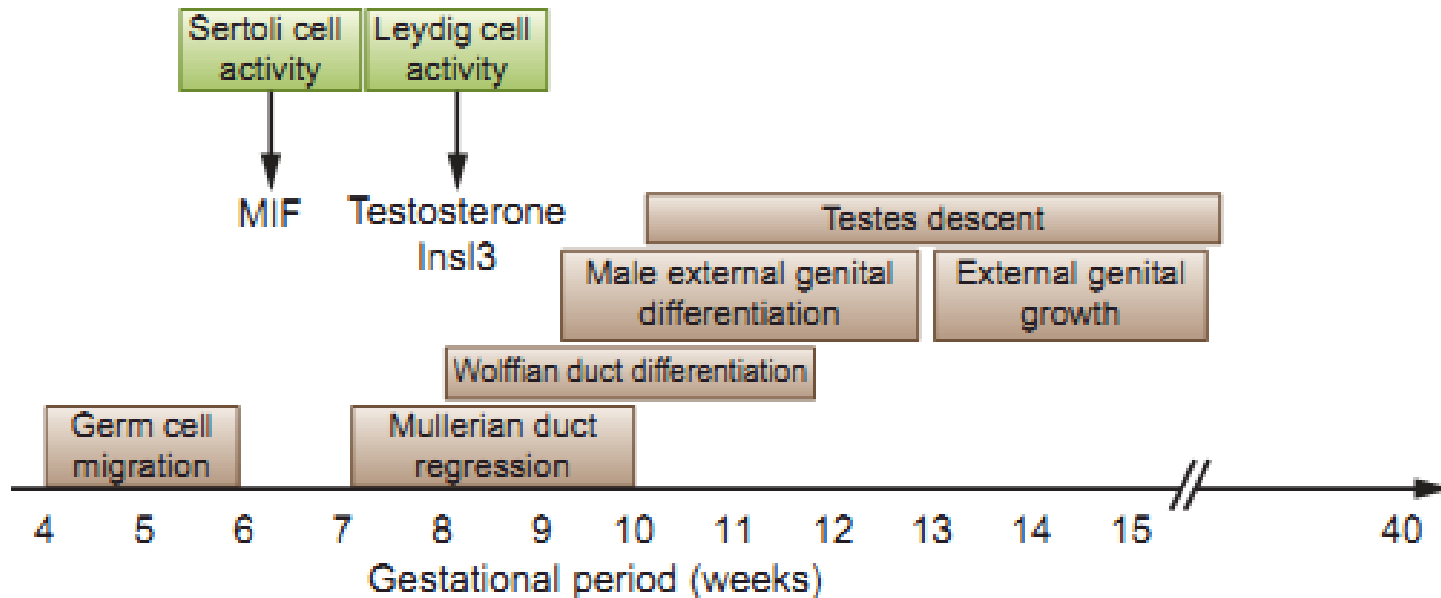
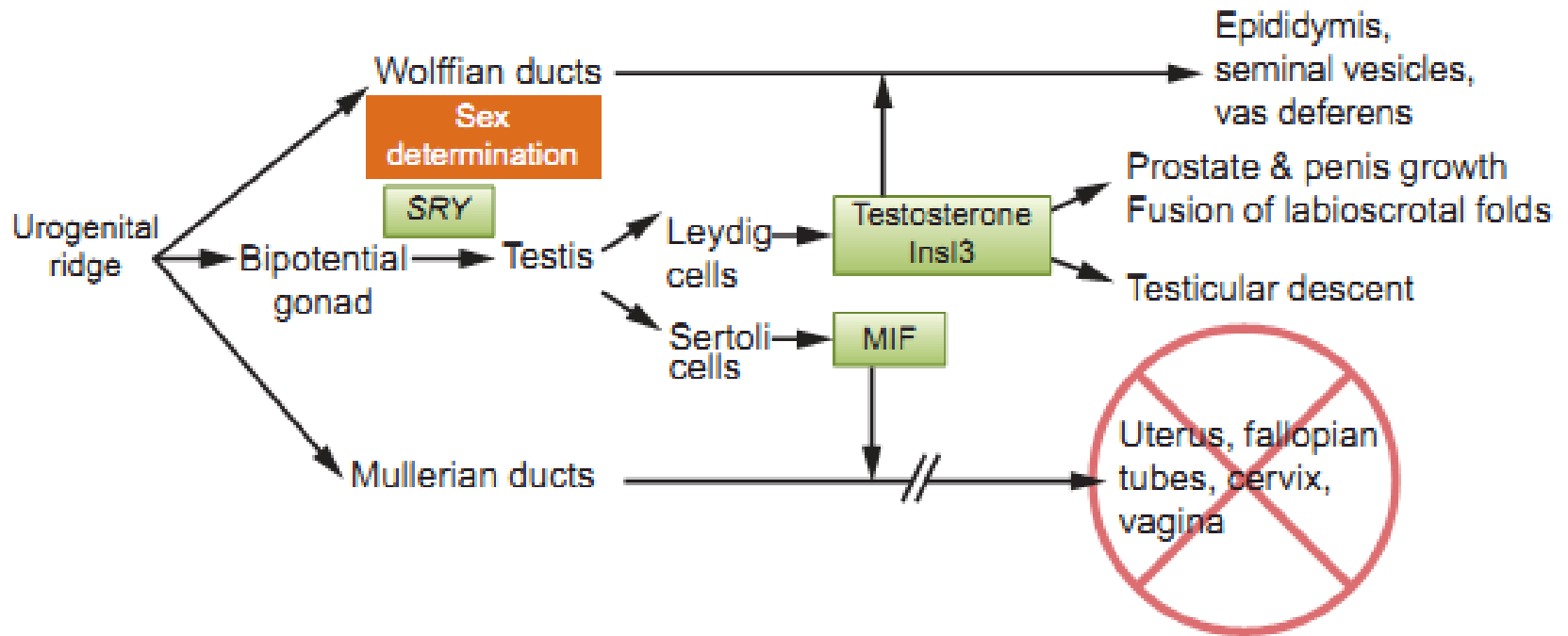


FIGURE 16-20 Major events in the sexual differentiation of male and female human embryos.

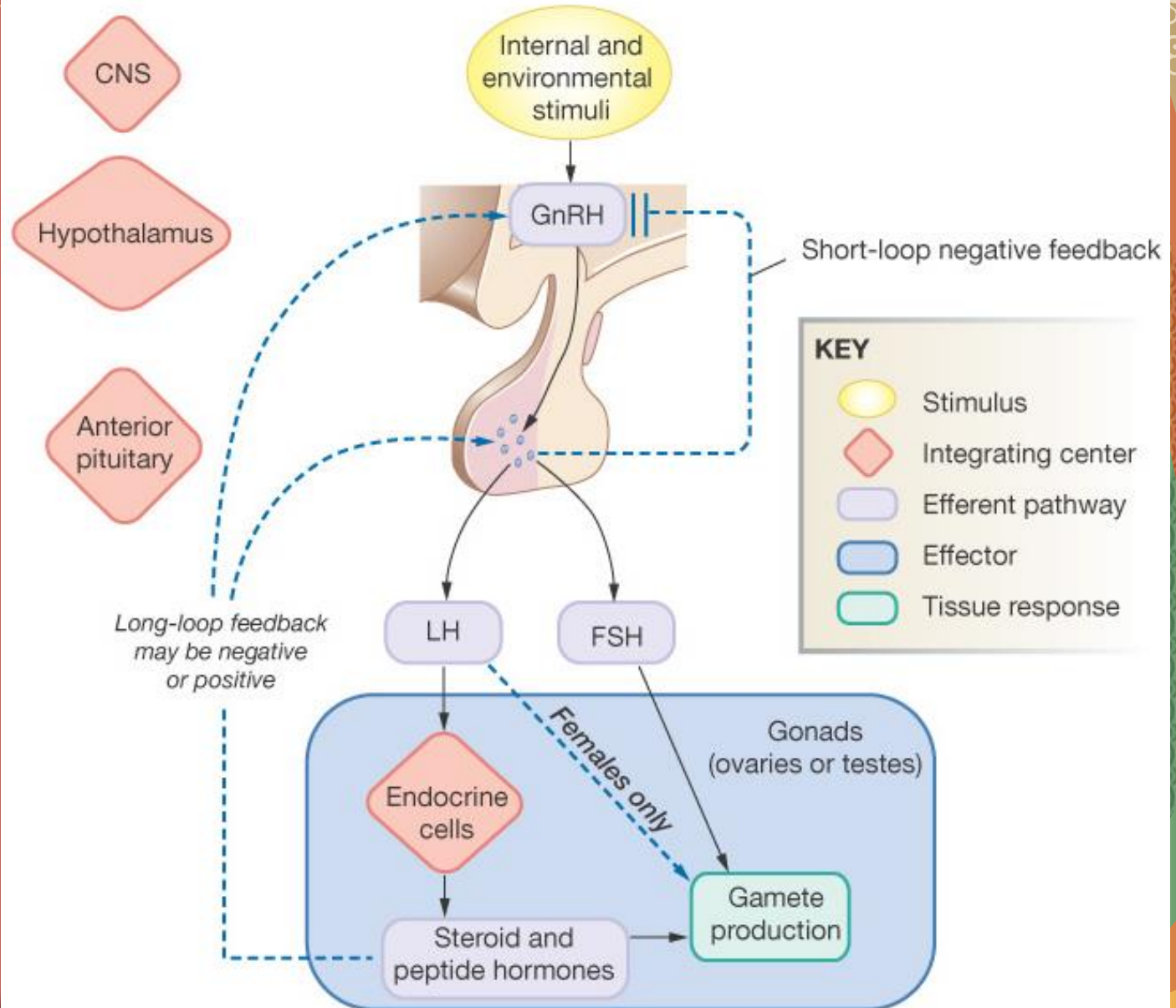


Anak-anak

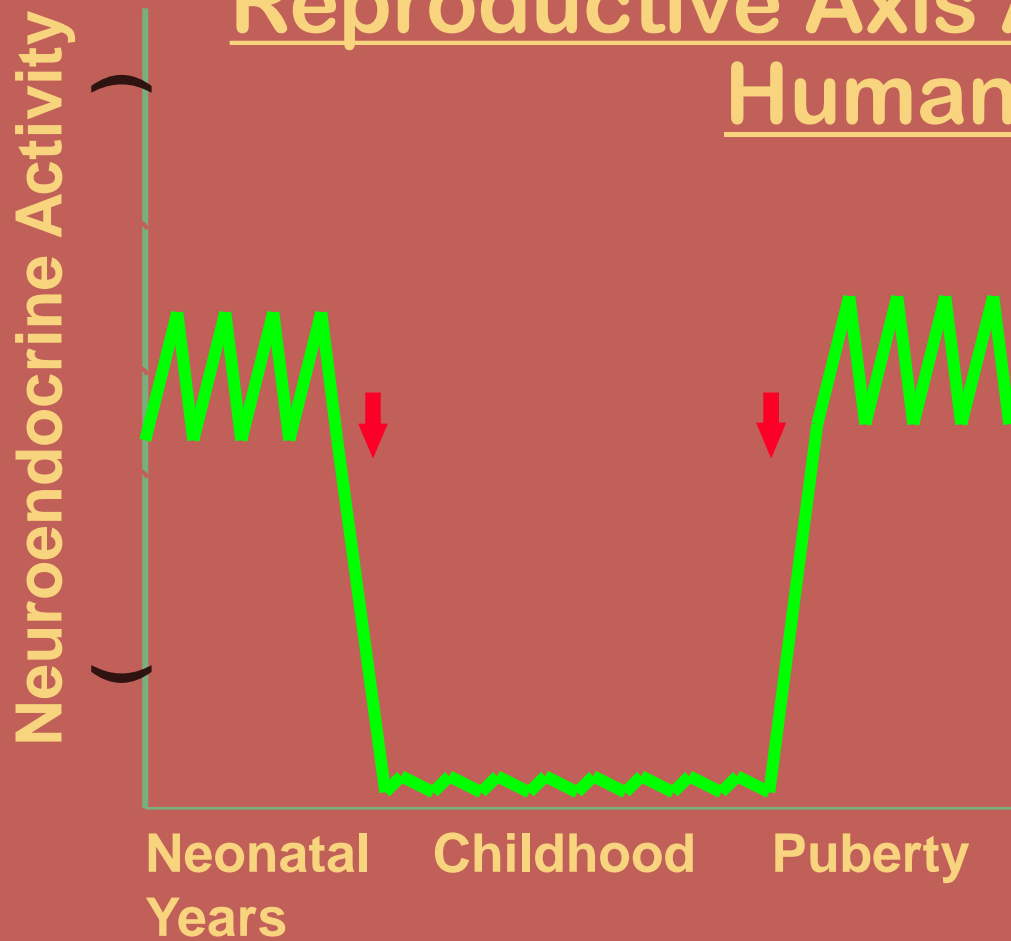
- Ovarium tumbuh dan mensekresikan estrogen kadar rendah yang menghambat pengeluaran GnRH (umpan balik negatif)
- Mendekati masa pubertas, GnRH kembali dikeluarkan secara pulsatil; hipofise mengeluarkan FSH dan LH yang bekerja pada ovarium
- Siklus ini berlangsung hingga dewasa dan terjadi menarche

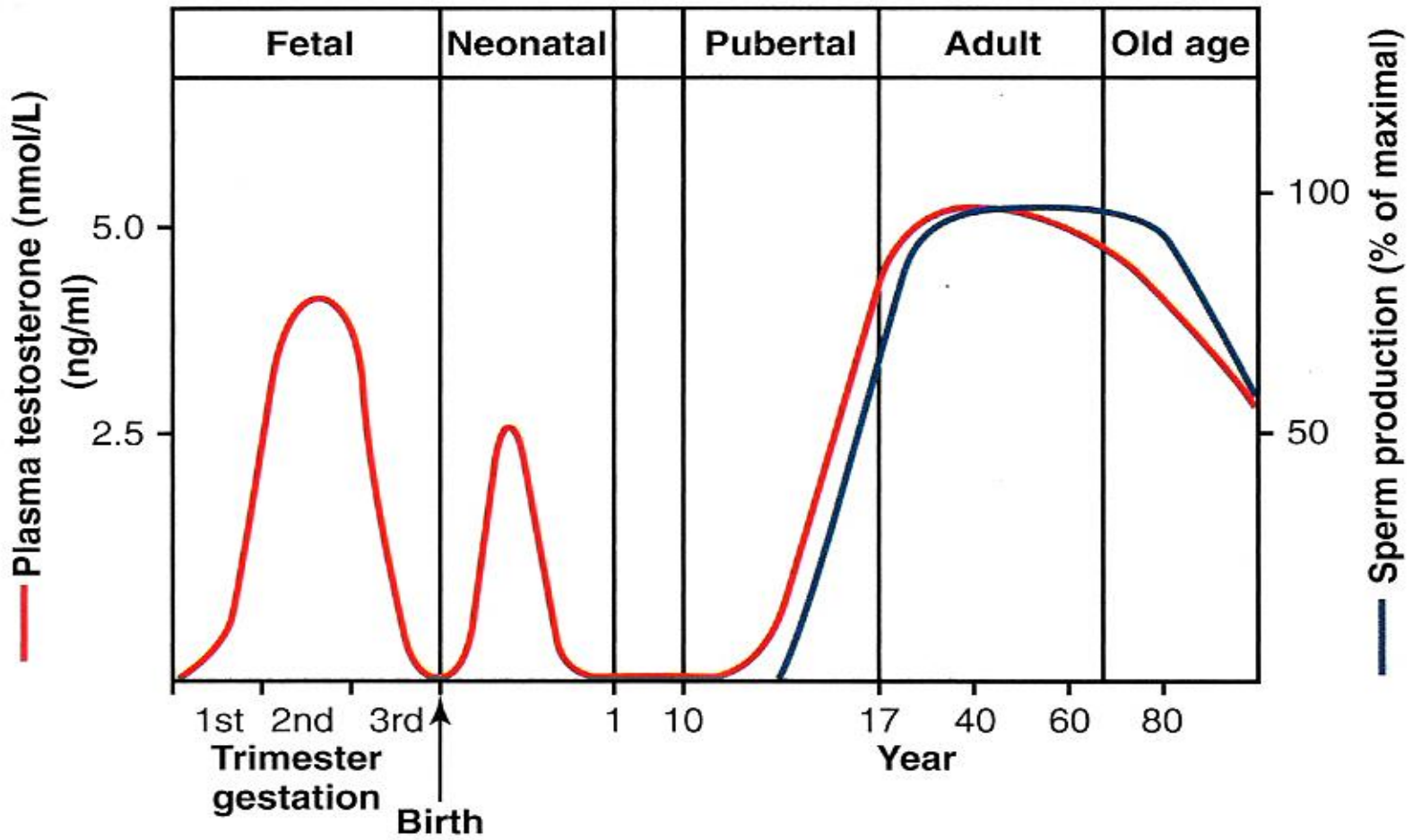


Regulation of Reproduction: General Pathways



Neuroendocrine Activity of the Reproductive Axis Across Life in Humans





Pubertas

- Peningkatan aktivitas gonad & produksi hormon sex
- Kematangan organ reproduksi dan produksi gamet
- Perkembangan karakteristik seksual sekunder
- Onset pubertas lebih cepat pada wanita dibandingkan pada pria
- Usia pubertas bervariasi pada berbagai negara, dipengaruhi oleh kadar lemak tubuh wanita
- Peningkatan sekresi GnRH akan meningkatkan pengeluaran gonadotropin, diikuti aktivitas gonad (steroidogenesis, gametogenesis).



Pubertas pada pria

■ Mulai usia 14, kematangan seksual usia 17-18 tahun

■ Peningkatan Testosteron berperan pada :

■ Awal pubertas/onset of puberty

■ Perbesaran prostat, testes, scrotum, dan penis (DHT)

■ Karakteristik seks sekunder

■ Peningkatan pertumbuhan tulang dan massa otot

■ Perbesaran laring dan penebalan pita suara

■ Peningkatan rambut di daerah pubis dan axila

■ Peningkatan rambut di wajah dan tubuh (DHT)

■ Peningkatan libido dan perilaku agresif



Mekanisme dan efek testosteron

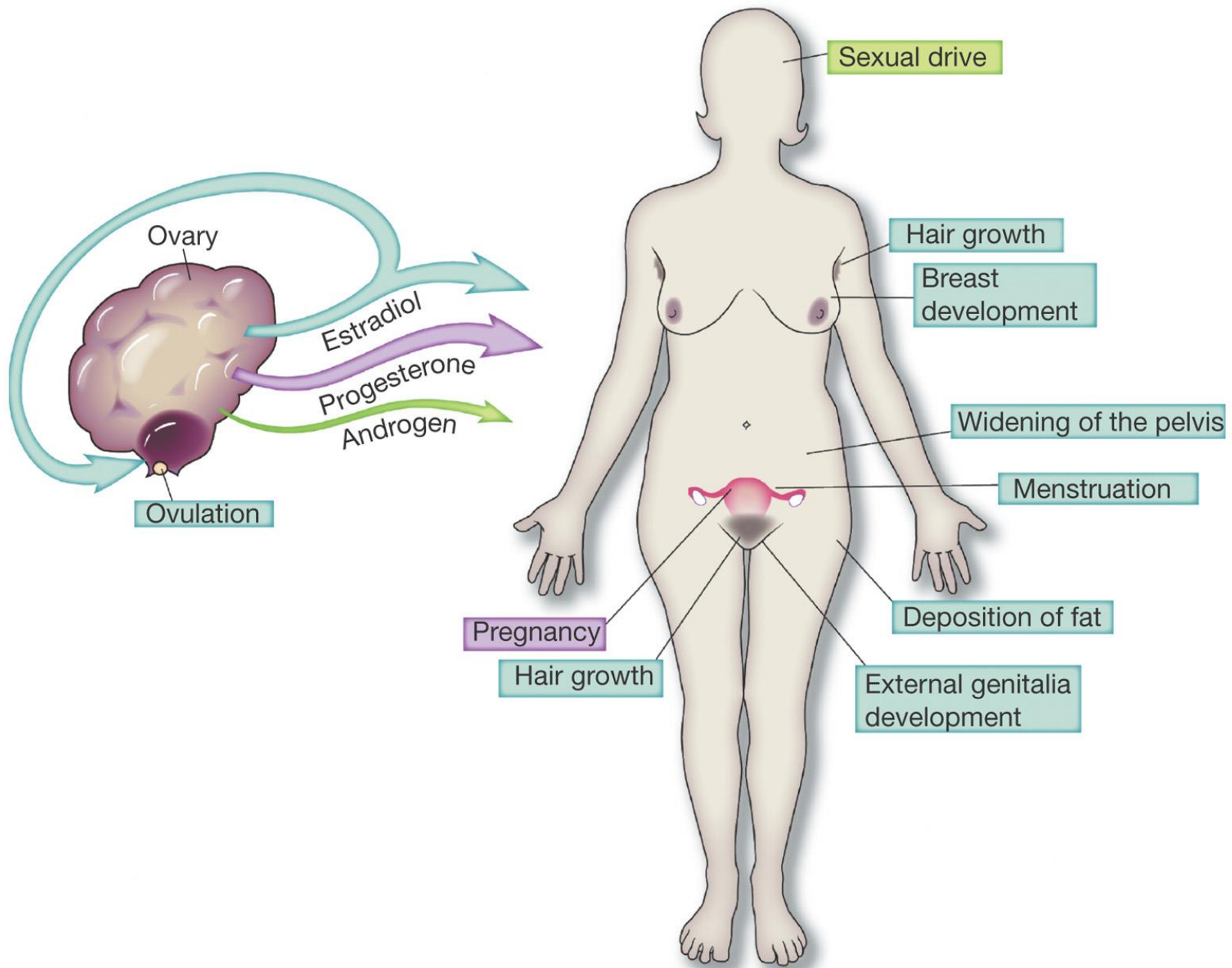
- Testosterone disintesis dari kolesterol
- Prostate – diubah menjadi dihydrotestosterone (DHT) sebelum dapat berikatan dengan nukleus
 - Membutuhkan enzim 5alpha-reductase
 - DHT memiliki afinitas yang lebih tinggi terhadap reseptor androgen daripada T
- Neurons – diubah menjadi estrogen untuk efek stimulasi
 - Membutuhkan enzim *aromatase*
- Testosterone bekerja pada semua organ ascesorius, defisiensi menyebabkan atrofi



Pubertas pada wanita

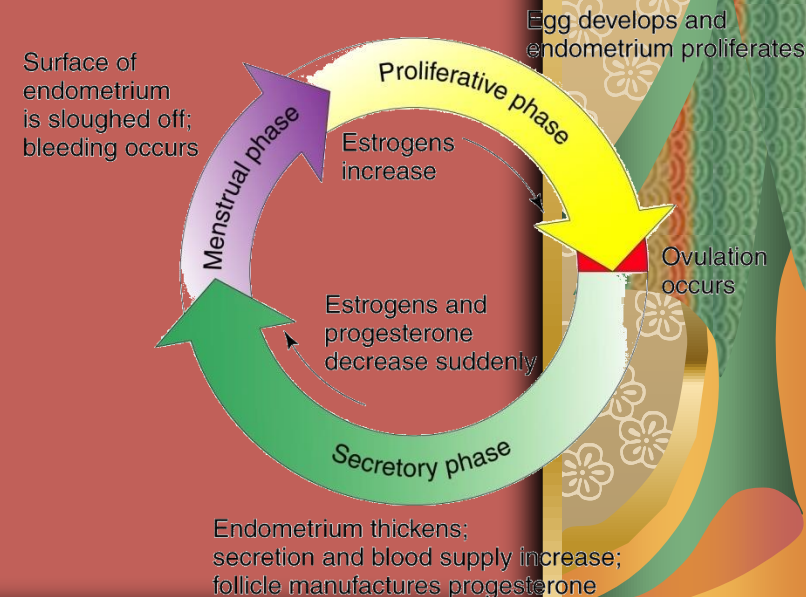
- Wanita ditandai oleh menarche (9 – 17 tahun)
- Peningkatan produksi steroid
- Karakteristik seks sekunder :
 - ❖ Pertumbuhan payudara
 - ❖ Perbesaran labia nimora dan majora
 - ❖ Munculnya sedikit rambut pada wajah dan tubuh
 - ❖ Pertumbuhan rambut pubis dan axila (androgen adrenal)
 - ❖ Peningkatan pertumbuhan tulang
 - ❖ Peningkatan lebar panggul
 - ❖ Peningkatan presentase lemak tubuh
 - ❖ Pengecilan larynx, penipisan vocal cords



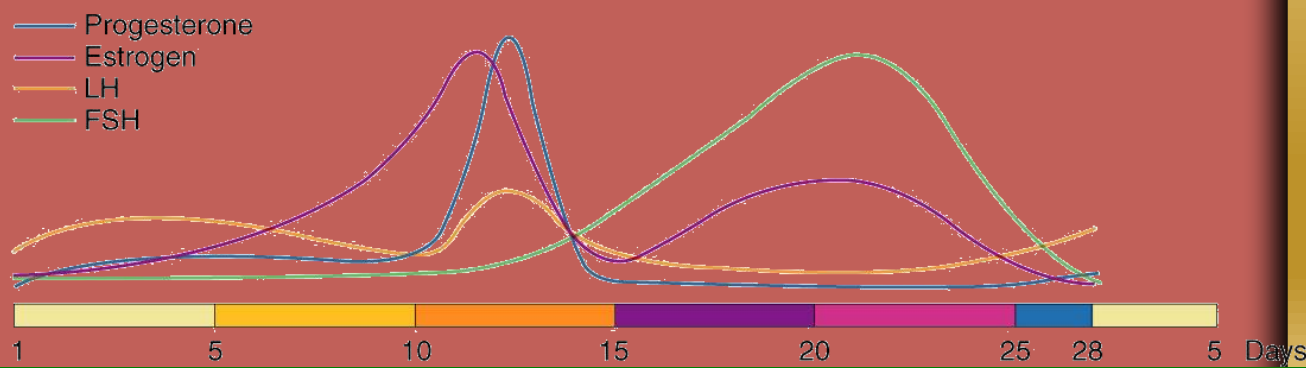
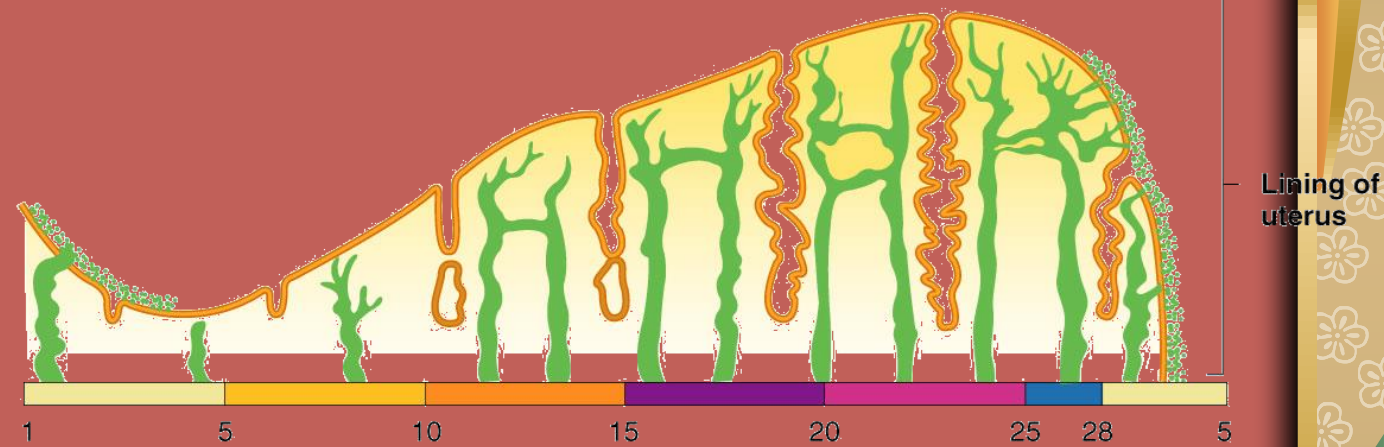


Menarche

- Ovulasi: pengeluaran ovum
- Selama siklus ovulasi, tingginya estrogen memberikan umpan balik positif terhadap LH dan FSH sehingga terjadi lonjakan sekresi gonadotropin
- Siklus Menstruasi : 3 fase dalam rata-rata 28 hari
 - Proliferative
 - Secretory
 - Menstrual



Hormonal Control and Phases of the Menstrual Cycle

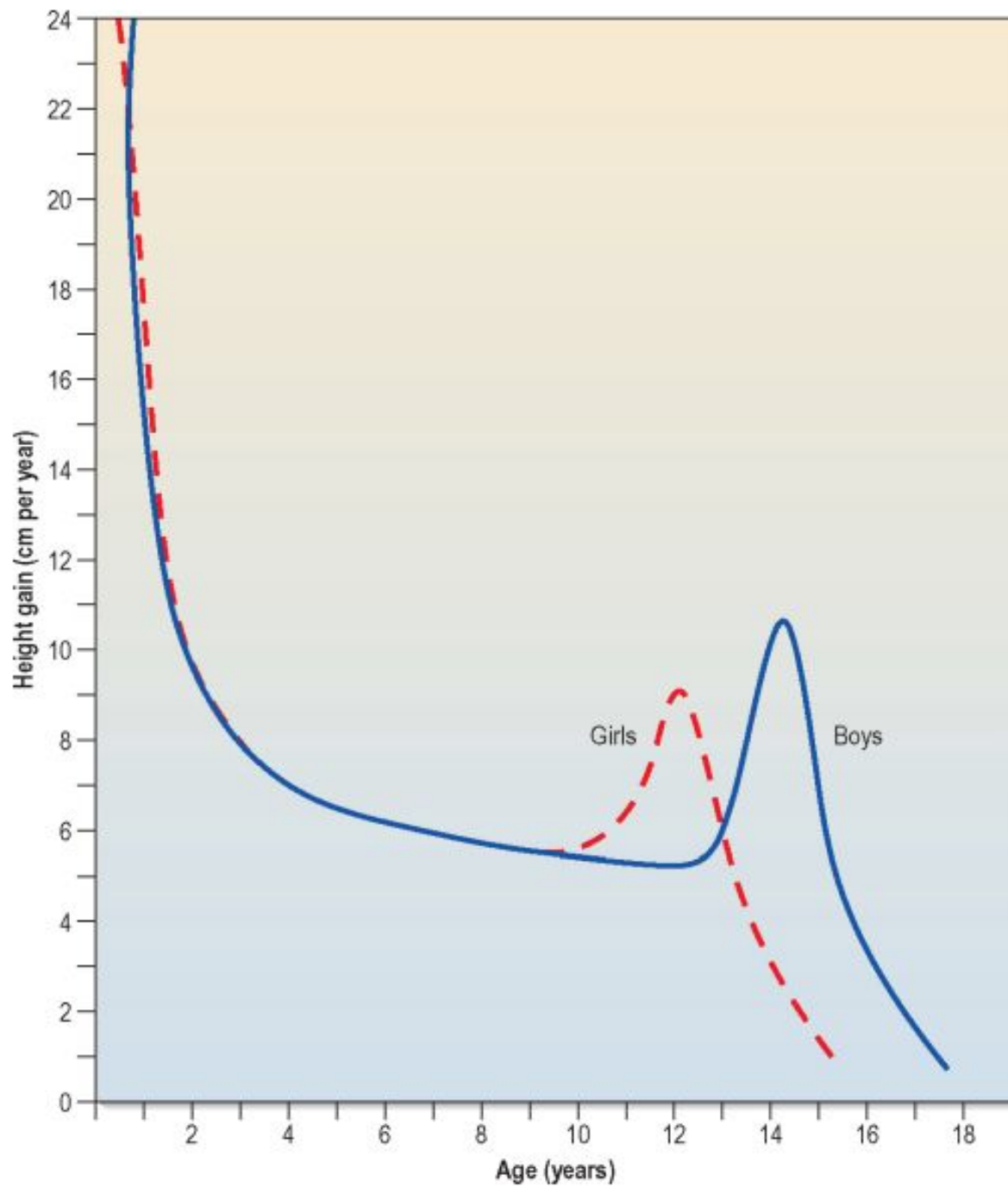


Menstrual phase Proliferative phase Secretory phase Menstrual phase

Dewasa

- Fungsi reproduksi
- Perbedaan jenis kelamin juga menentukan sensitivitas organ terhadap hormon testosteron/Estrogen
- Perbedaan hormonal tersebut juga menentukan perilaku seksual





ogenesis
Body Plan
part of Organoge

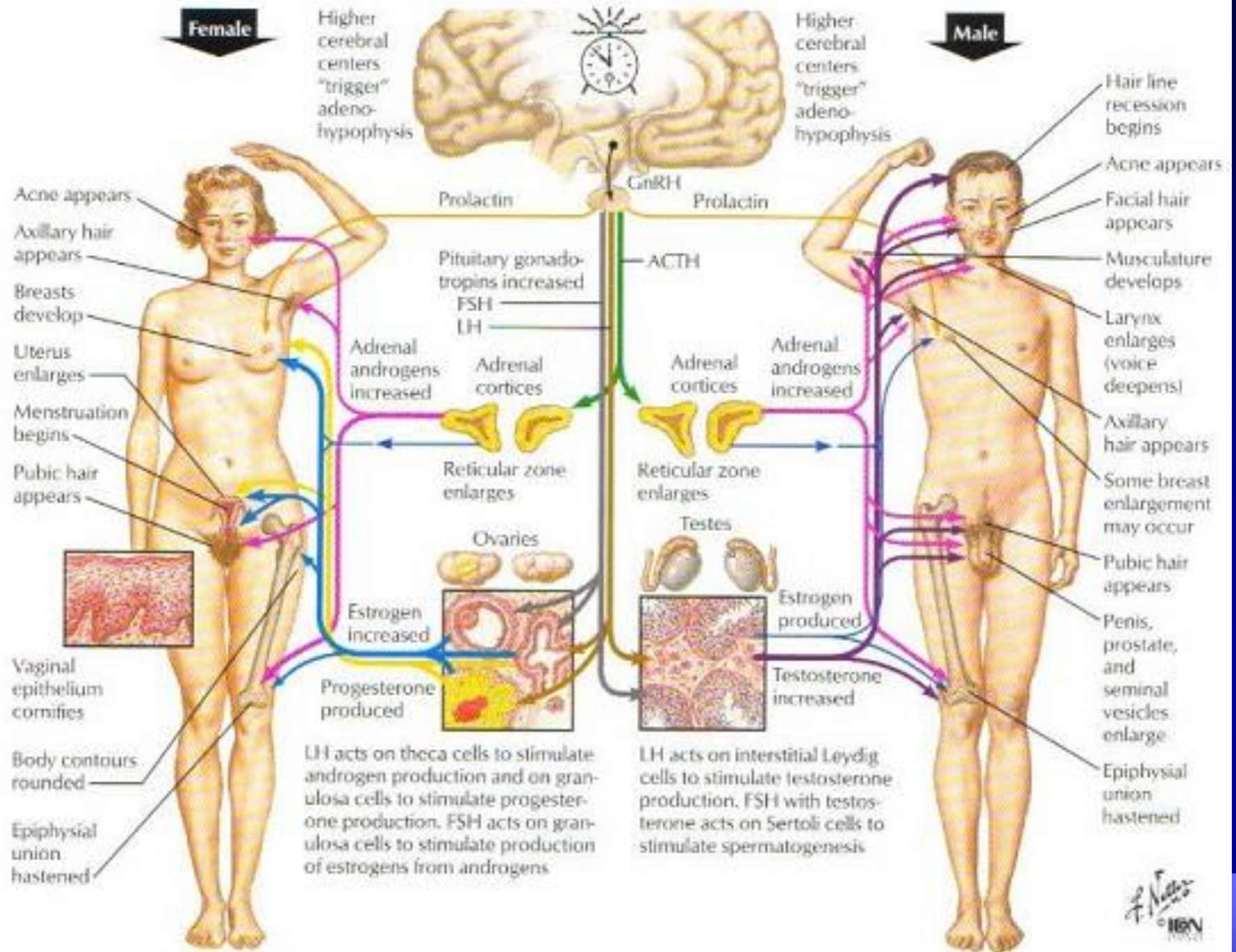
g Development

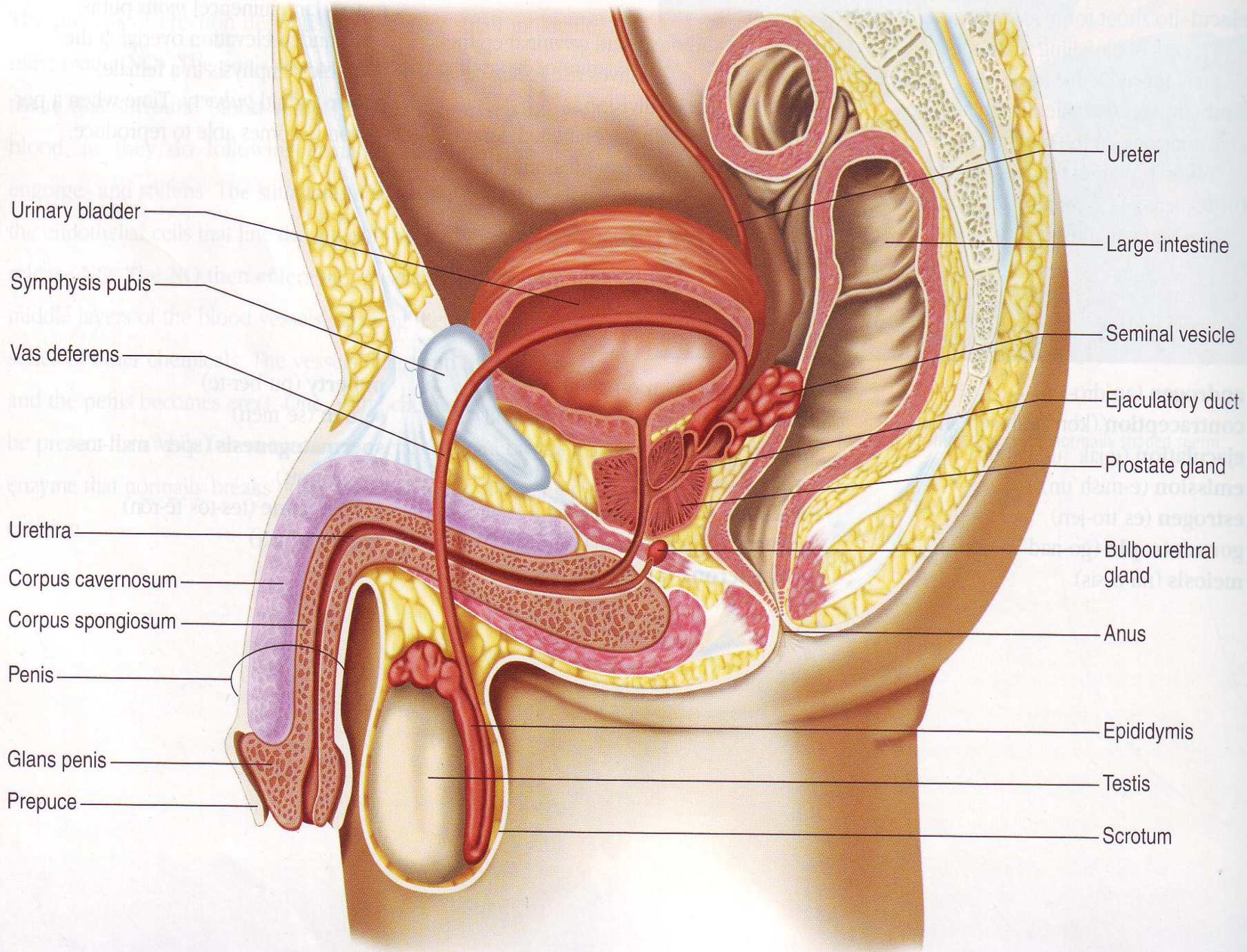
MENSTRUASI

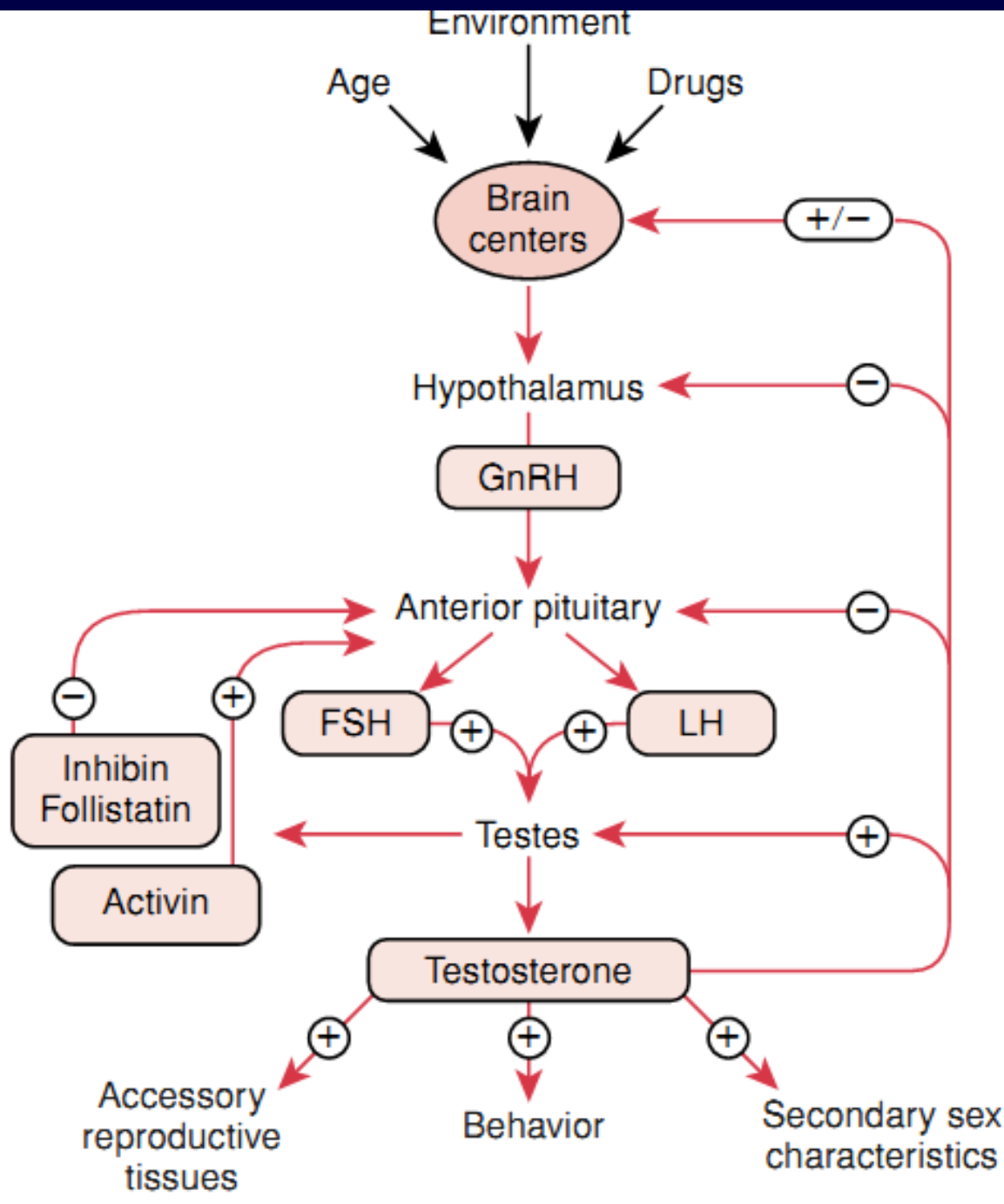
&

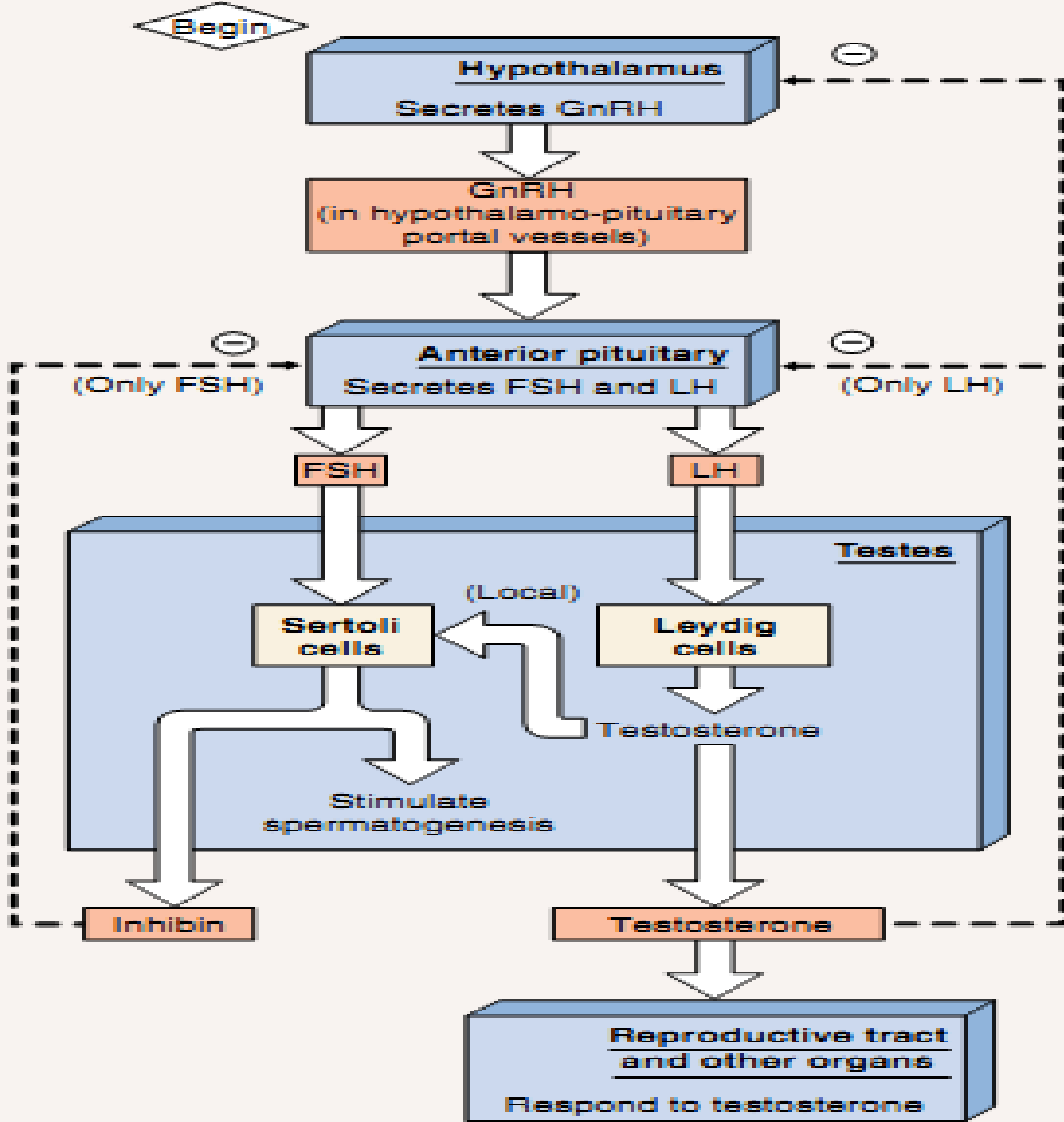
MIMPI BASAH

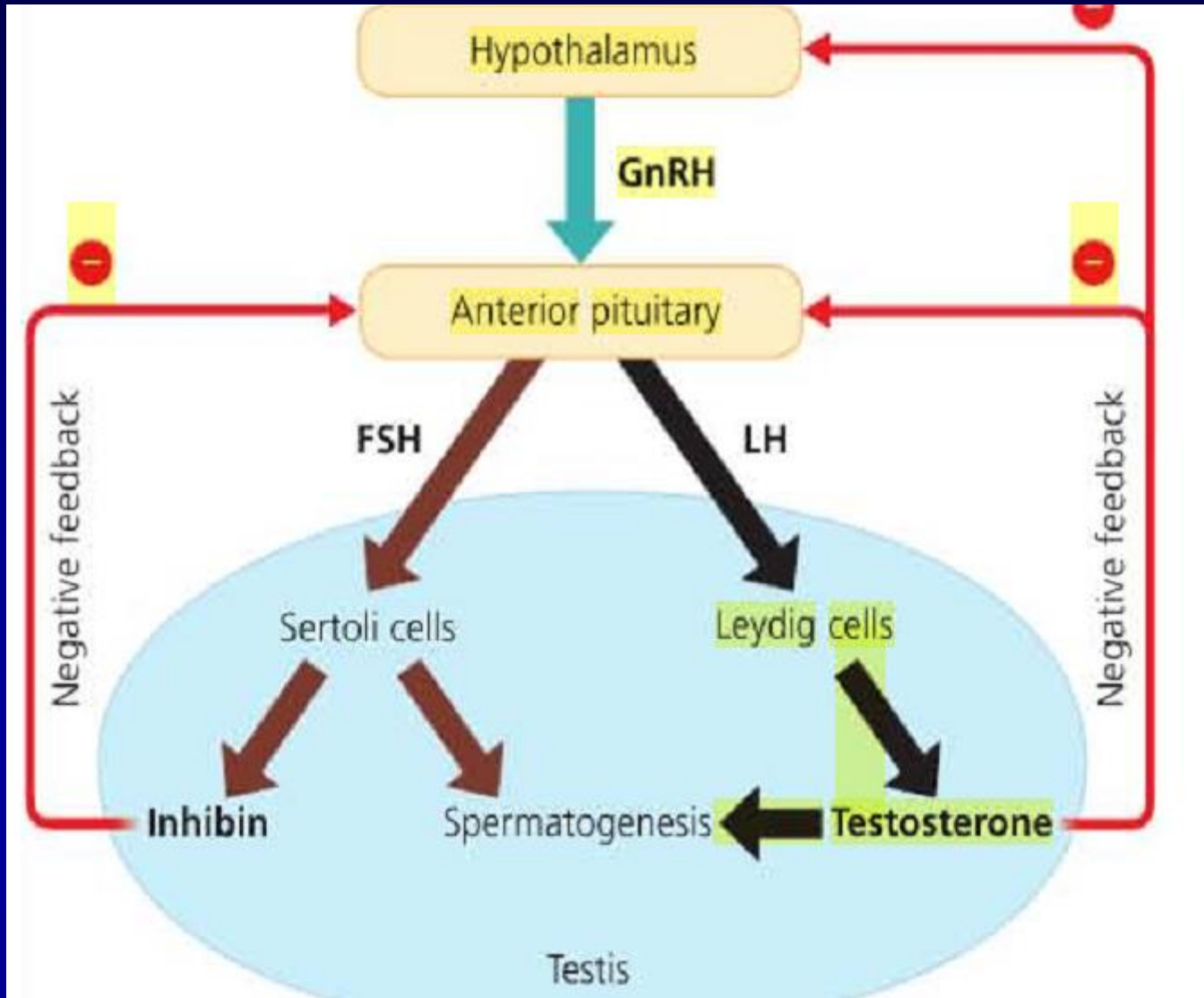


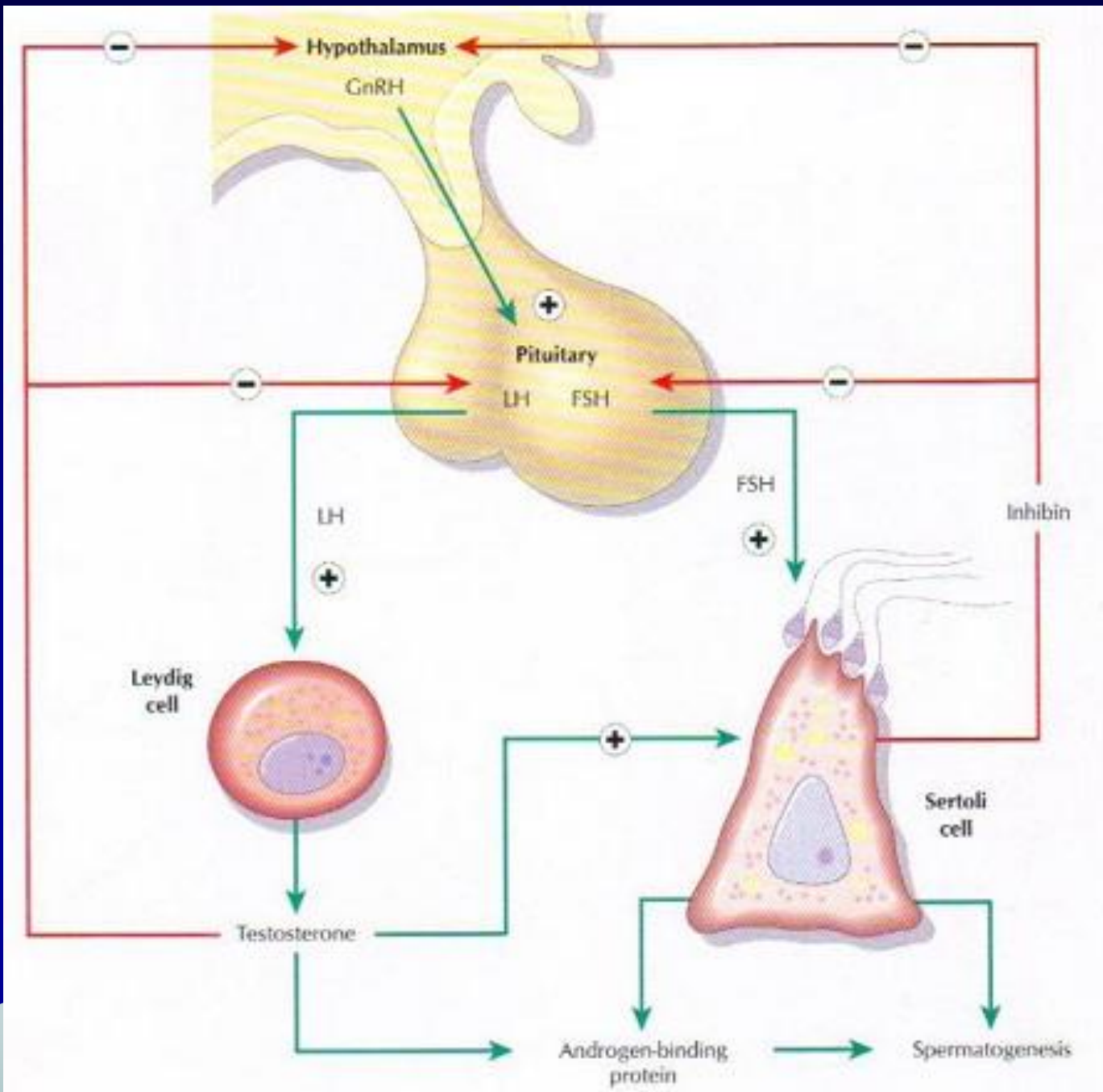












FF

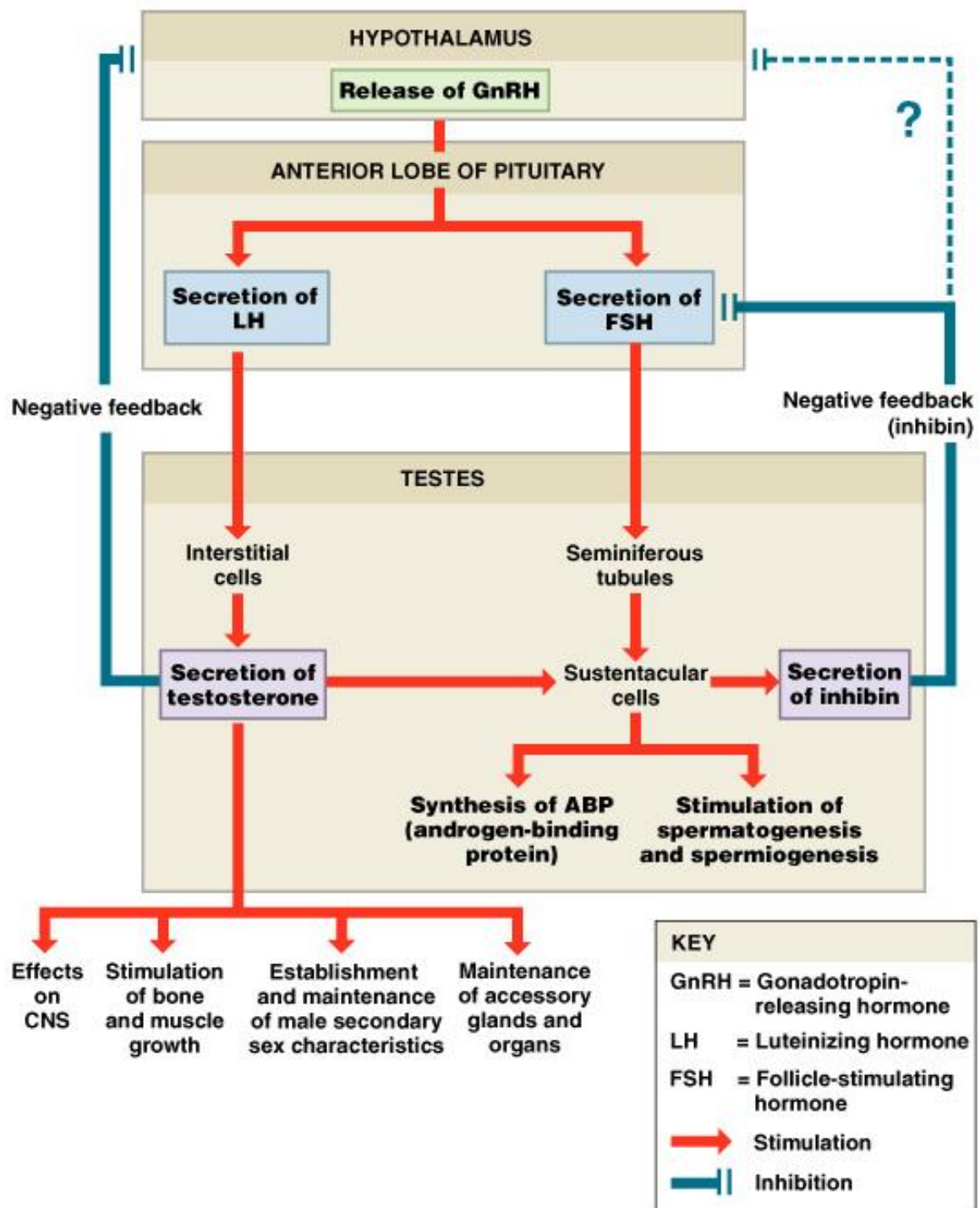
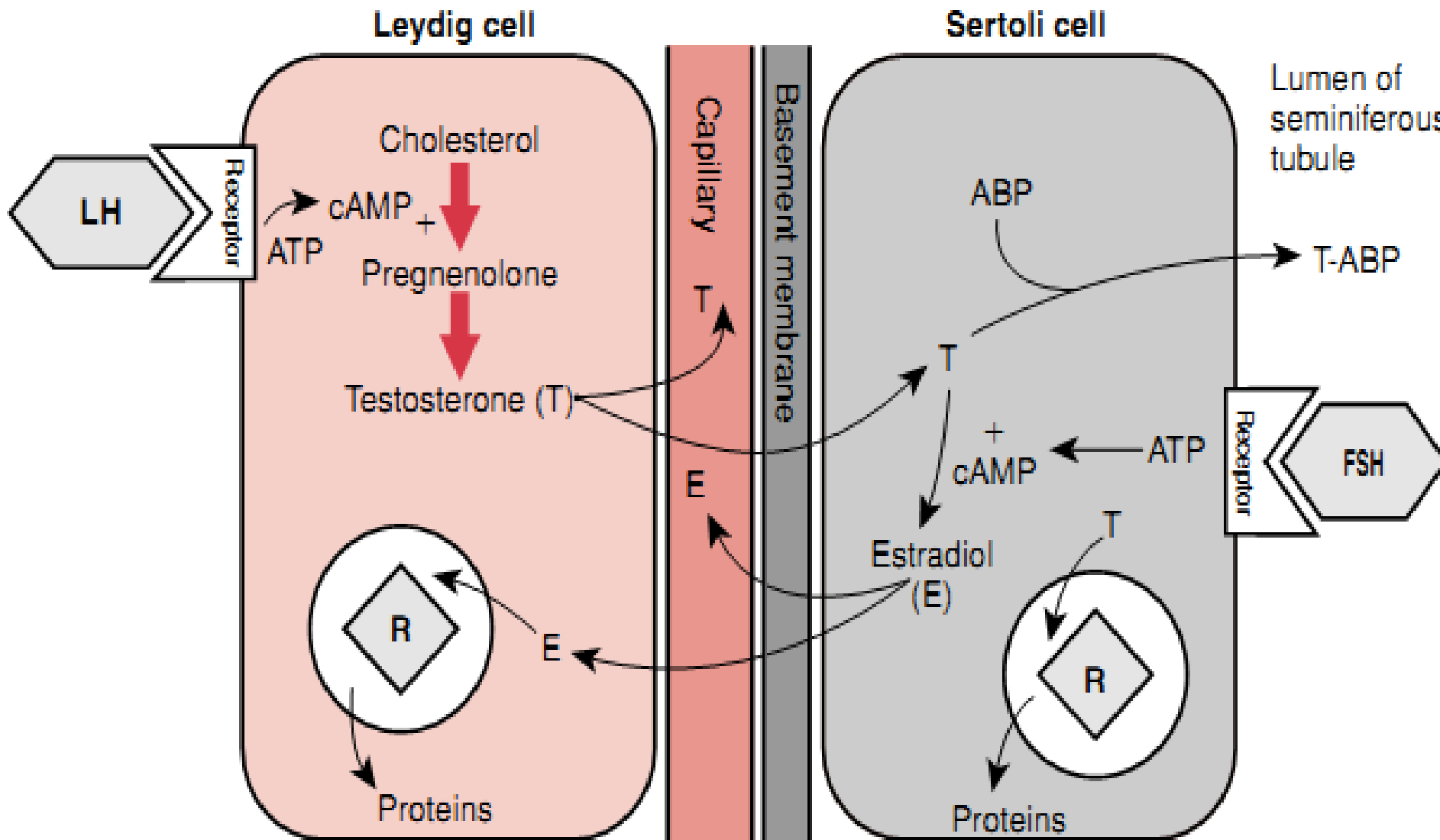
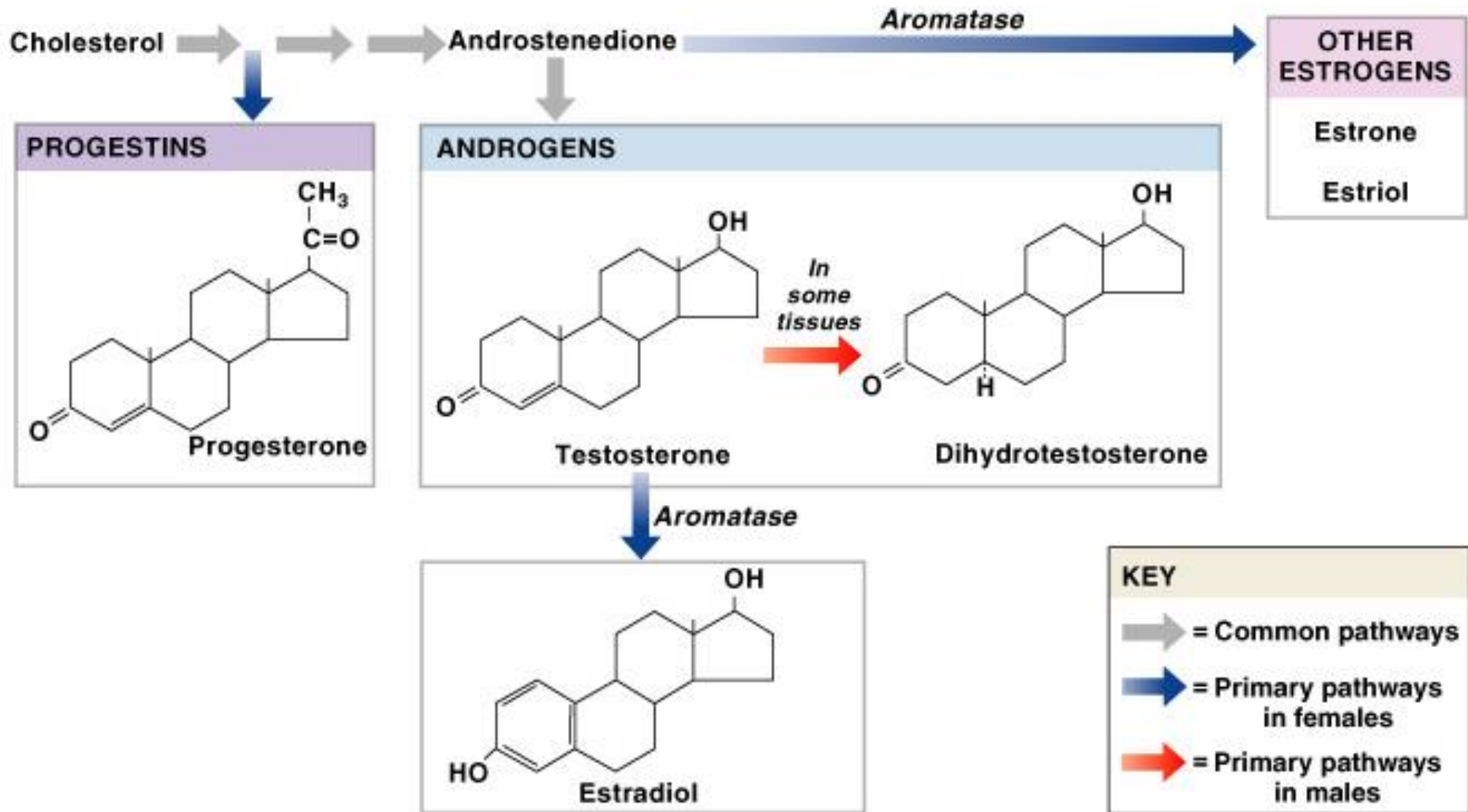
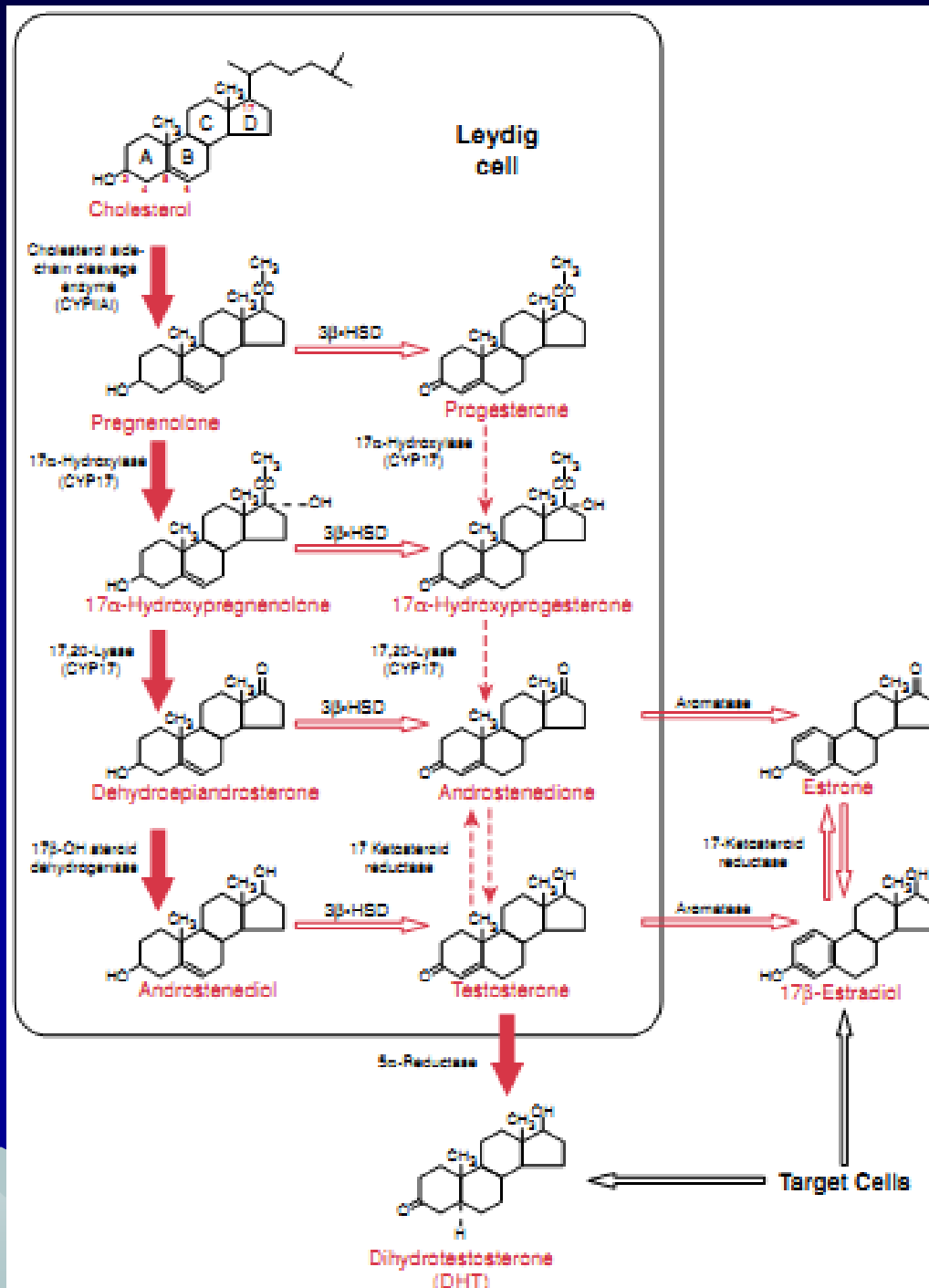


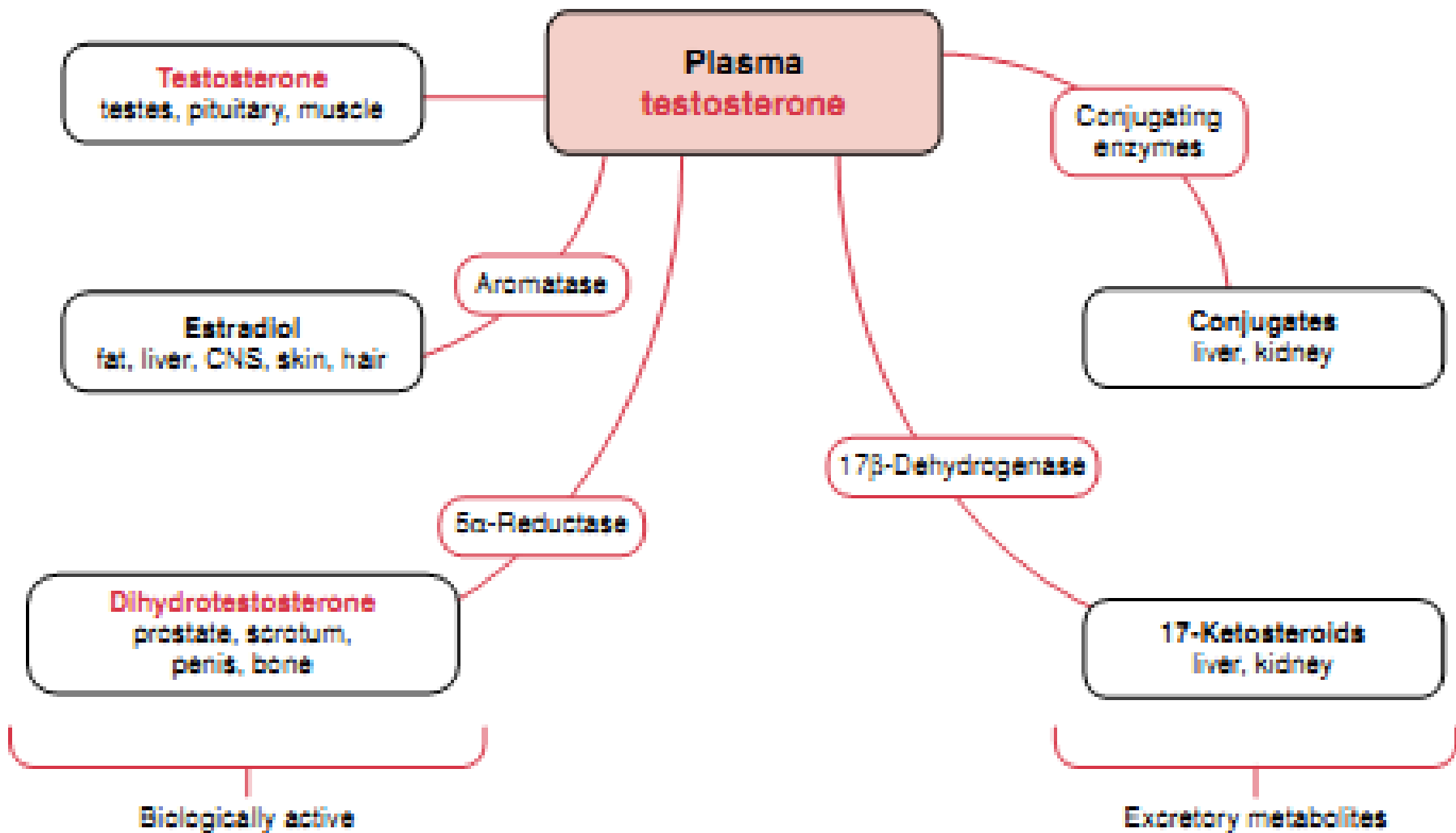
Figure 28-12



Pathways of Steroid Hormone Synthesis in Males and Females







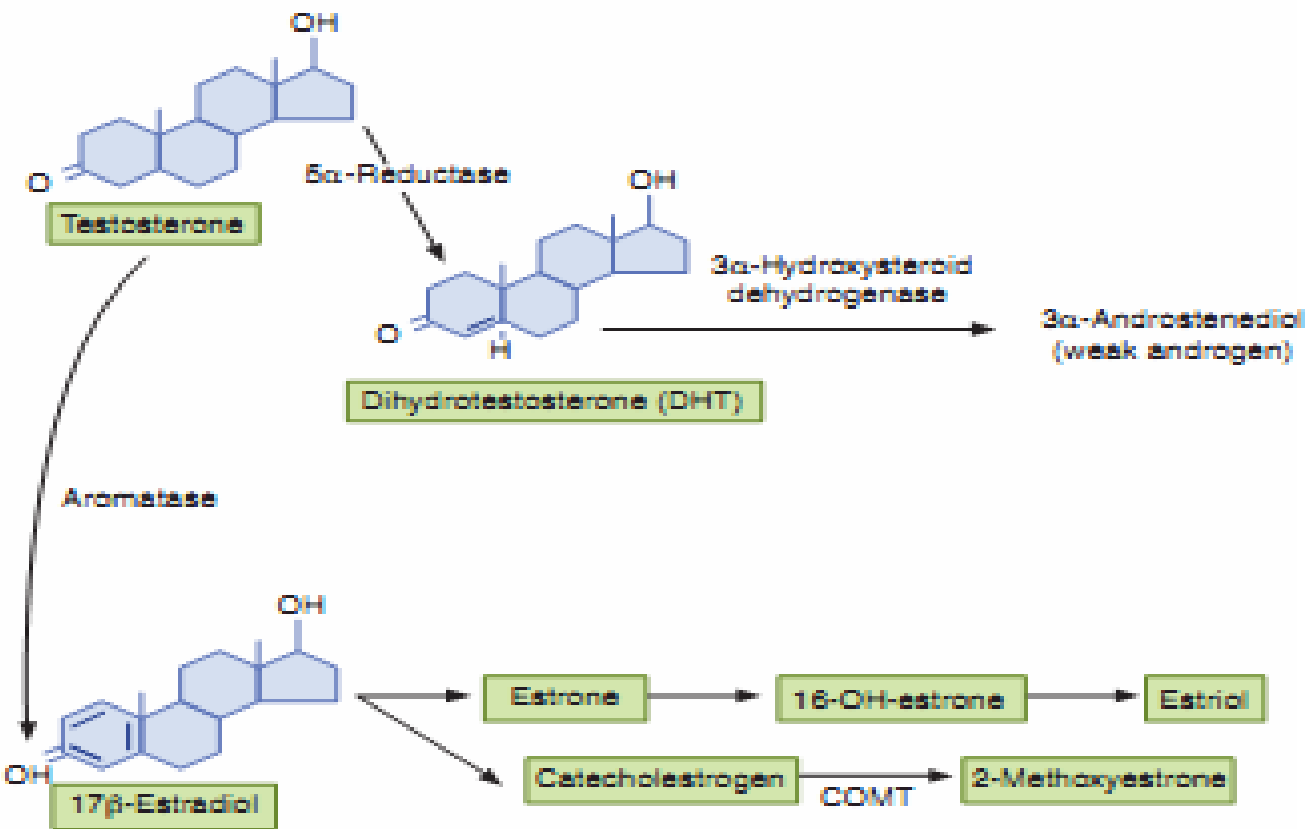
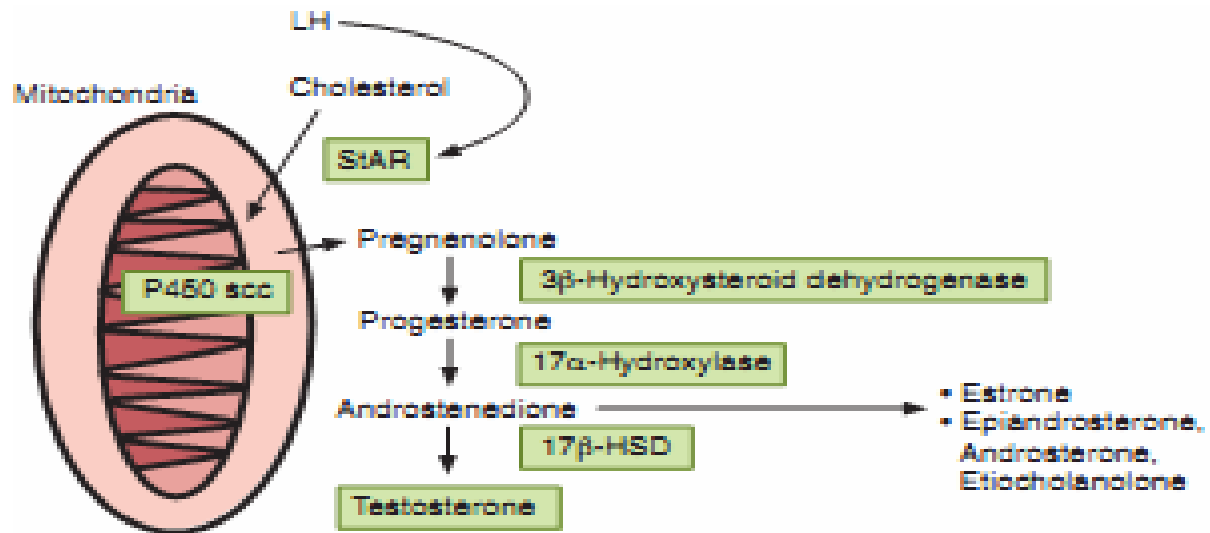


TABLE 67–2 Specific actions of testosterone, dihydrotestosterone, and estradiol.

Testosterone	DHT (5 α -Reductase Activity)	17 β -Estradiol (Aromatase Activity)
Embryonic development of Wolffian duct–derived structures	Embryonic development of the prostate	Epiphyseal closure
Postpubertal secretory activity	Descent of the testes	Prevention of osteoporosis
Pubertal growth of larynx and deepening of voice	Phallic growth	Feedback regulation of GnRH secretion
Anabolic effects on muscle and erythropoiesis	Male pattern balding	
Inhibition of breast development	Development of pubic and underarm hair	
Stimulation of spermatogenesis; libido	Activity of sebaceous glands	
Feedback inhibition of GnRH, LH, and FSH release		

DHT, dihydrotestosterone; GnRH, gonadotropin-releasing hormone. The enzyme activities that metabolize testosterone to DHT or estradiol are in parentheses.

AKTIVITAS SEXUAL ♂

- *Rangsang Saraf*

- Isyarat awal : *glans penis*

- Hub. Kelamin : pemijitan glans → rangsang organ-akhir sensorik → N. pudendus → plexus sacralis → bgn sakral medula spinalis → serebrum

- Impuls jg bisa dari : epitel anus
skrotum
perineum

Unsur Psikis

- memikirkan gagasan sexual
- mimpi melakukan hub. sex



meningkatkan kemampuan
melakukan tindakan sexual,
puncak : *ejakulasi*



Stadium Tindakan Sexual

a. Ereksi

- **Efek I rangsangan psikis/fisik**
- **Impuls parasimpatis sakral**



b. Lubrikasi

Impuls parasimpatis



Kel. Littre & kel. Bulbouretralis



sekresi mukus



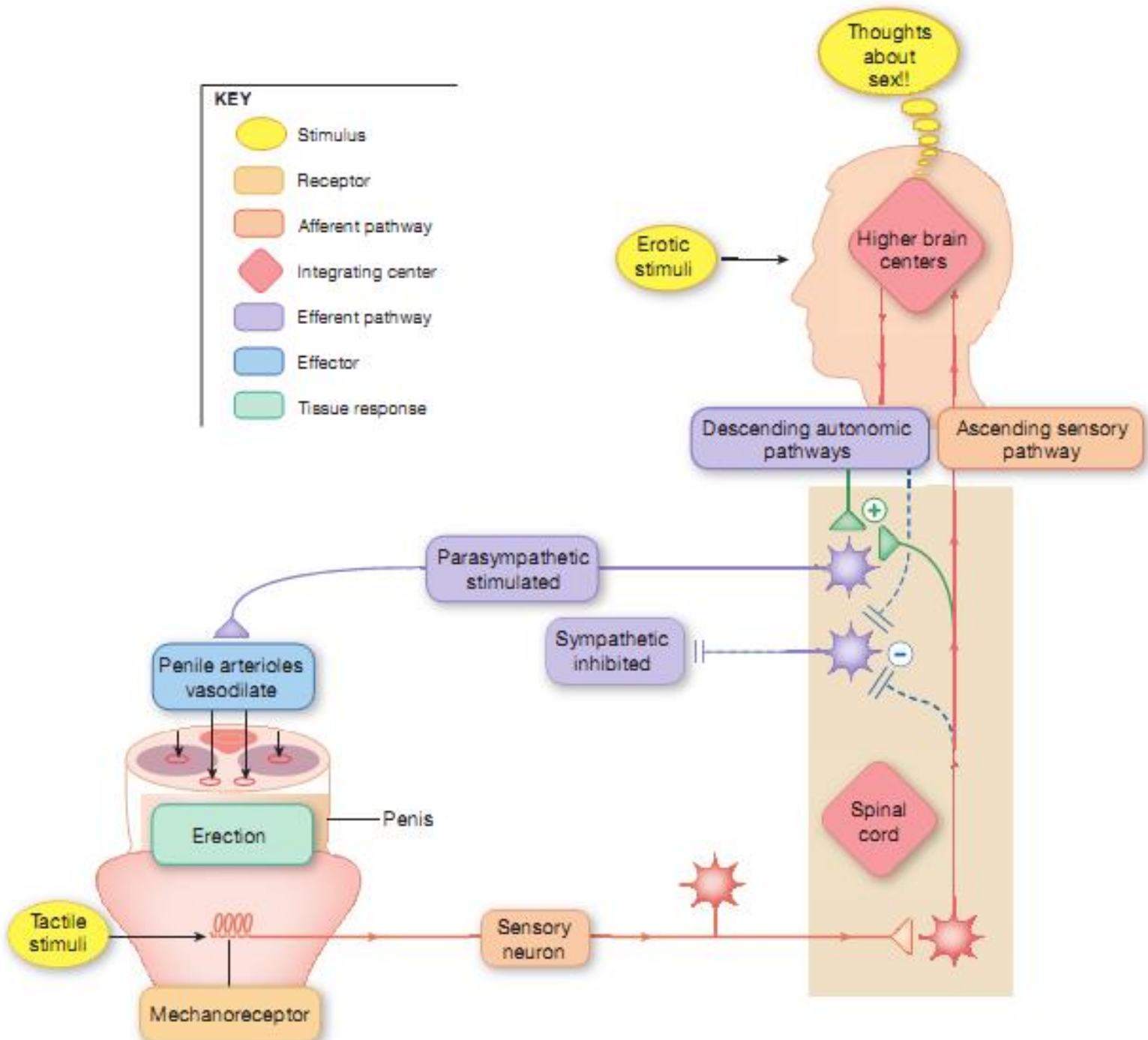
uretra

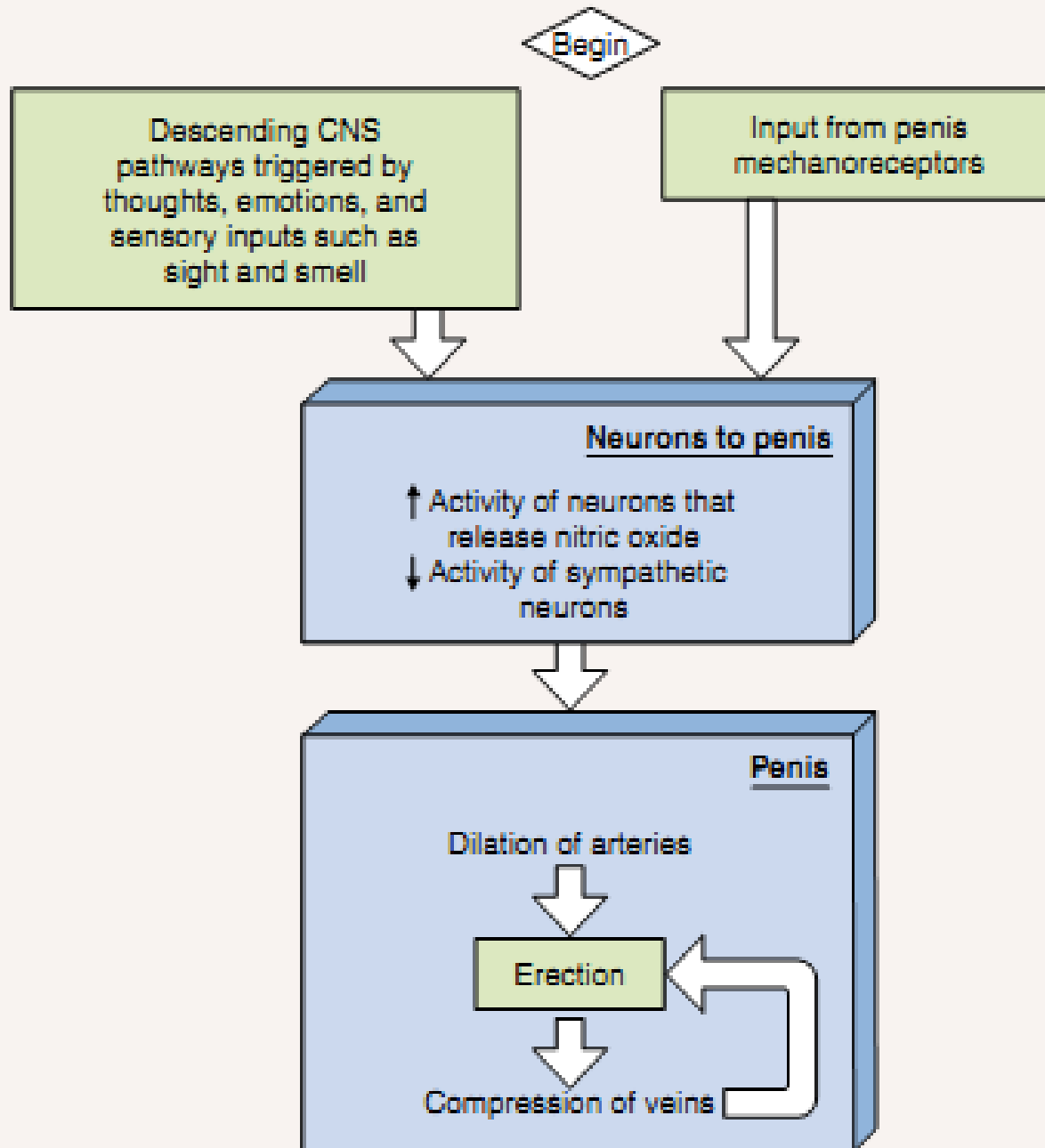


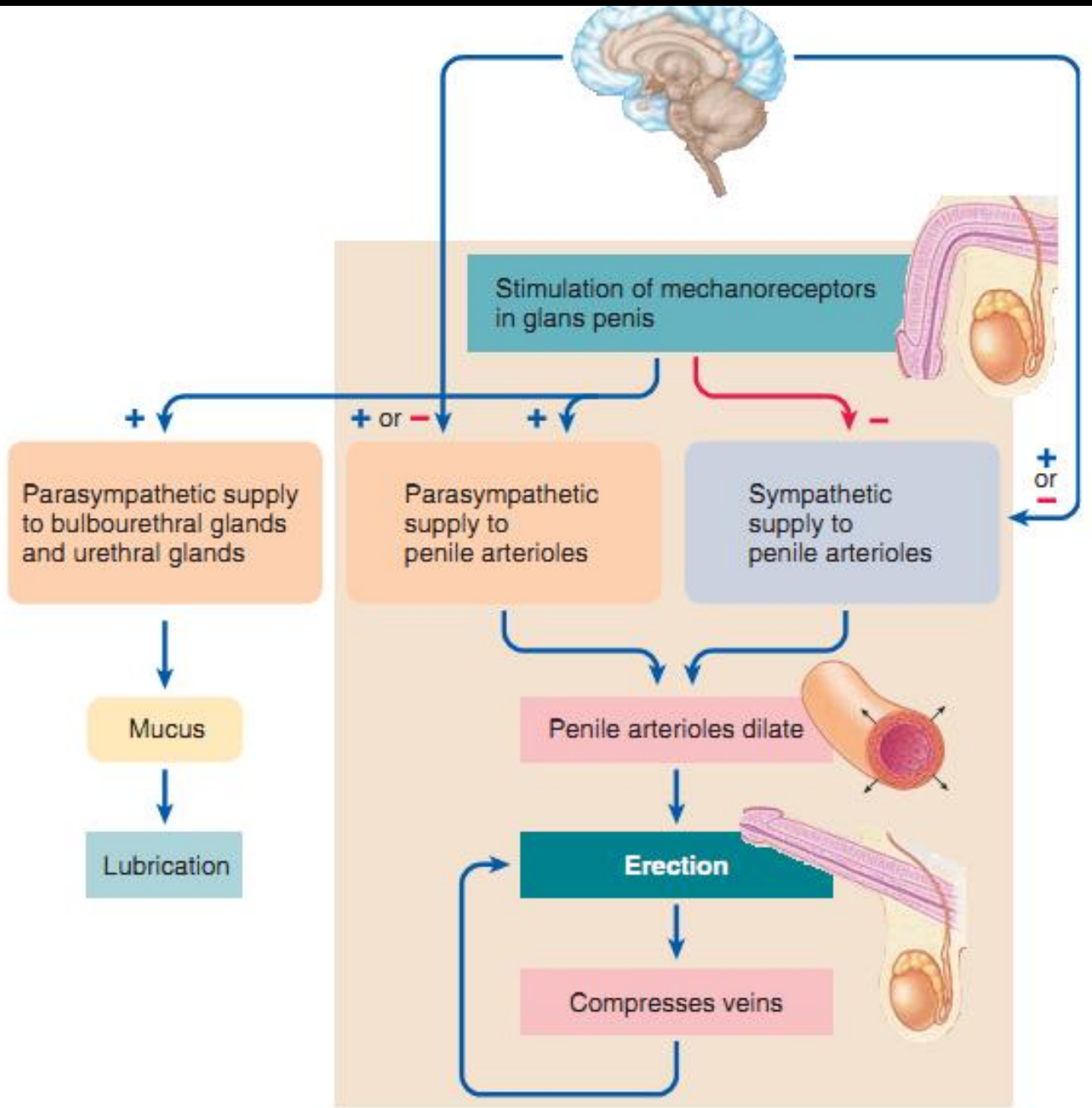
C. Emisi dan Ejakulasi

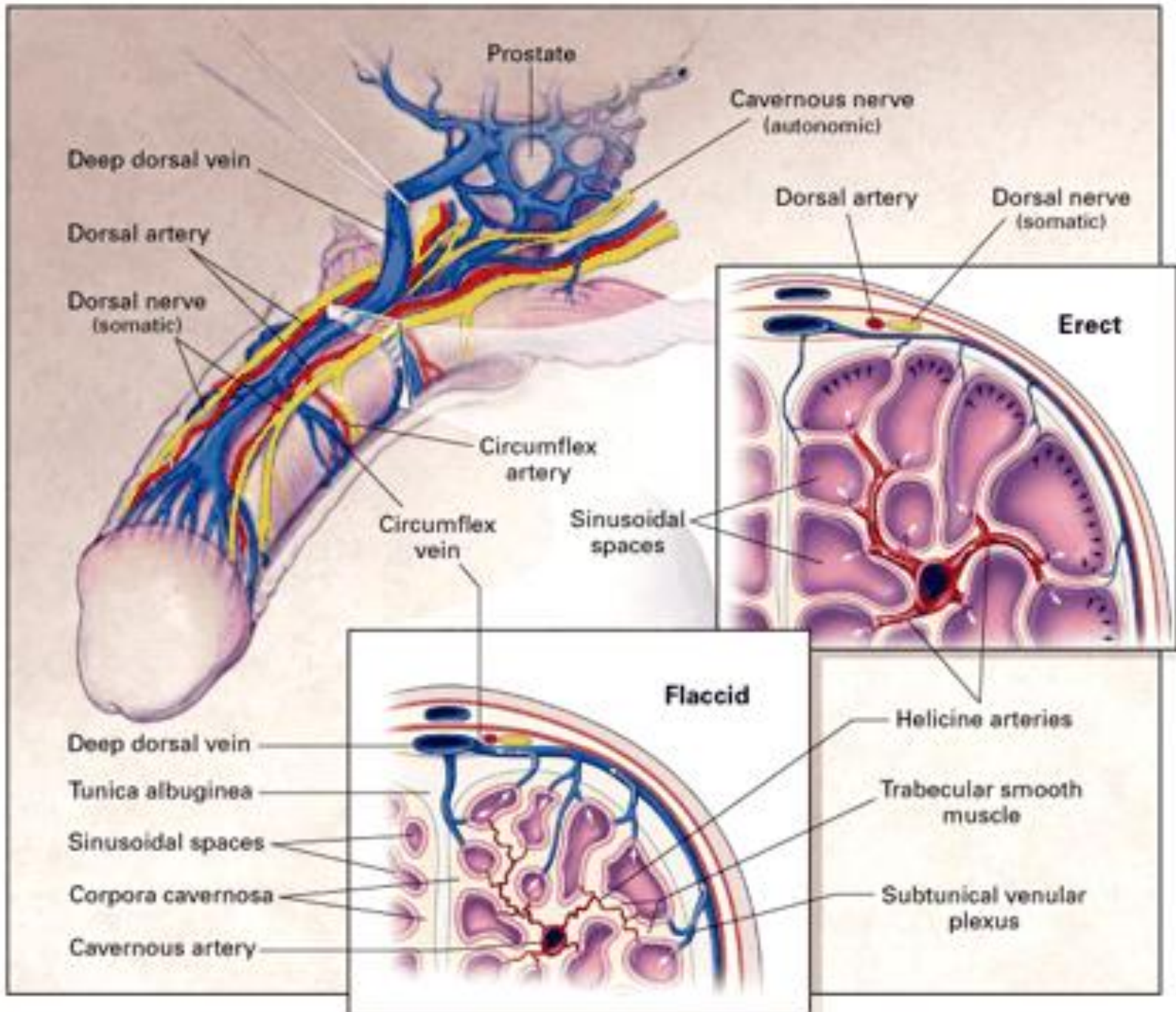
- Rangsang sex >> kuat → impuls simpatis med. spinalis L-1 & L-2 → organ genitalia → kontraksi :
 - epididimis
 - vas deferen
 - ampula
 - vesika seminalis
 - otot2 sekitar kel. prostat
- dorong sperma ke uretra int
- sekresi semen

Impuls berirama medula spinalis → otot rangka sekitar jaringan erektil → tekanan ↑ → ejakulasi

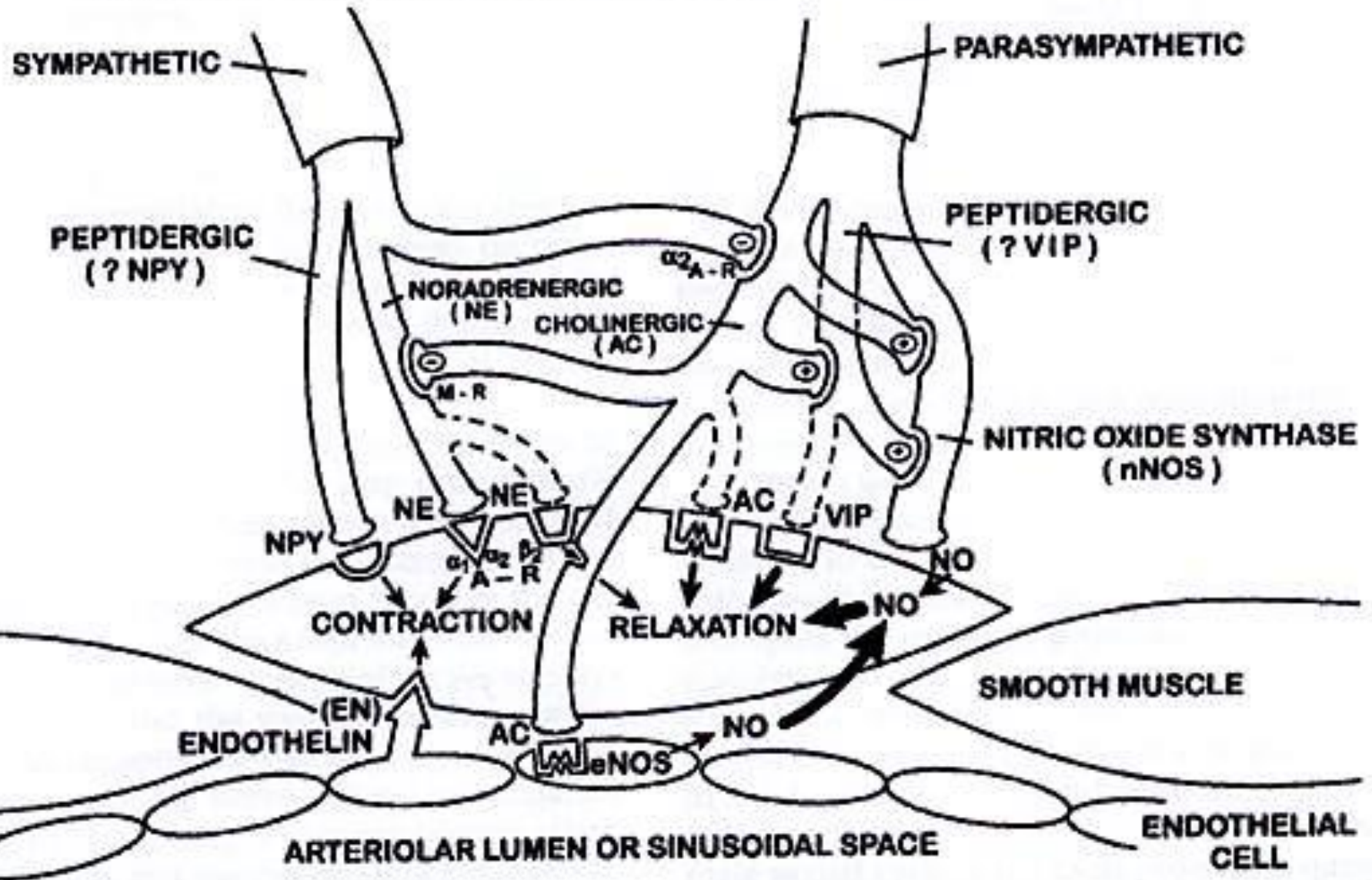


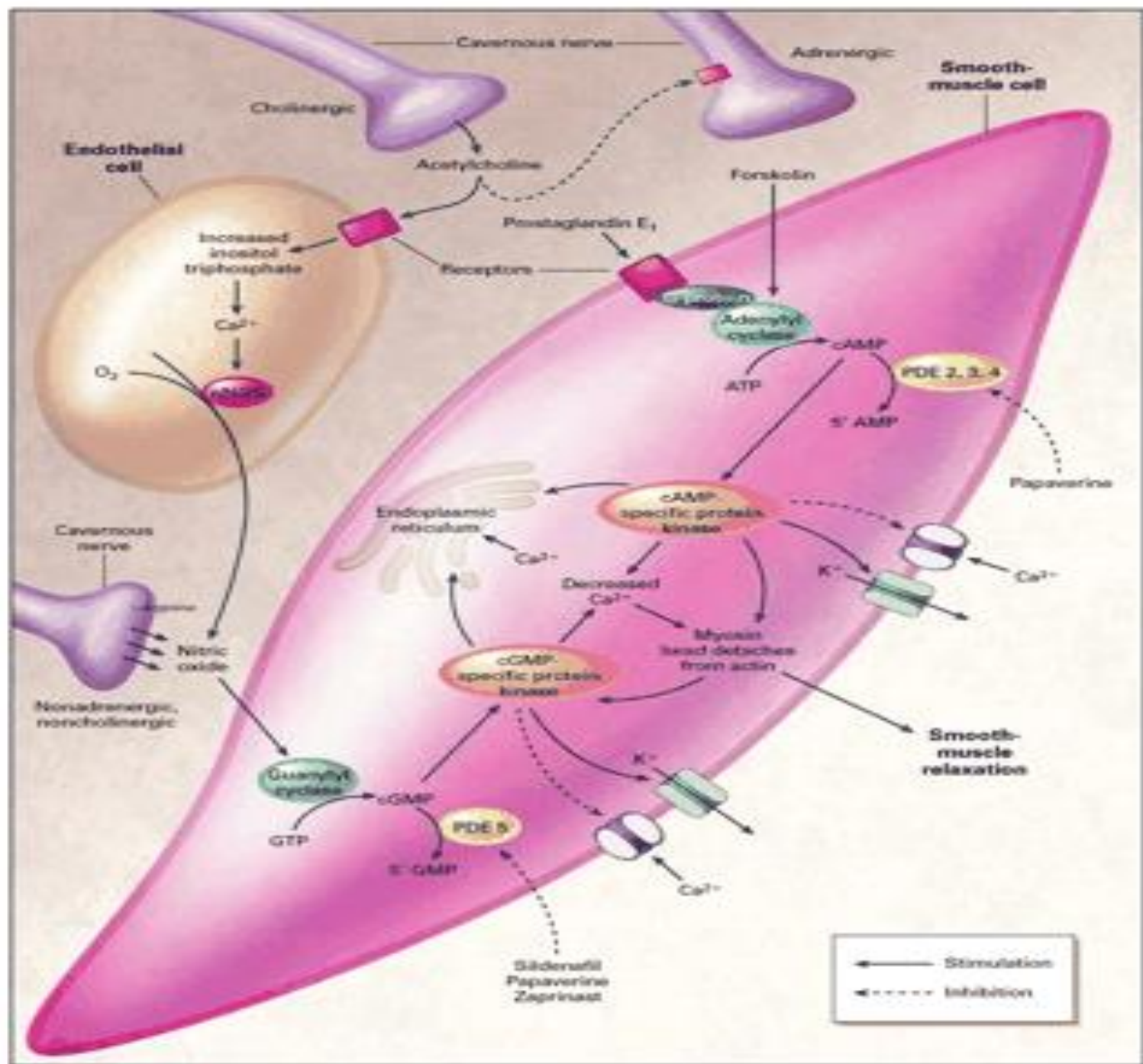






HYPOTHETICAL NEURAL CONTROL OF CORPUS CAVERNOSUM SMOOTH MUSCLE TONE





BRAIN

SPECIAL SENSORY AND PSYCHIC STIMULI

CEREBRAL CORTEX (INTERHEMISPHERIC TISSUE)

LIMBIC SYSTEM

SPINAL CORD

T₁₁-L₂

S₂-S₄

PELVIS

PARASYMPATHETIC NEURONS

NERVI ERIGENTES

PUDENDAL NERVES

FLACCIDITY

VASOCONSTRICTION

VASODILATION

ERECTION

RIGIDITY

EMISSION

EJACULATION

VASOCONSTRICTION

DETUMESCENCE

NONADRENERGIC NONCHOLINERGIC NEURAL AND ENDOTHELIAL-DERIVED MEDIATORS

TACTILE STIMULI

URETHRAL SENSORY STIMULI

CONTRACTION OF PELVIC FLOOR MUSCLES

MOTOR SOMATIC INNERVATION (S₂-S₄)

SYMPATHETIC NEURONS

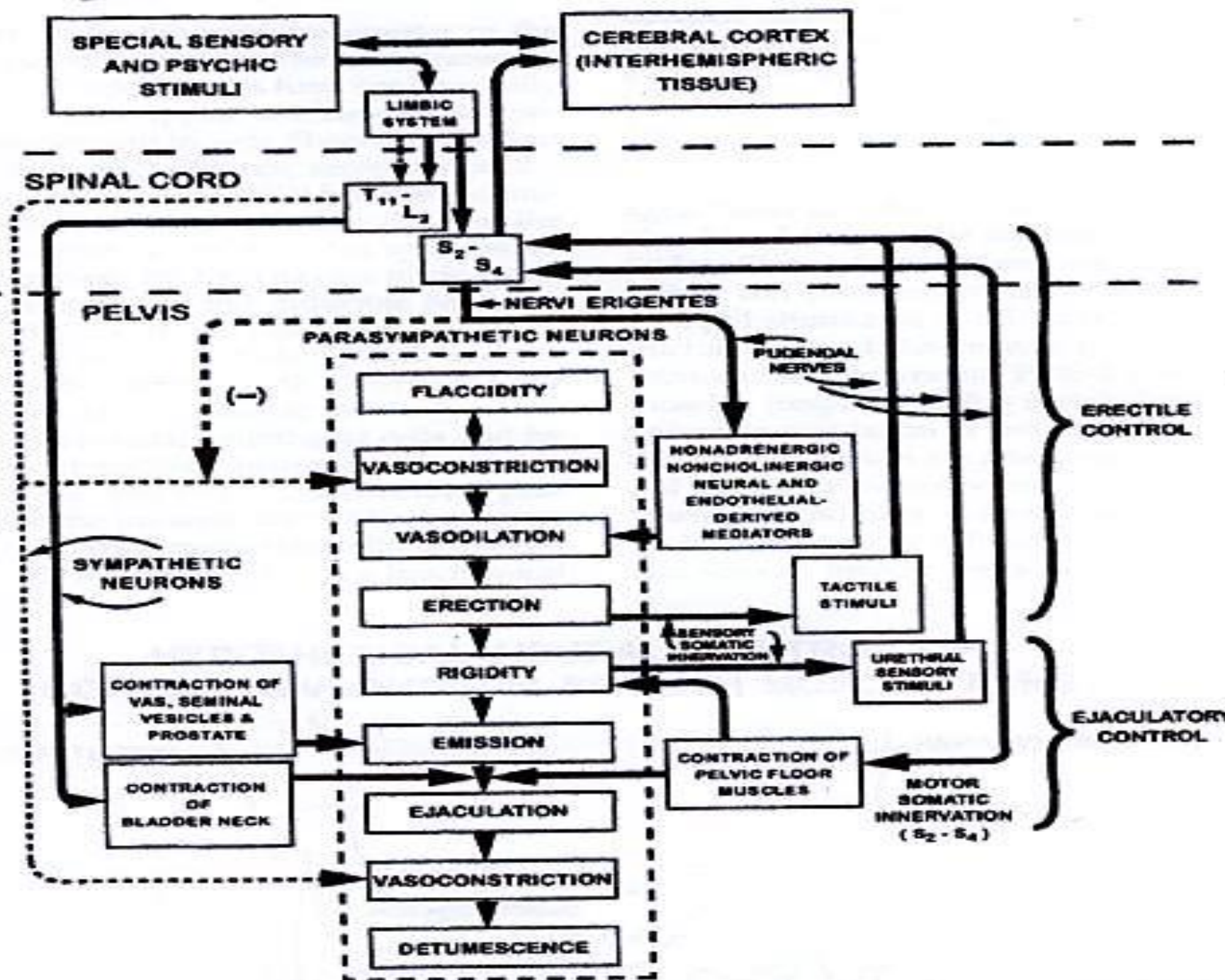
CONTRACTION OF VAS, SEMINAL VESICLES & PROSTATE

CONTRACTION OF BLADDER NECK

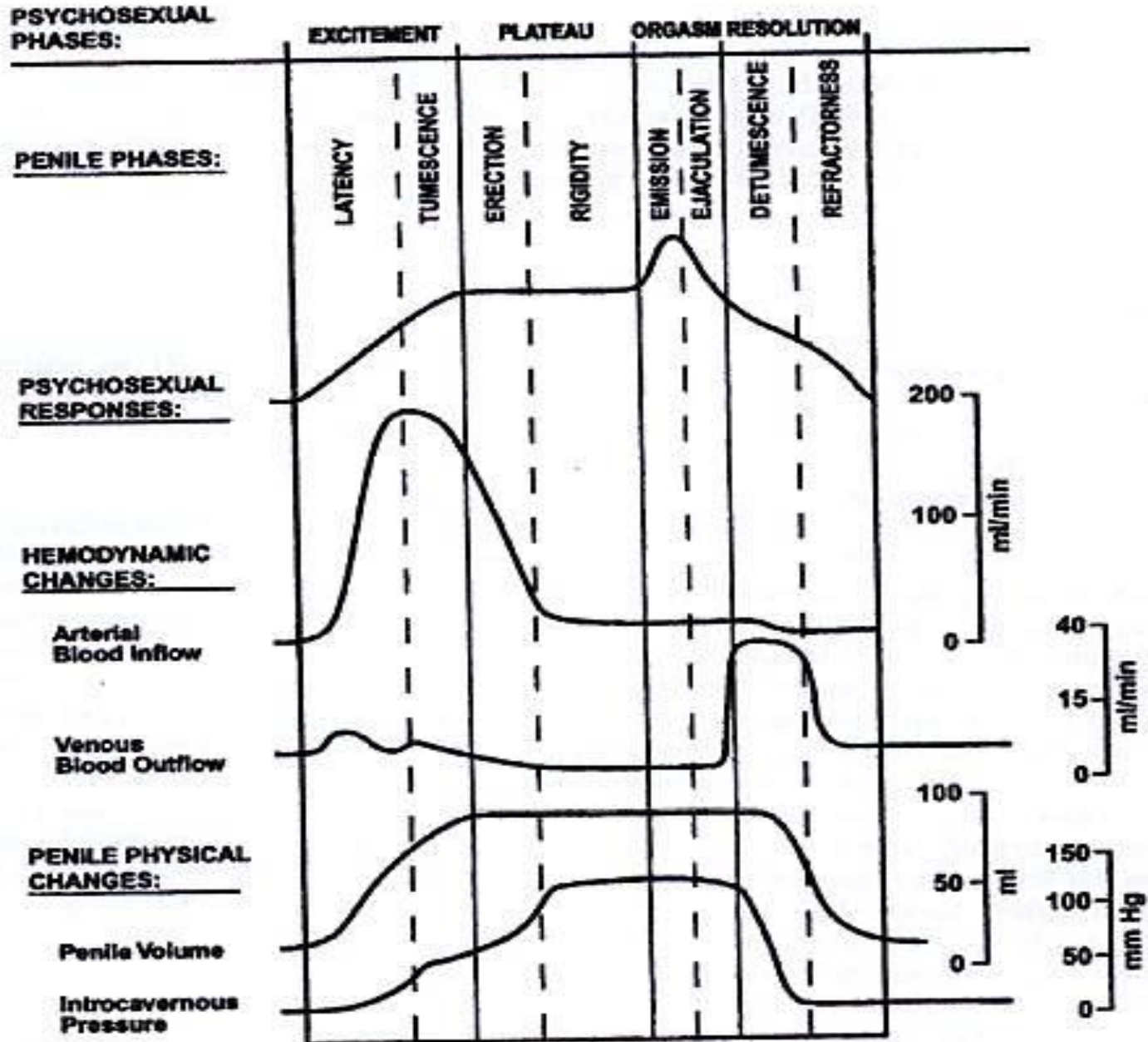
ERECTILE CONTROL

EJACULATORY CONTROL

(-)

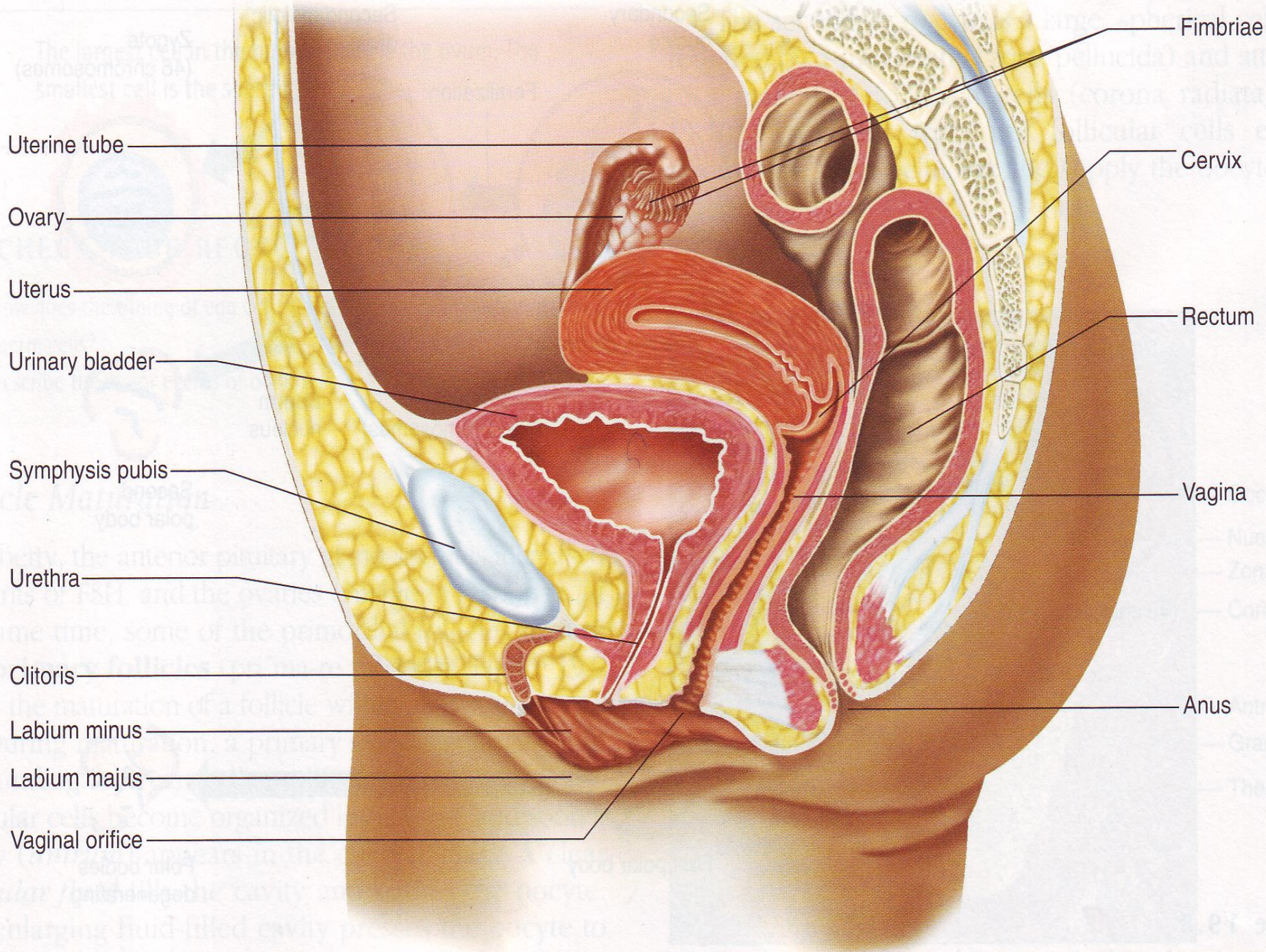


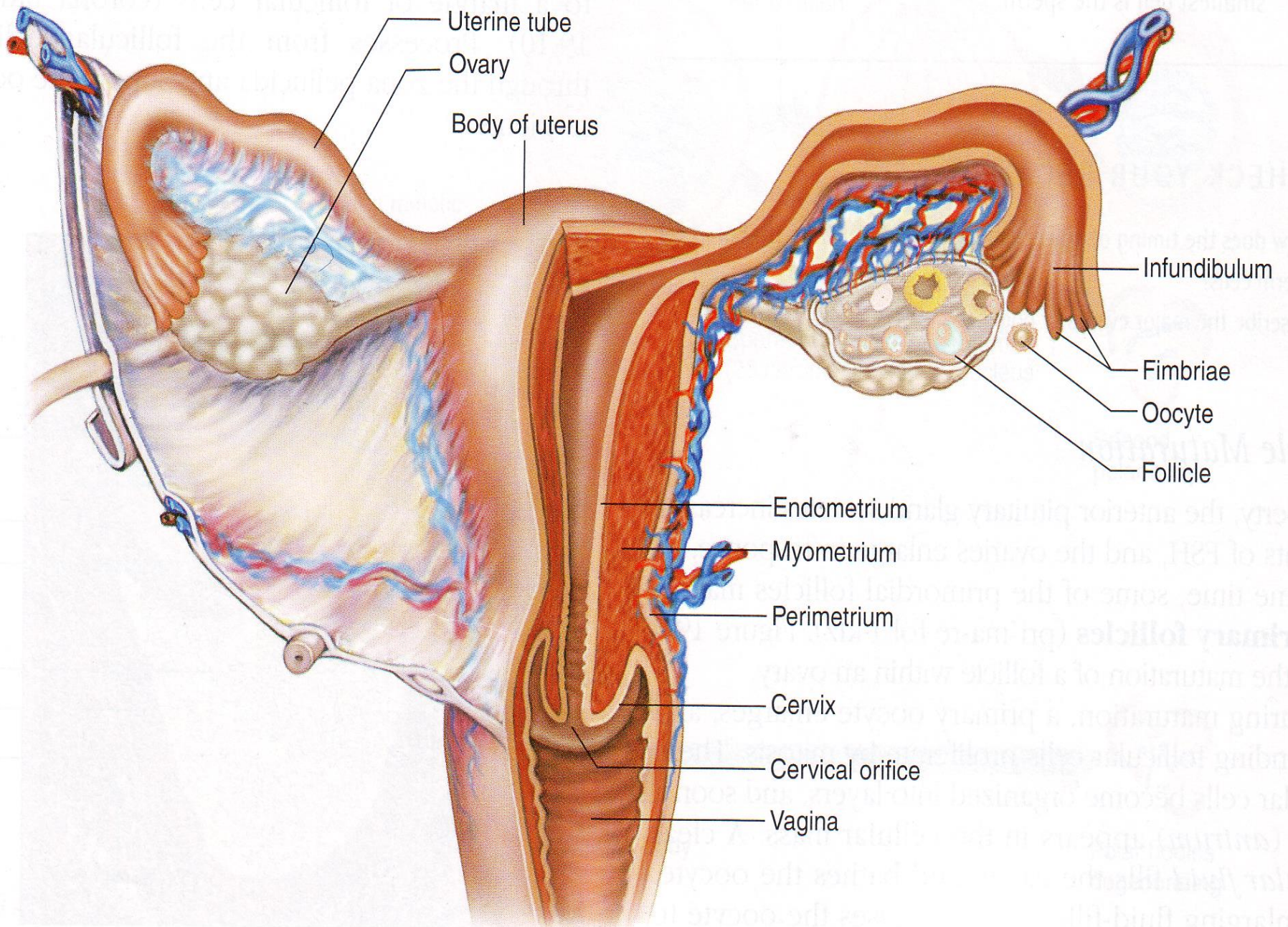
NORMAL MALE SEXUAL CYCLE: PSYCHOGENIC AND PENODYNAMIC EVENTS



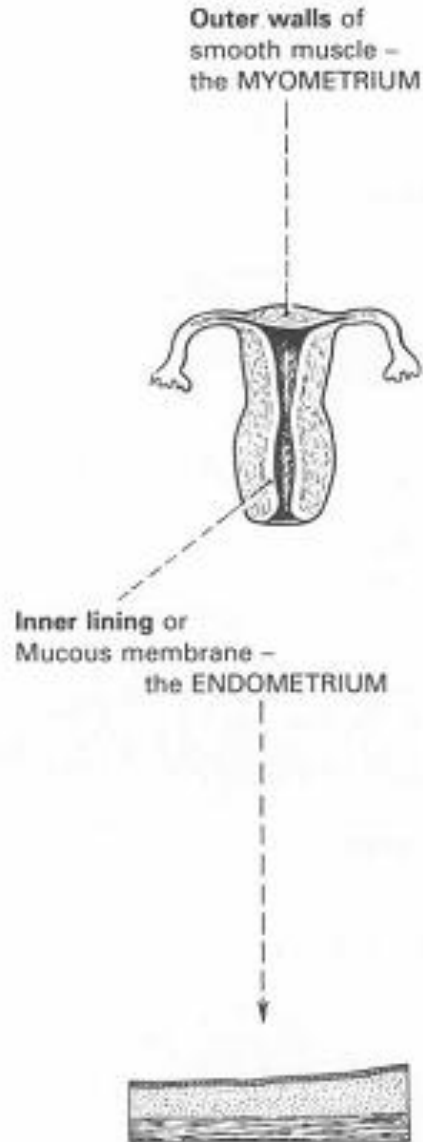
WENSTRIRIAS



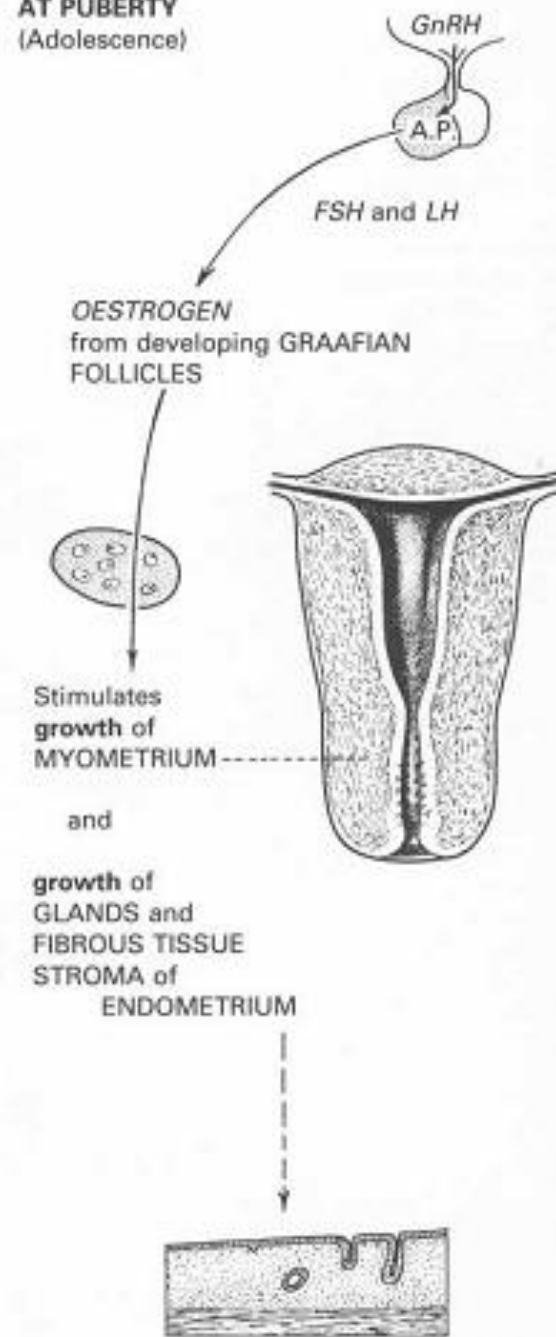




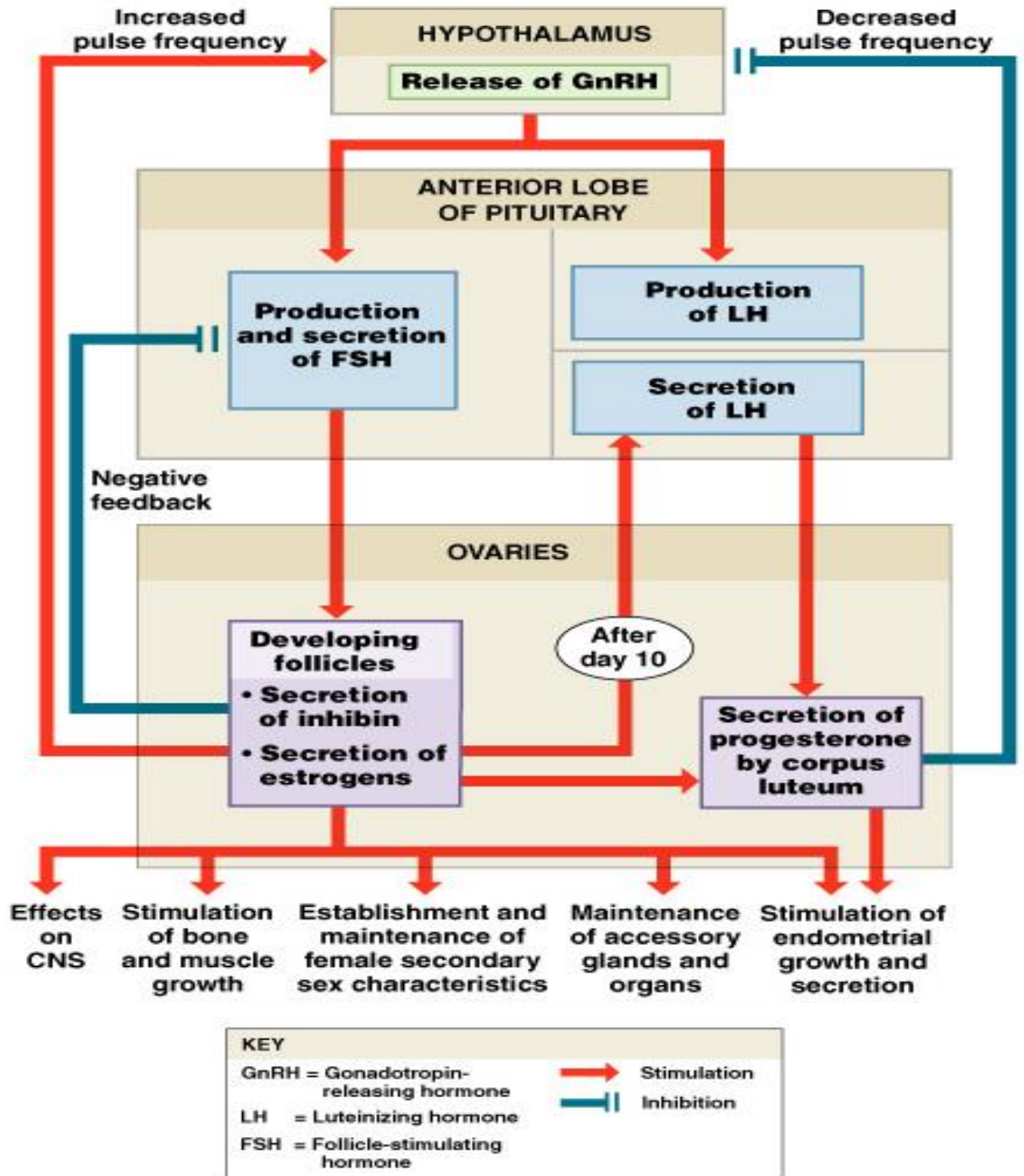
IN CHILDHOOD –
it is a small undeveloped organ
situated deep in the pelvis.

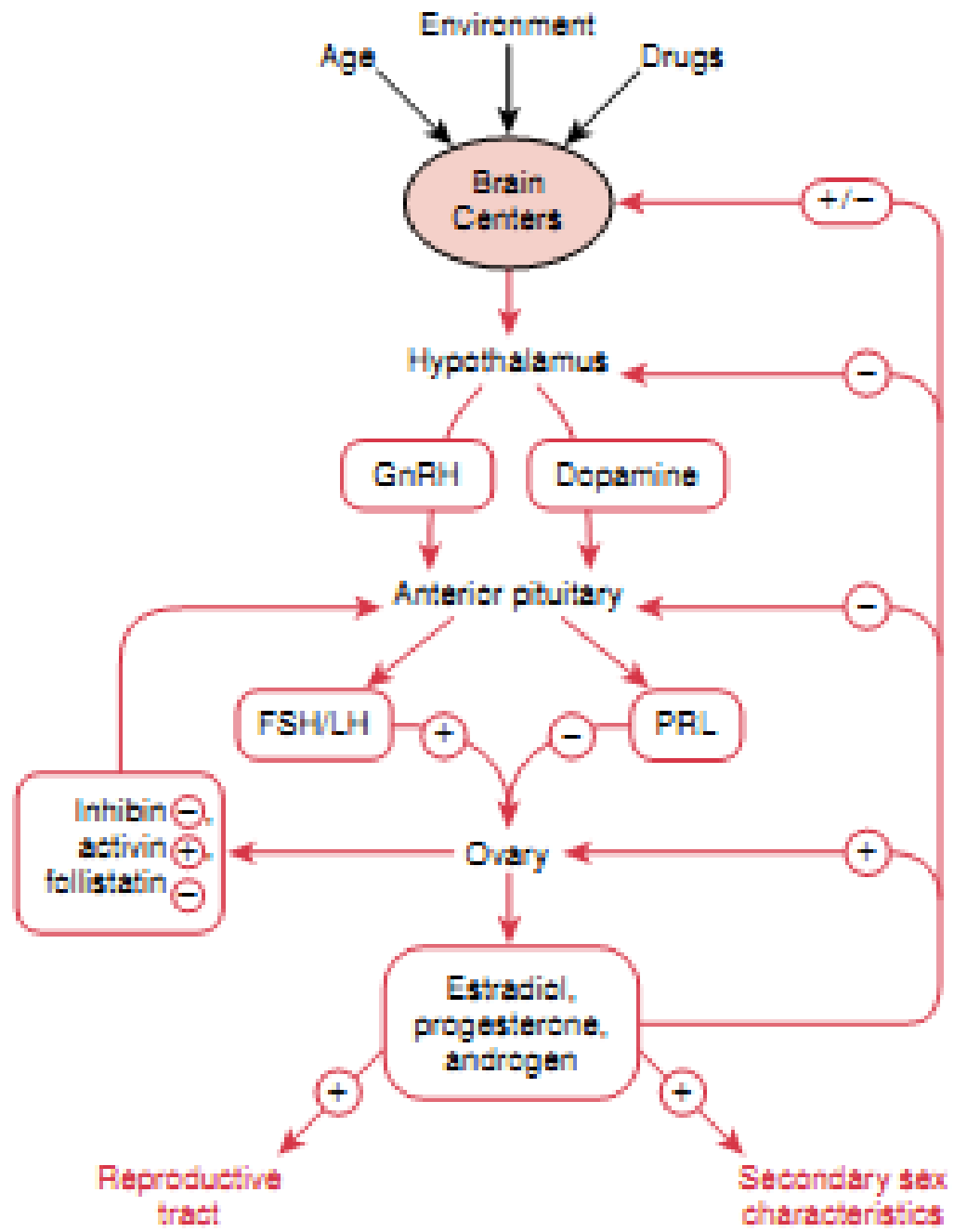


AT PUBERTY
(Adolescence)



The Hormonal Regulation of Ovarian Activity





Siklus Menstruasi

1. Stadium Menstruasi (desquamasi)

- Endometrium (kecuali stratum basale) lepas dari dinding uterus disertai dengan perdarahan → 4 hari
- Darah haid tdd : darah, cairan jaringan, mucus & epitel dr endometrium, fibrinolisin
- Kalau darah yg keluar >>, fermen tsb tidak cukup → bekuan darah haid
- Vol darah menstruasi $\pm 50 - 150$ cc

2. Stadium regenerasi

- Mulai stad menstruasi , \pm 4 hari;
- Tebal endometrium \pm 0,5 mm
- Endometrium lepas \rightarrow luka, ditutup oleh selaput lendir baru (epitel kelenjar) endometrium

3. Stadium proliferasi

- Hari ke 5 -14 hr I haid, tebal endometr \pm 3,5 mm

4. Stadium sekresi

- Tebal endometr tetap, bentuk kelenjar memanjang, berkelok & mengeluarkan getah.
- Glikogen & Ca \gg sbg makanan utk ovum \rightarrow persiapan terima ovum ; hari ke 14 – 28
- Kalau fertilisasi (-) \rightarrow endometrium dilepas \rightarrow silkus menstruasi

FOLICULAR PHASE

LUTHEAL PHASE

Mulai perdarahan

Hari

1

7

14

25

28

Banyak folikel tumbuh

Folikel dominan matang

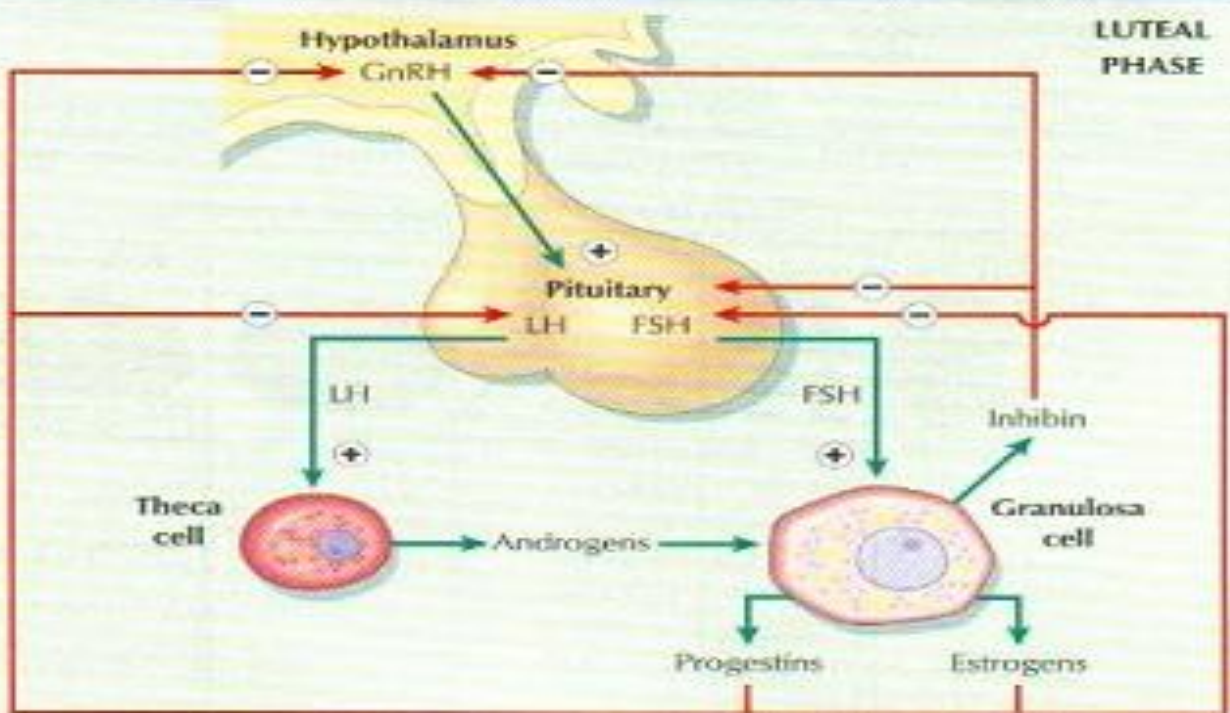
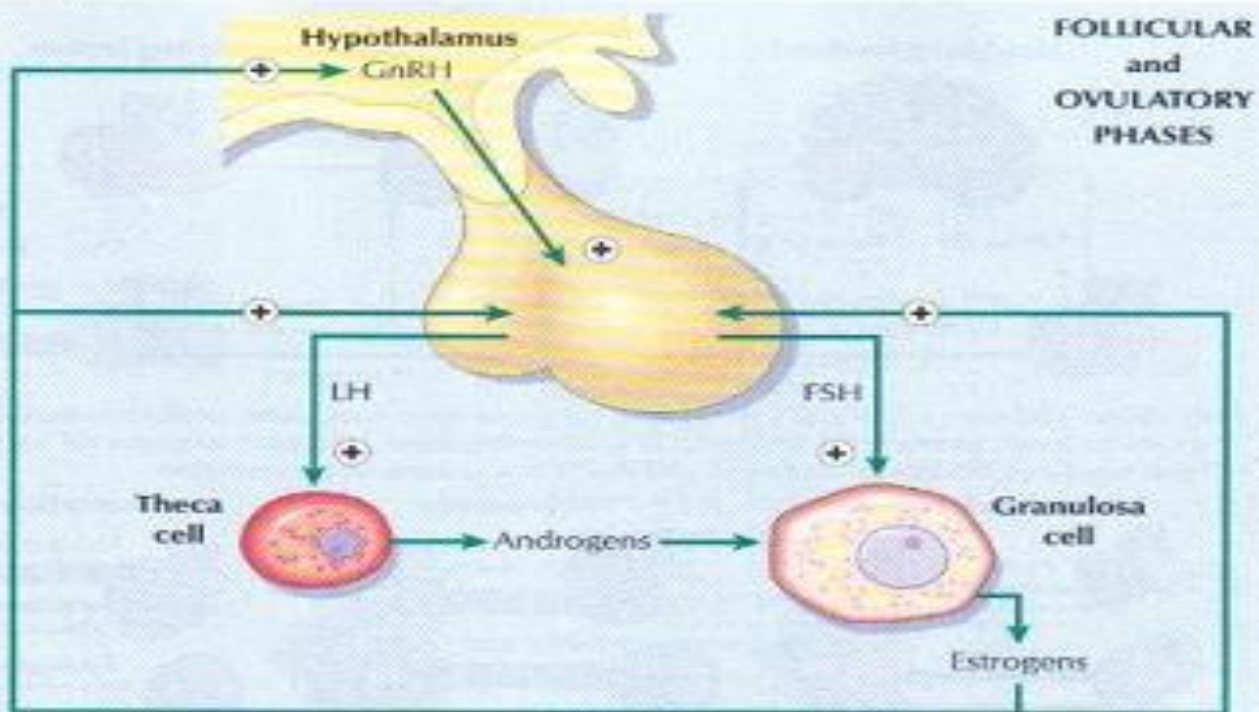
Corpus luteum berfungsi

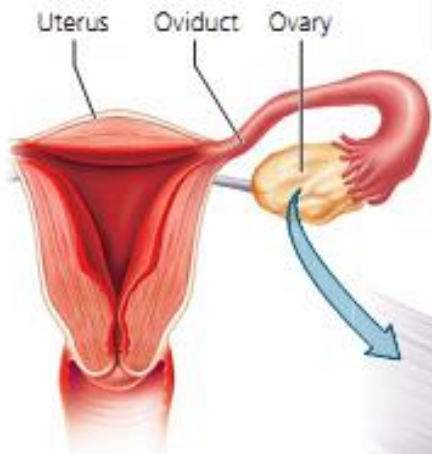
Degradasi corpus luteum

Ovarium

Terbentuk folikel dominan

Terjadi ovulasi

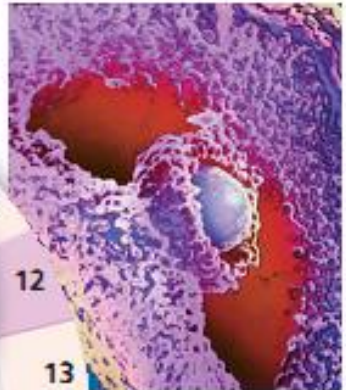
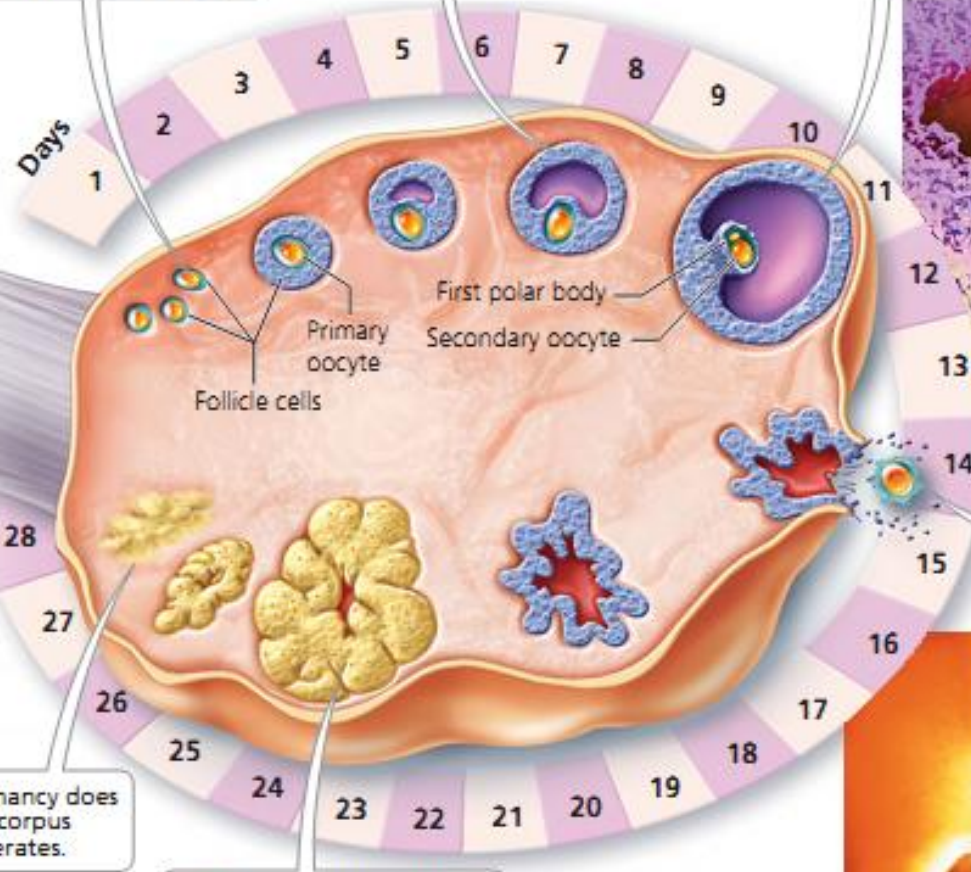




Step 1: The primary follicle contains the primary oocyte. The follicle cells secrete the sex hormone estrogen.

Step 2: The layer of follicle cells thickens. Estrogen-containing fluid accumulates, resulting in the formation of a cavity.

Step 3: The mature (Graafian) follicle results from rapid growth. Meiosis I forms a secondary oocyte and a polar body.



A mature follicle

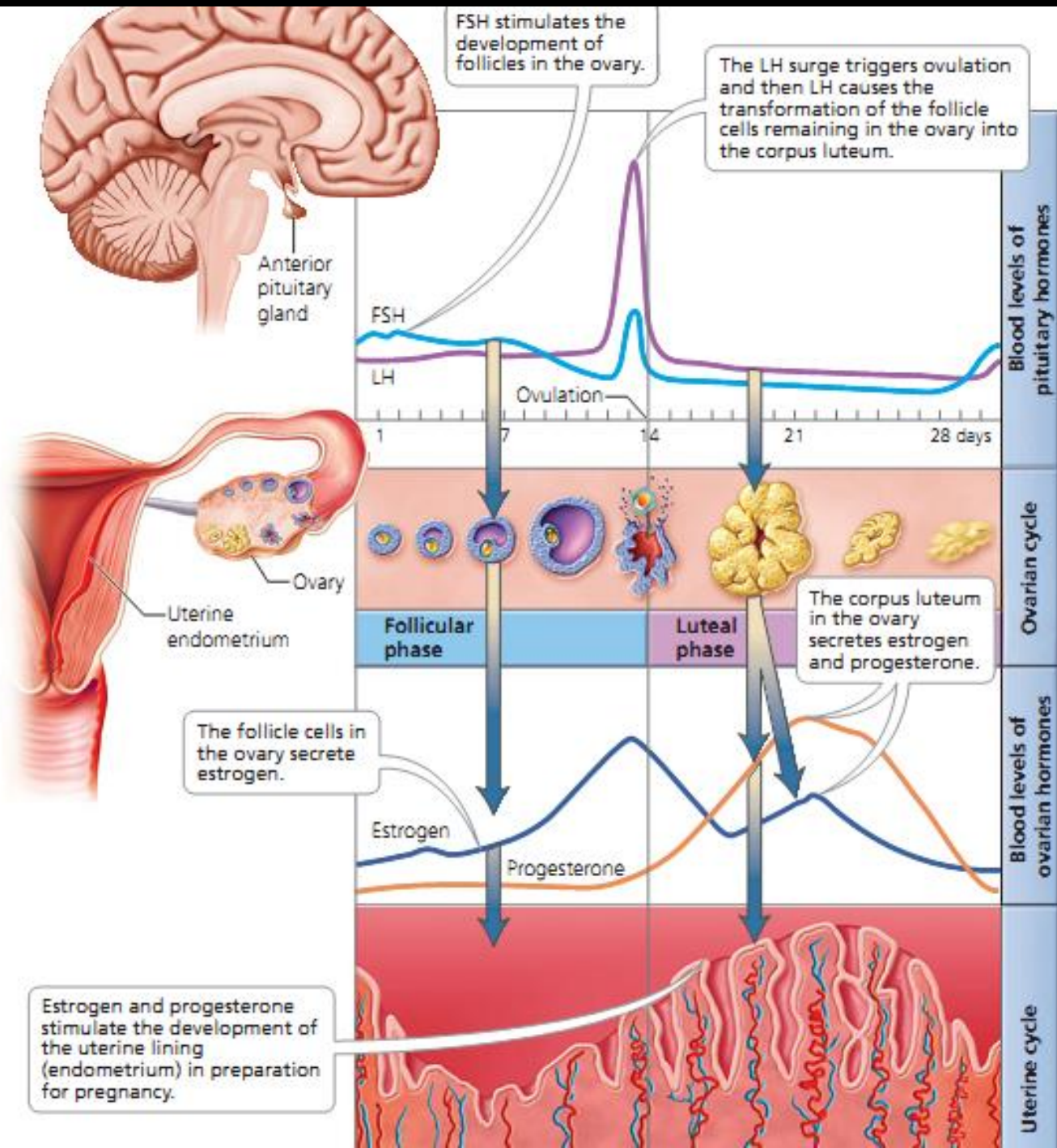
Step 4: At ovulation, the mature follicle ruptures, releasing the secondary oocyte.



Ovulation

Step 6: If pregnancy does not occur, the corpus luteum degenerates.

Step 5: The corpus luteum forms from the follicle cells that remain in the ovary. It secretes the sex hormones estrogen and progesterone.



FSH stimulates the development of follicles in the ovary.

The LH surge triggers ovulation and then LH causes the transformation of the follicle cells remaining in the ovary into the corpus luteum.

Anterior pituitary gland

FSH

LH

Ovulation

1

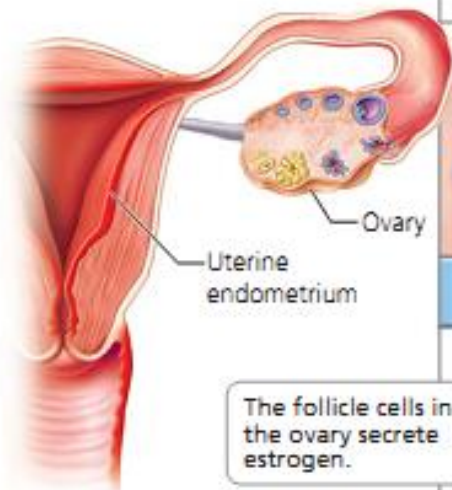
7

14

21

28 days

Blood levels of pituitary hormones



Follicular phase

Luteal phase

The corpus luteum in the ovary secretes estrogen and progesterone.

Ovarian cycle

The follicle cells in the ovary secrete estrogen.

Estrogen

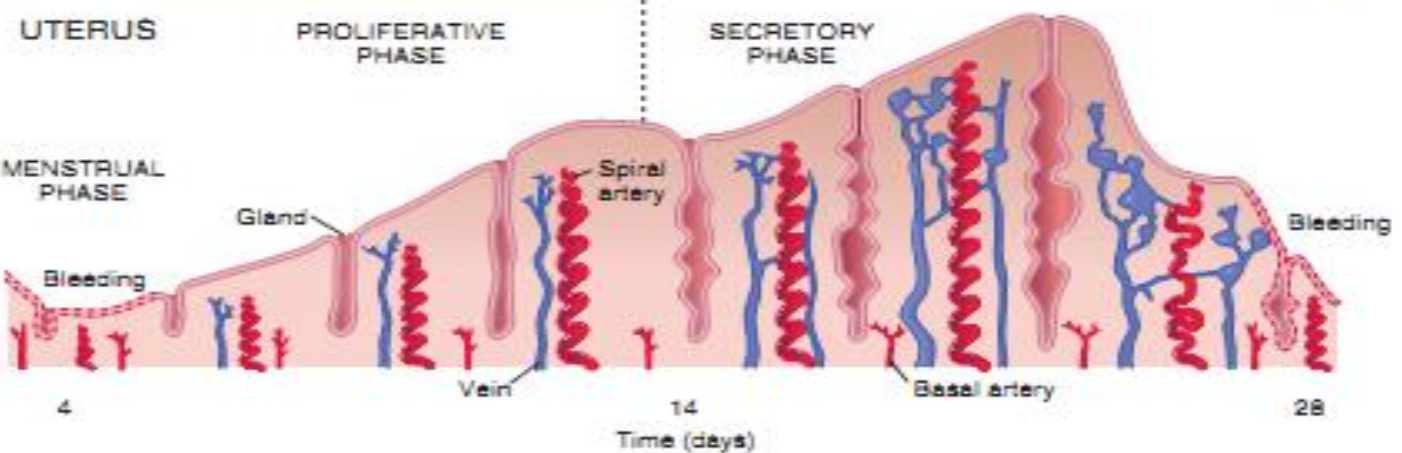
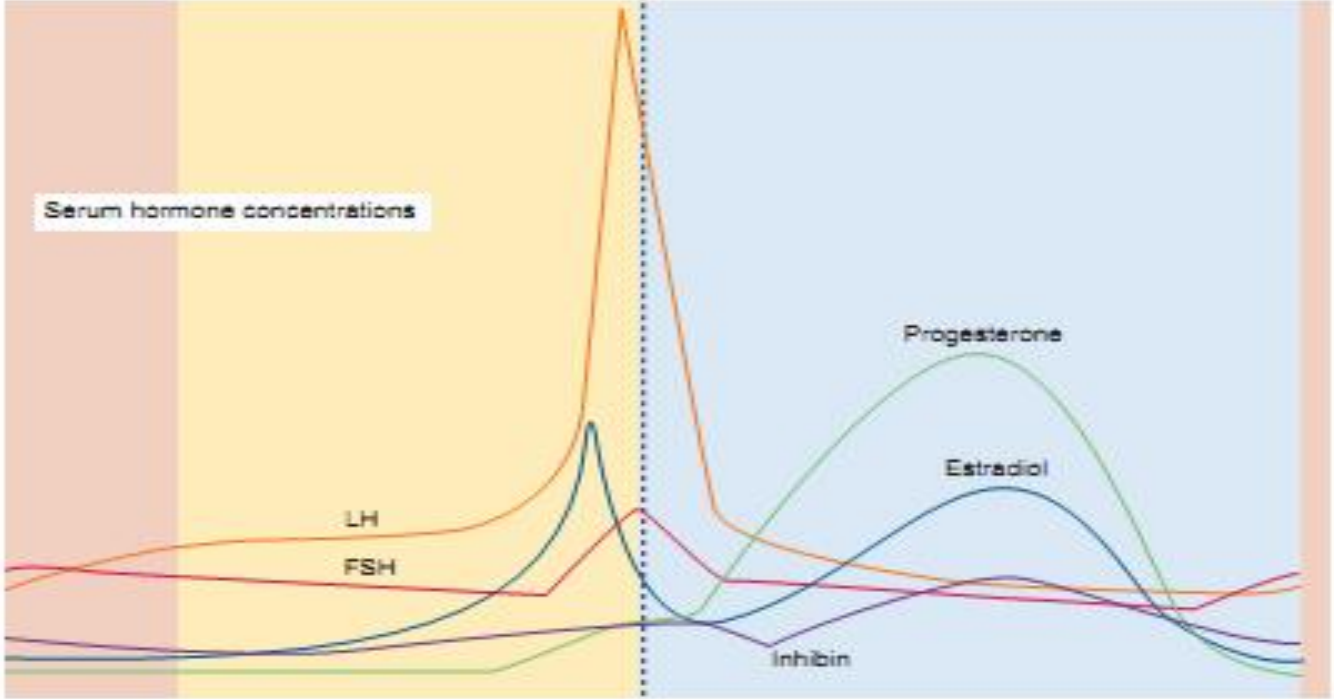
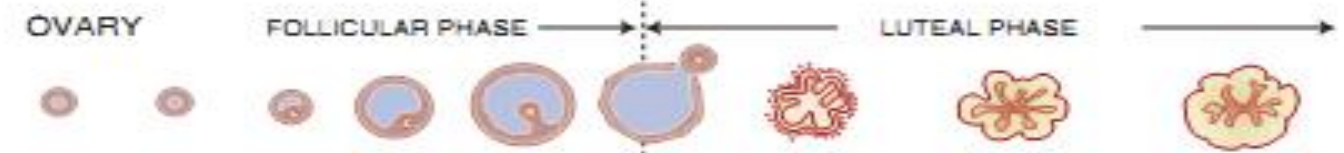
Progesterone

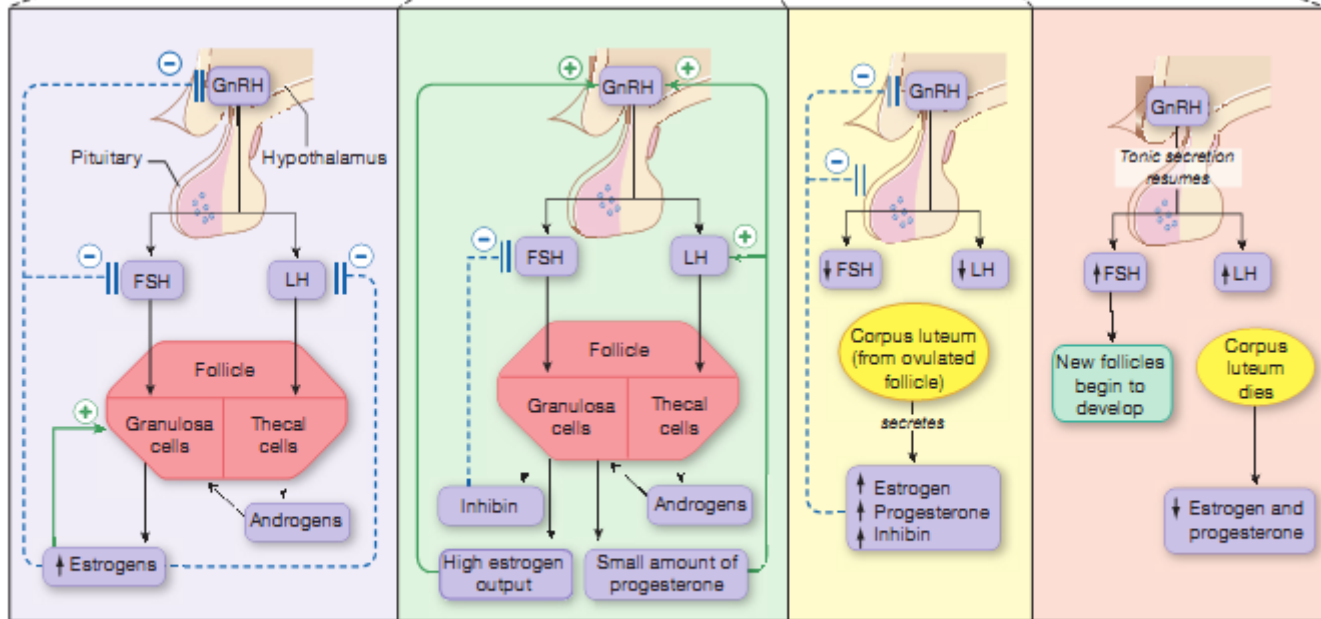
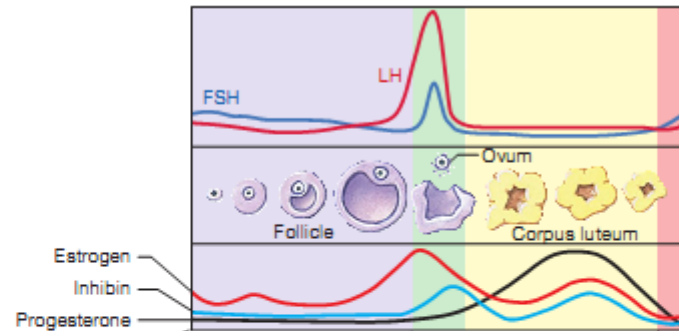
Blood levels of ovarian hormones

Estrogen and progesterone stimulate the development of the uterine lining (endometrium) in preparation for pregnancy.

Uterine cycle

DAY OF MENSTRUAL CYCLE
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28-0



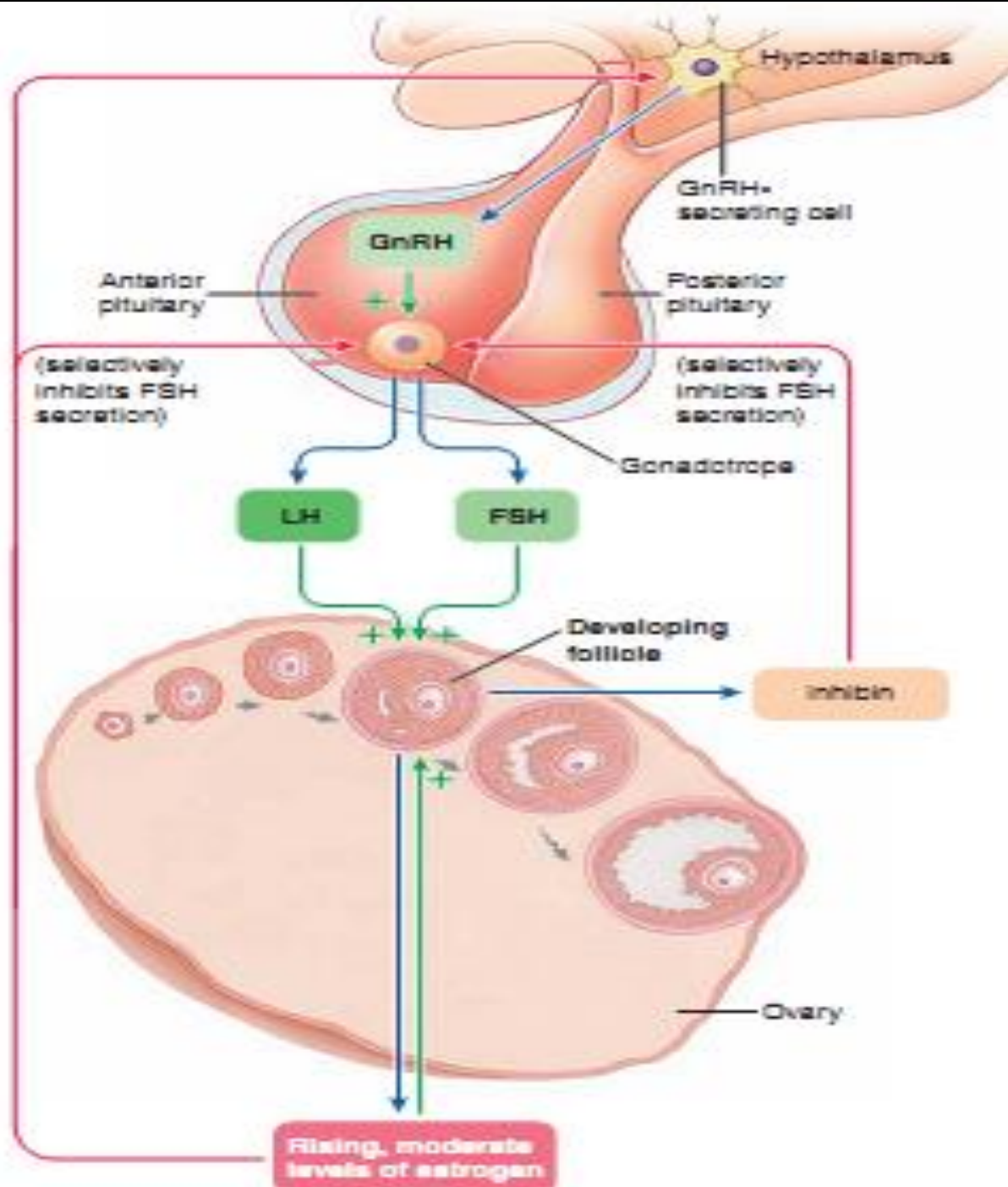


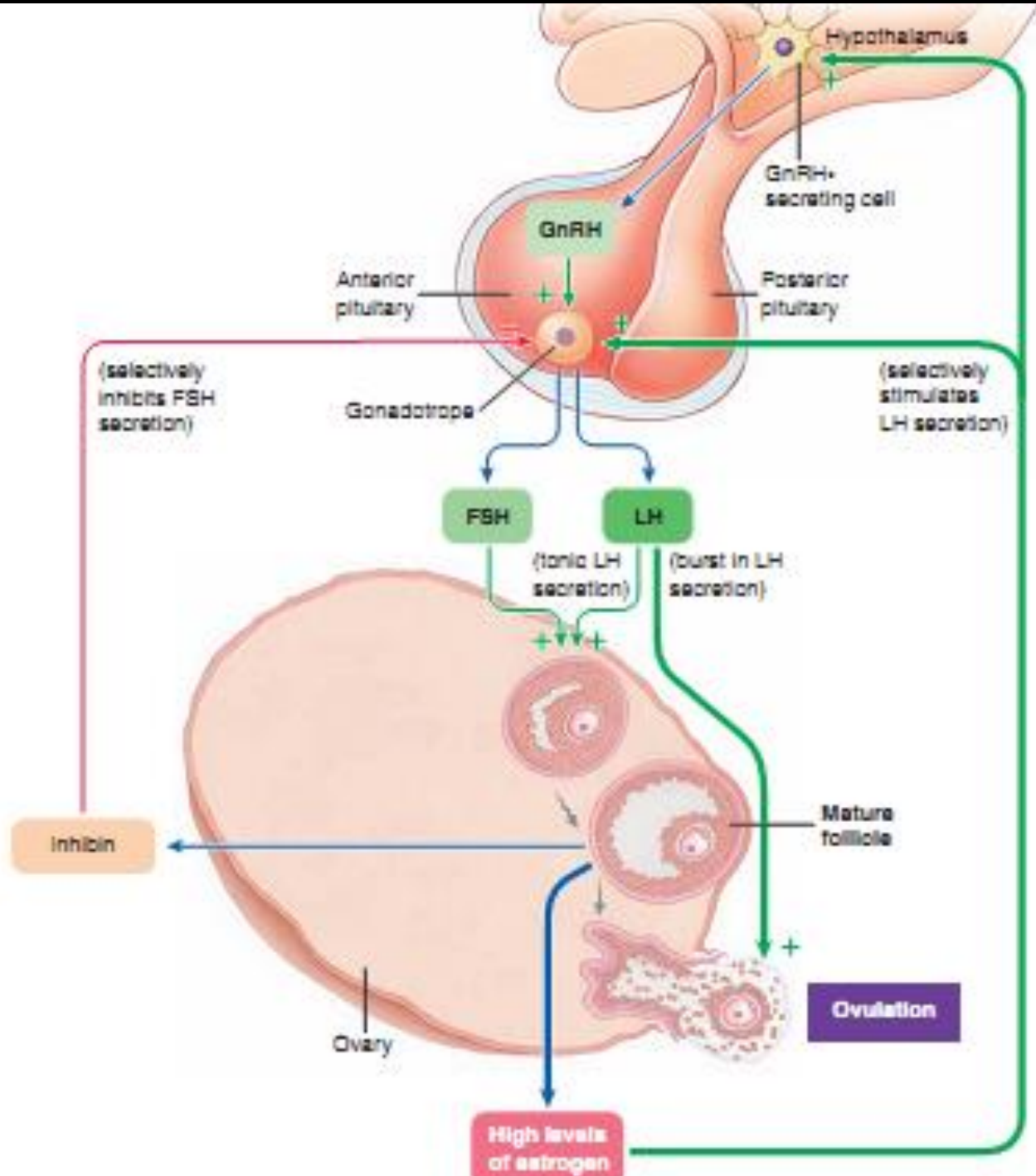
(a) Early to mid-follicular phase

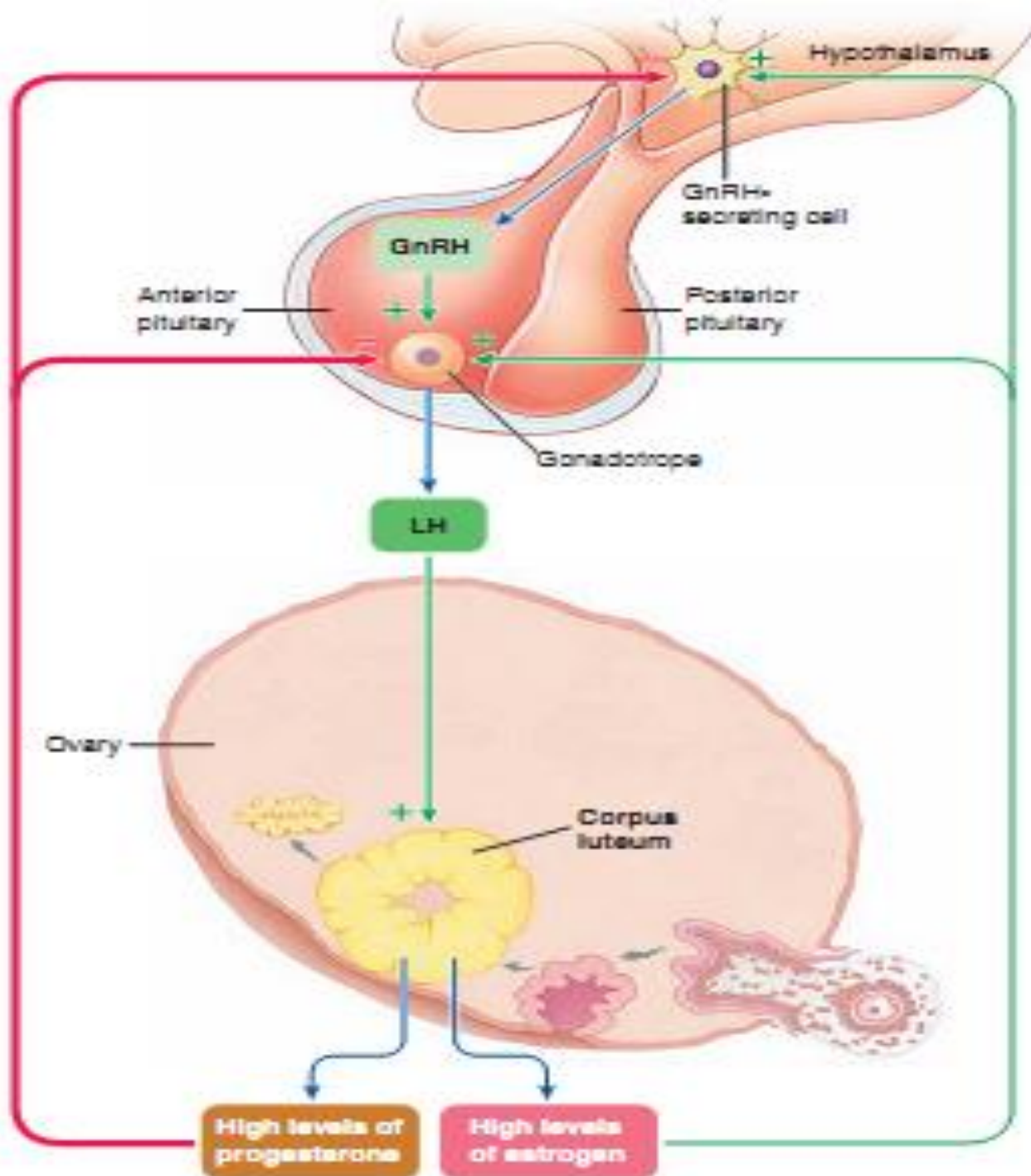
(b) Late follicular phase and ovulation

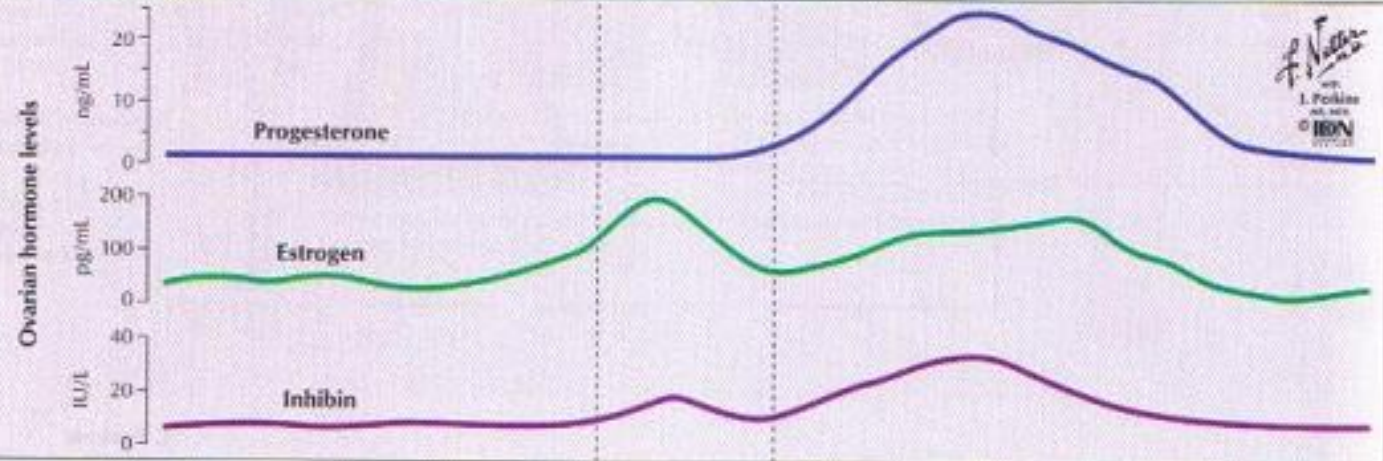
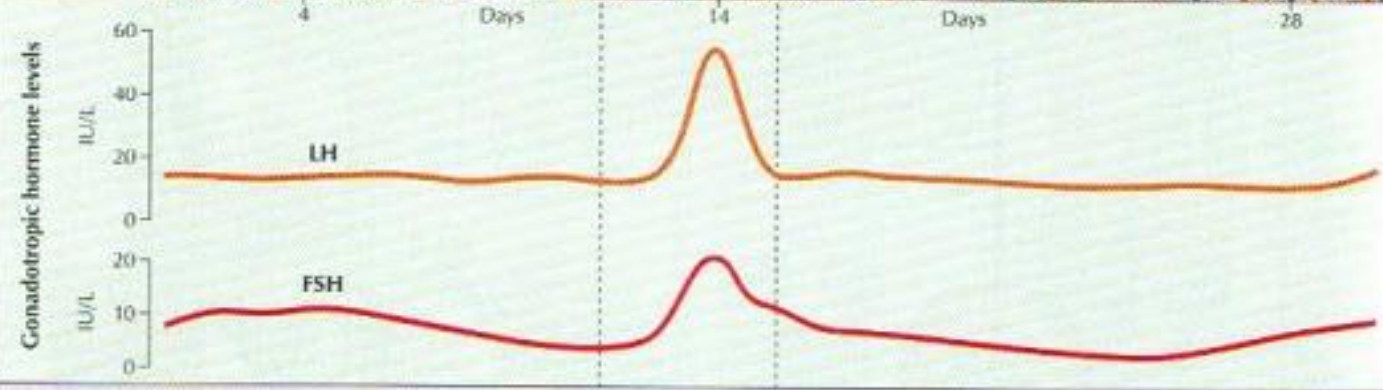
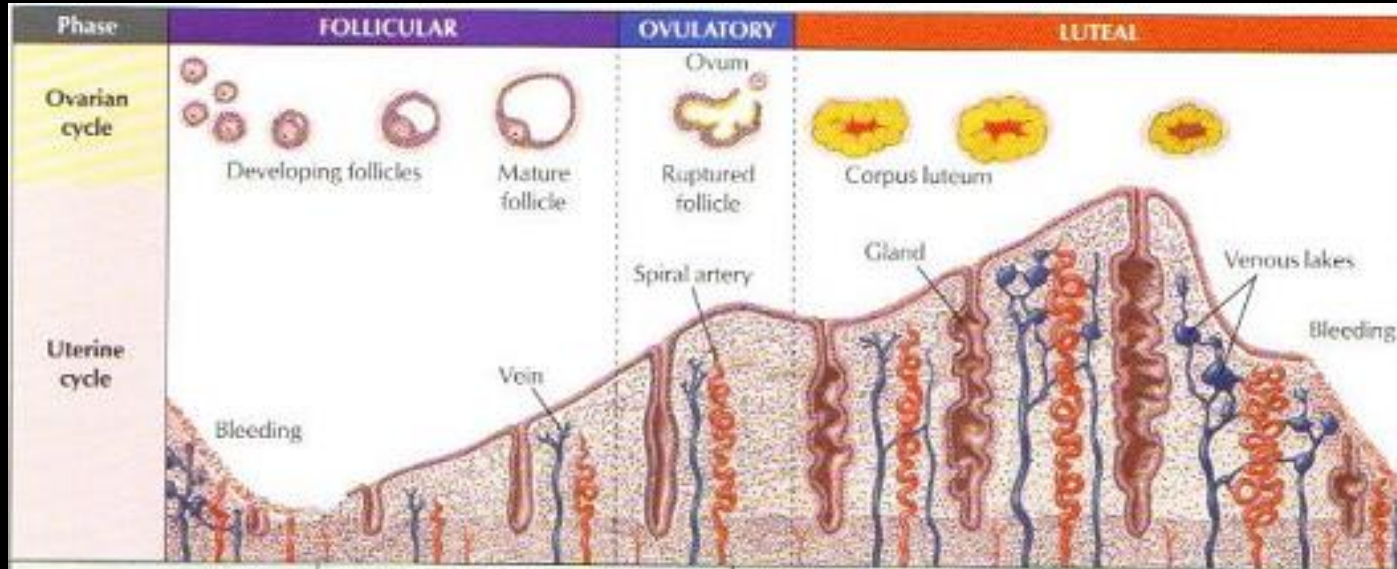
(c) Early to mid-luteal phase

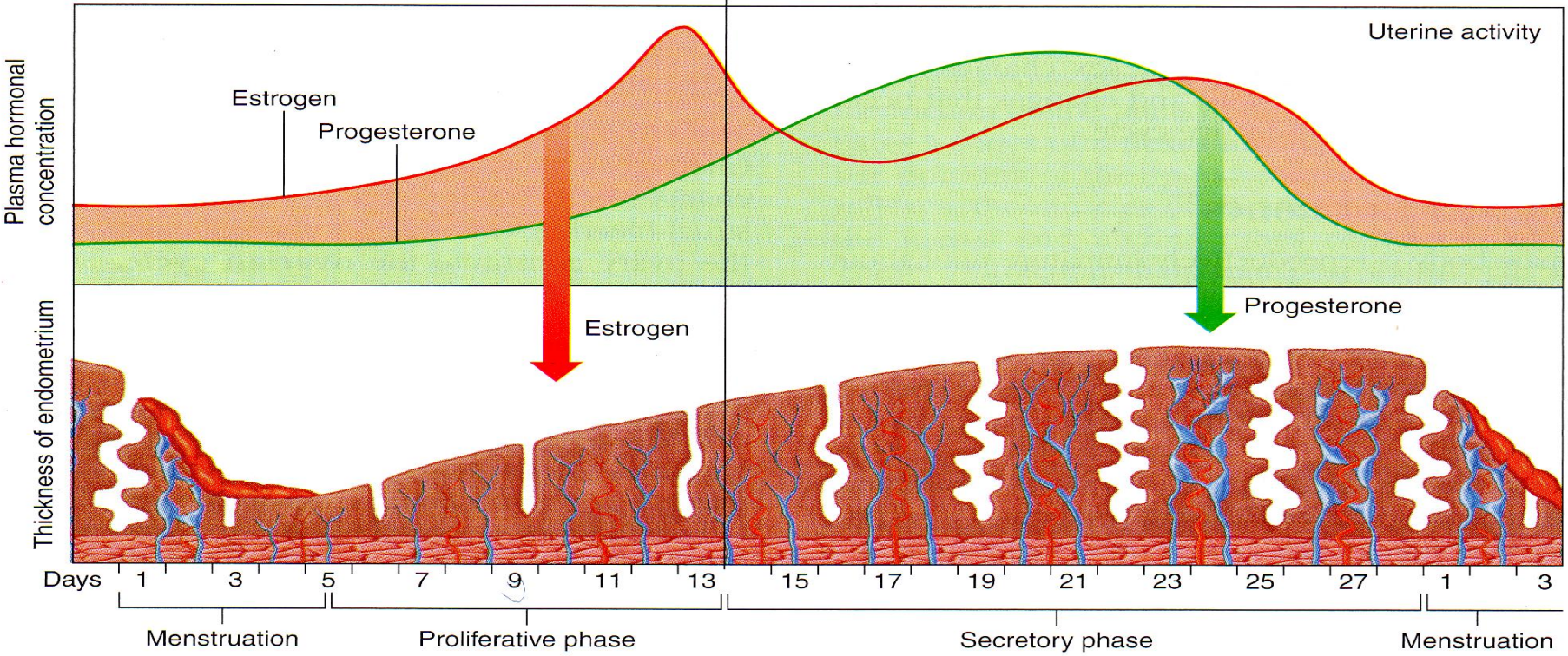
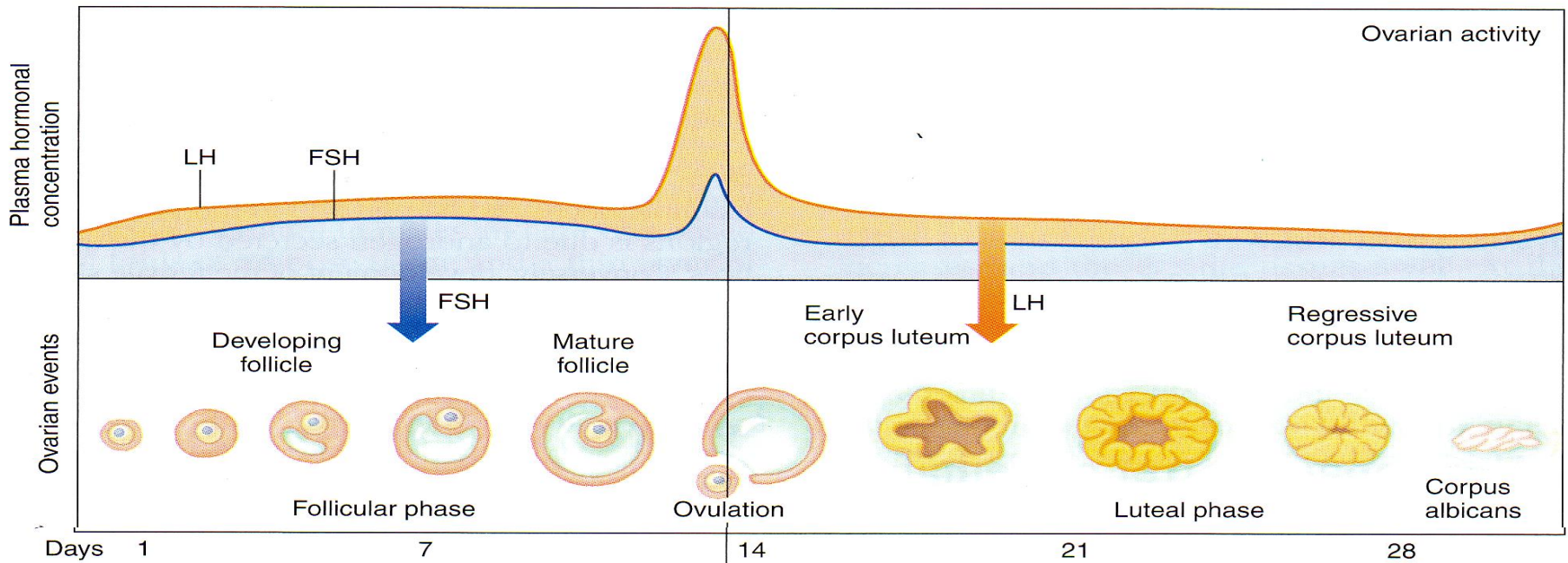
(d) Late luteal phase



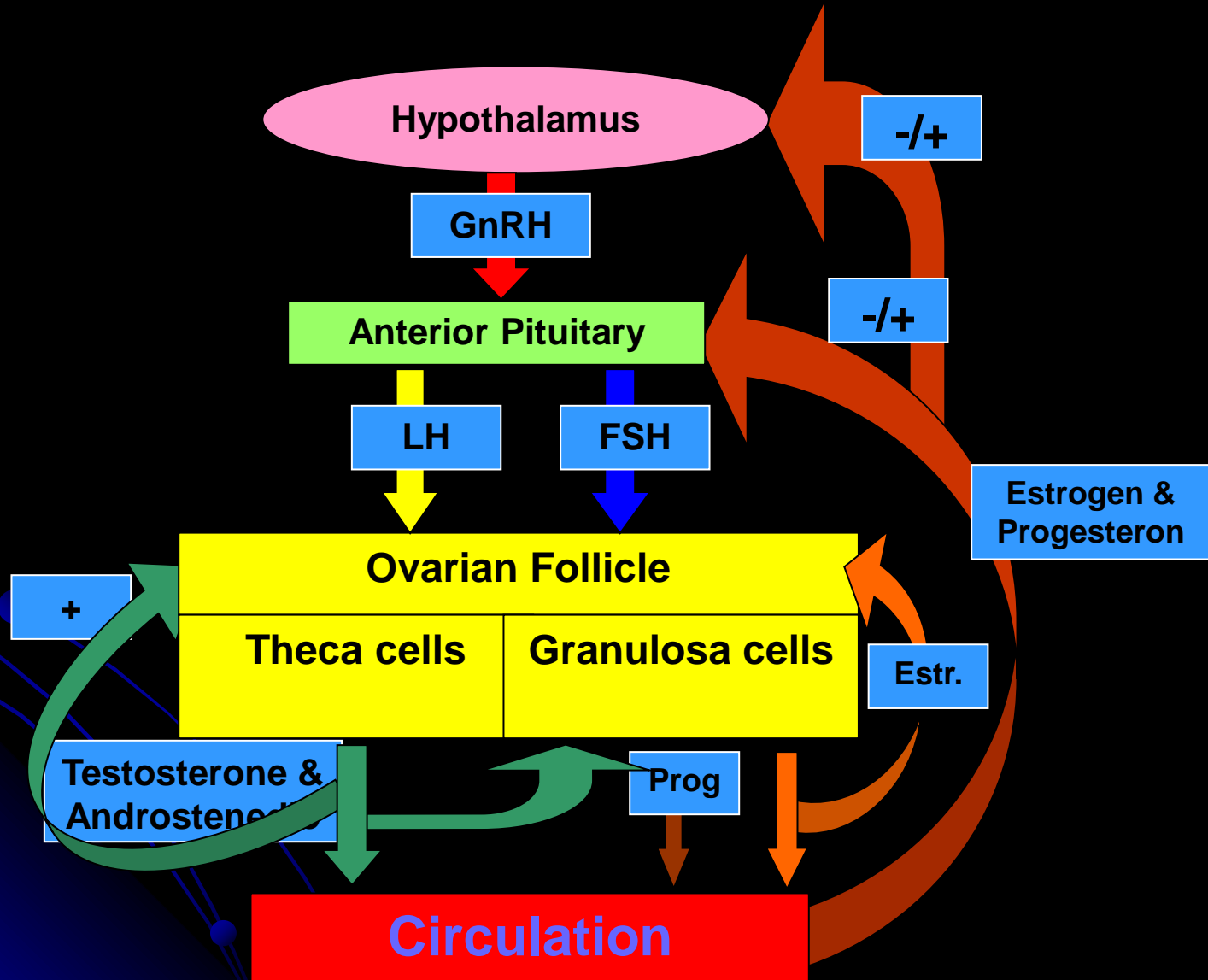


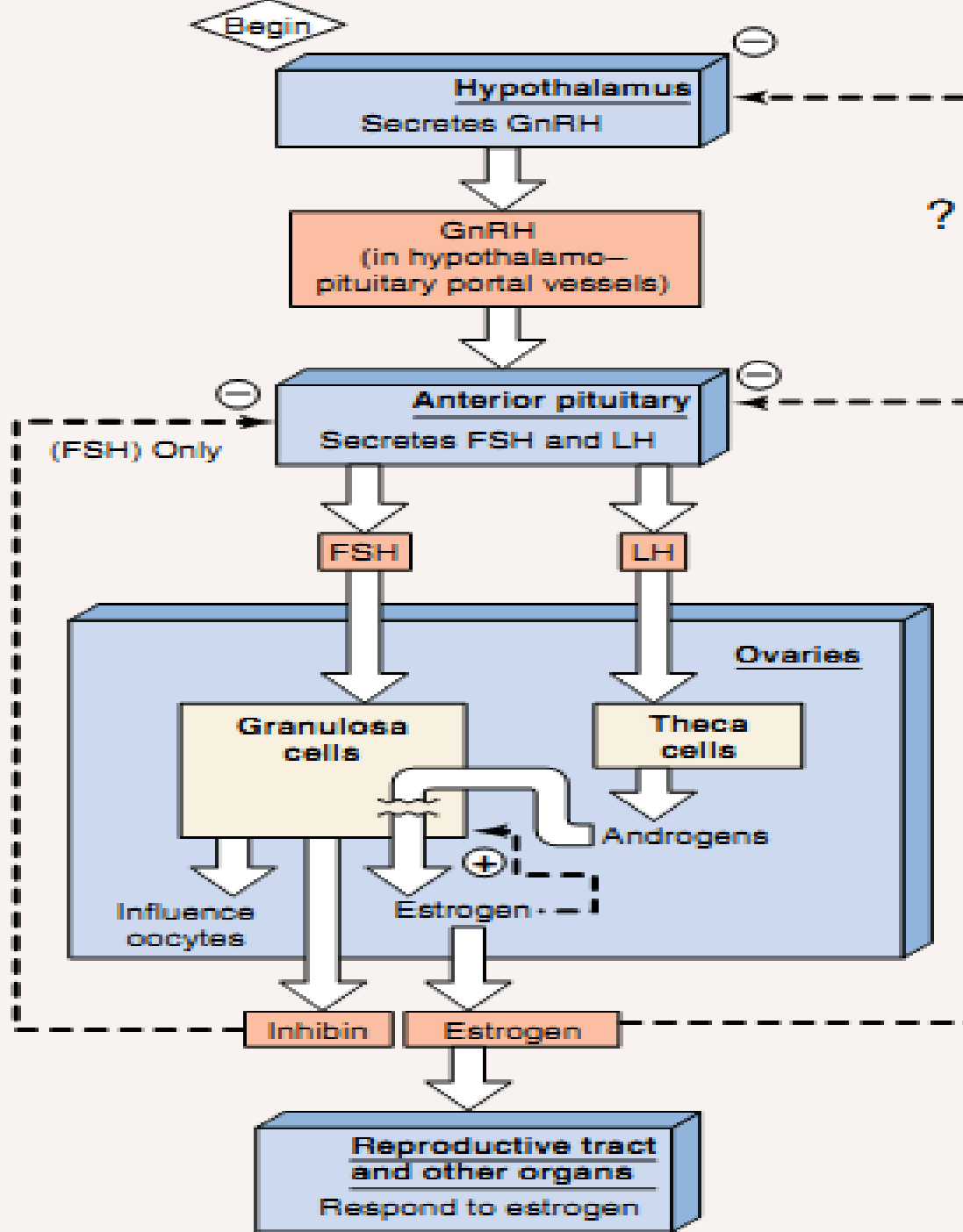


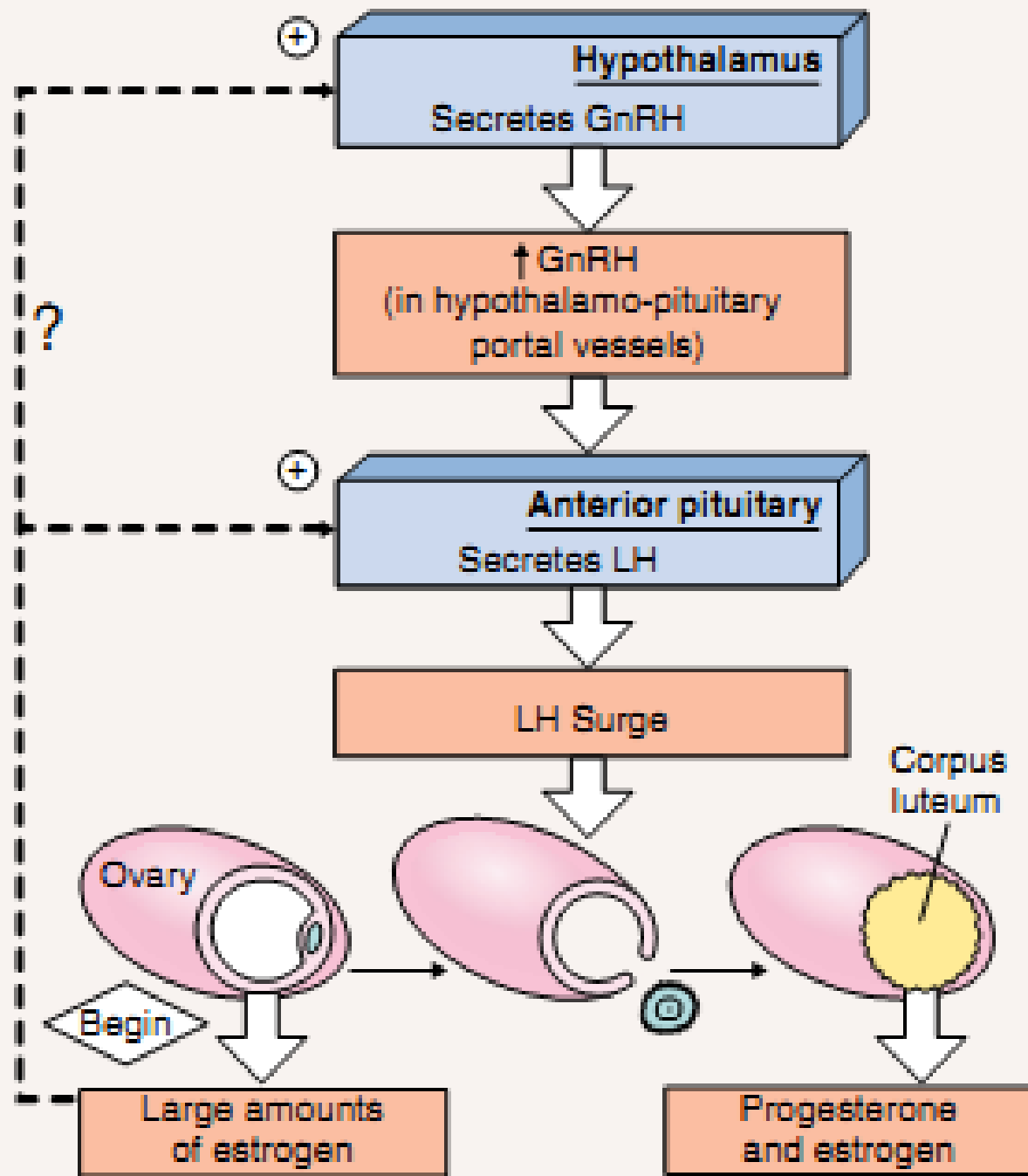




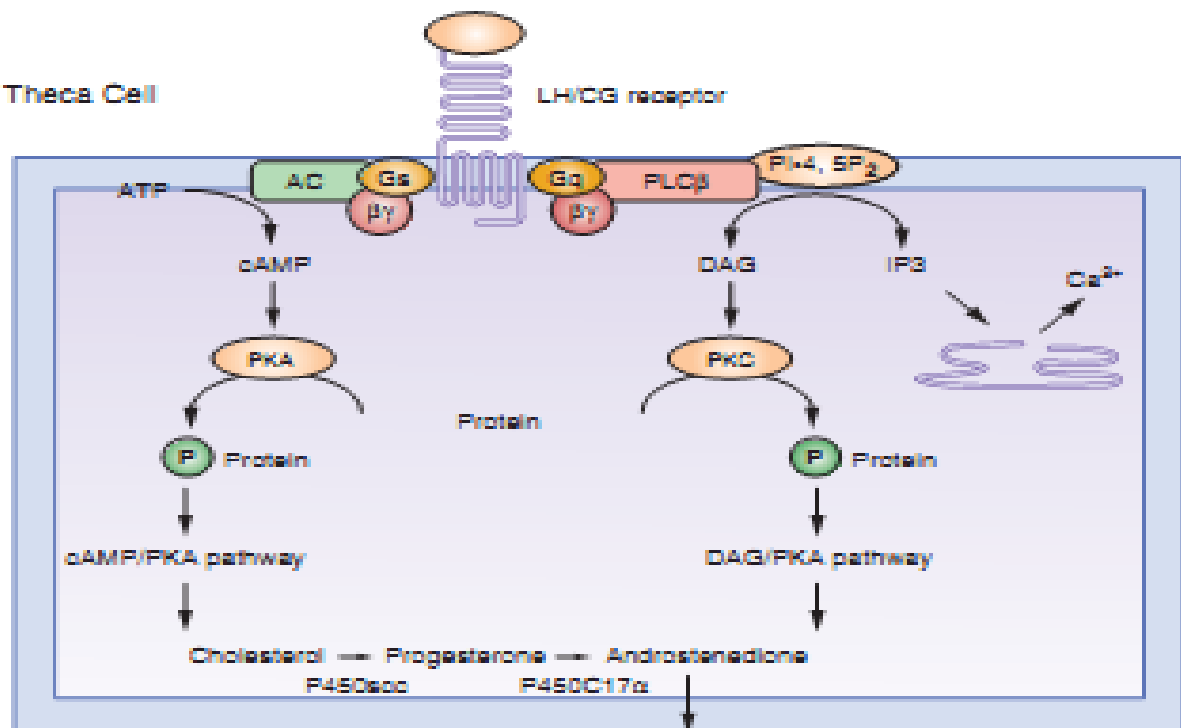
Neuro Endocrine Control





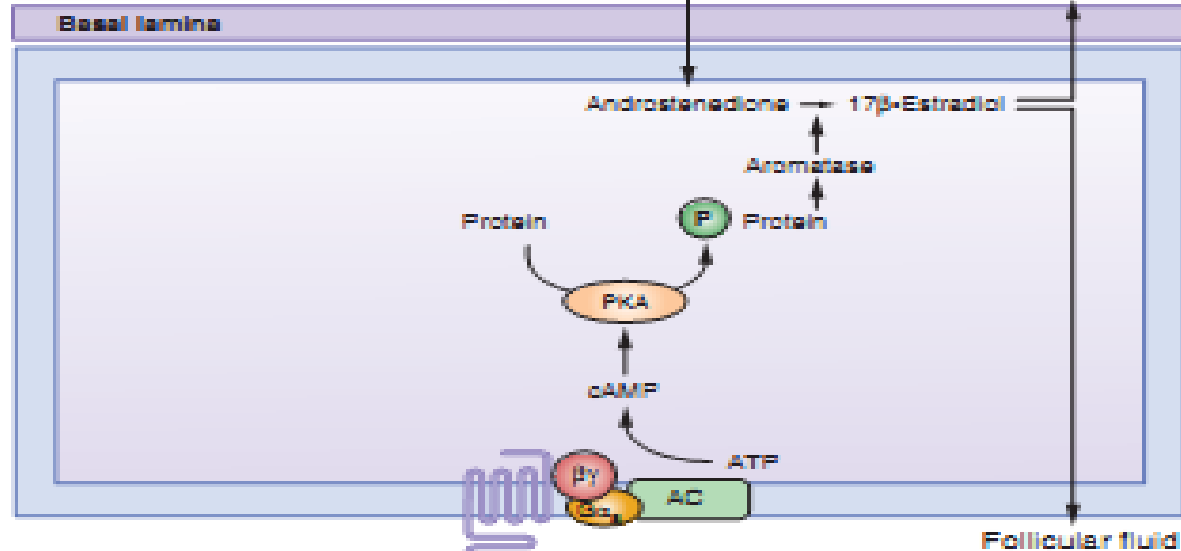


Theca Cell



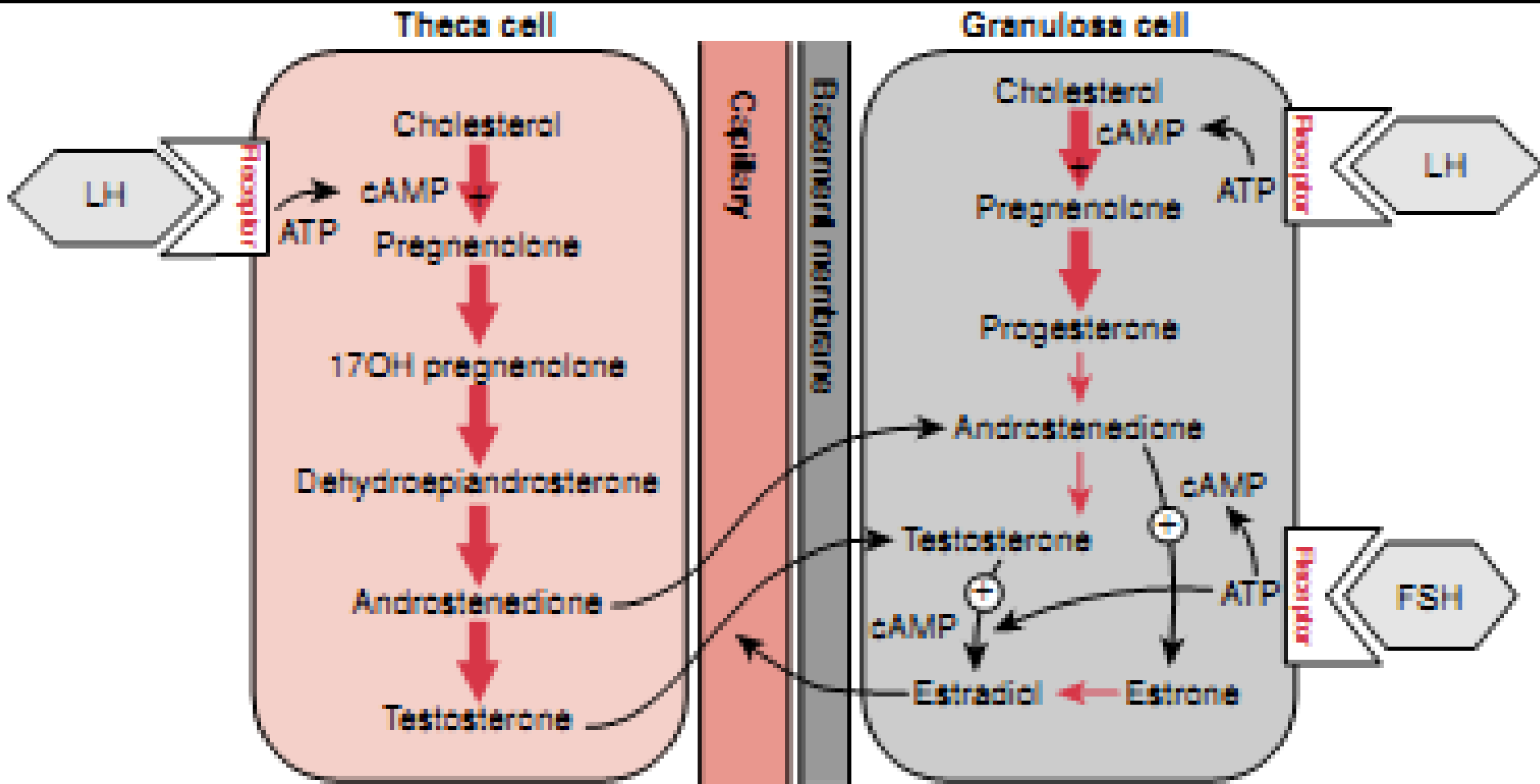
Androstenedione

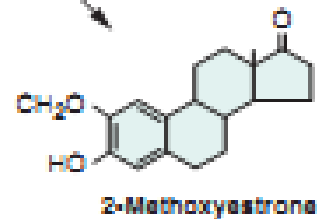
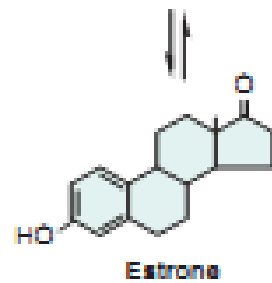
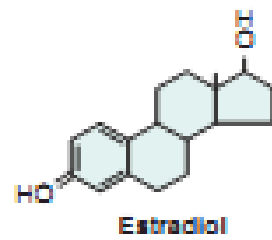
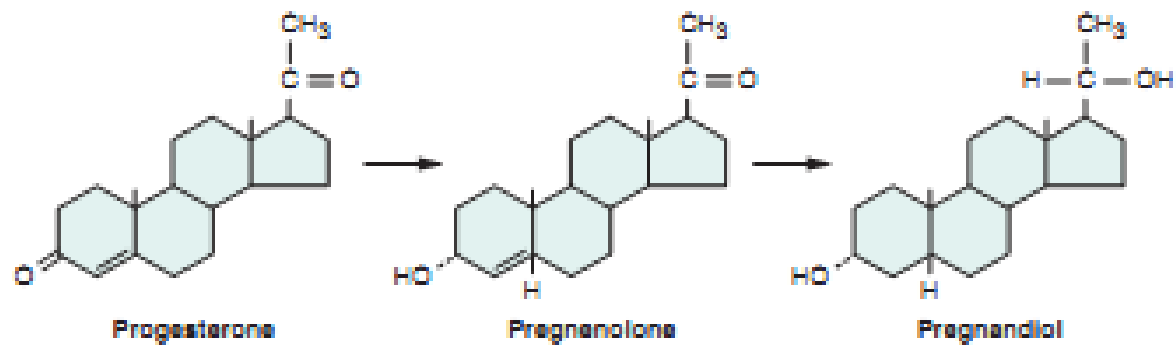
Systemic circulation

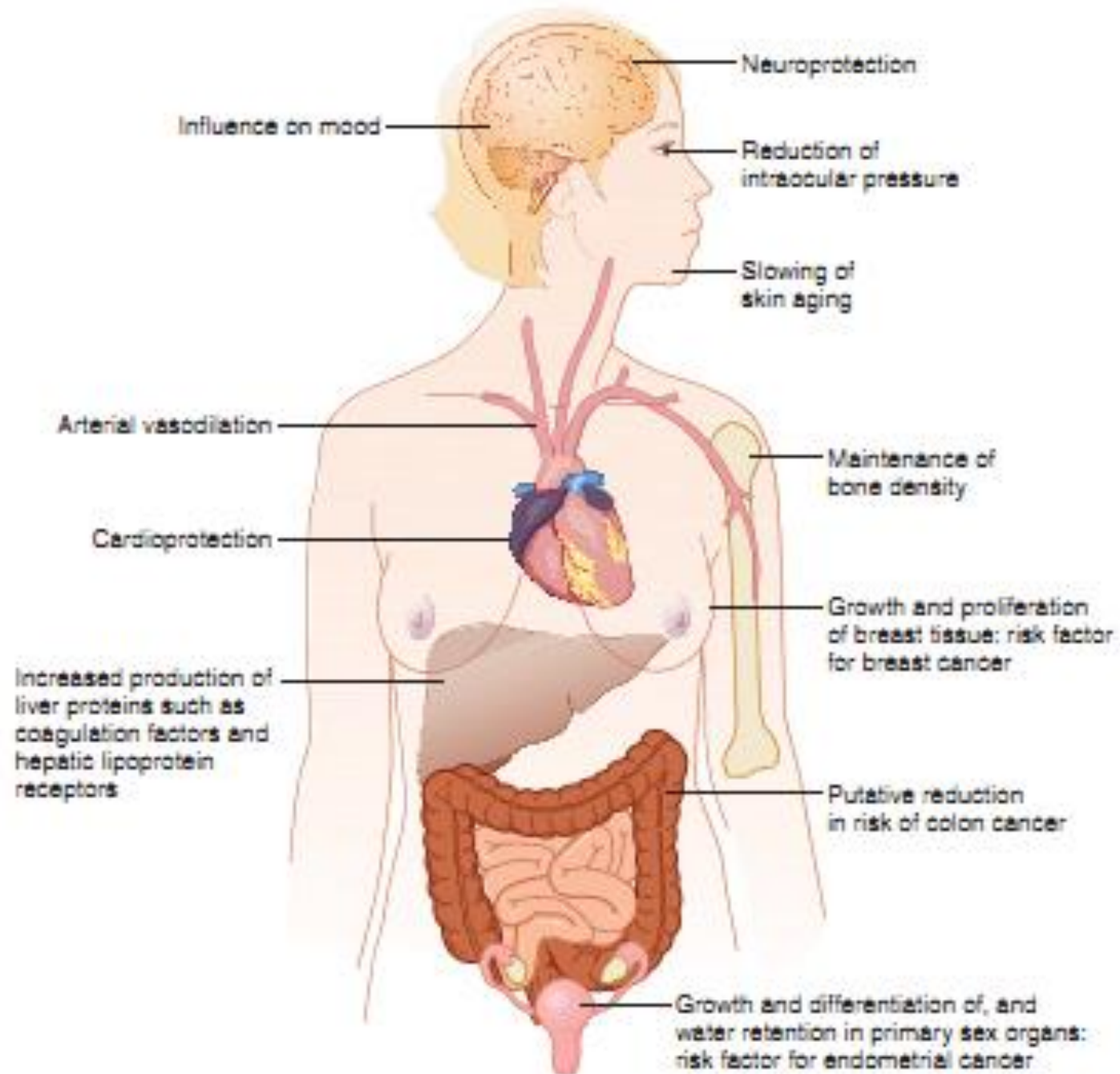


Granulosa Cell

FSH receptor







Estrogen


1. Stimulates growth of ovary and follicles.
2. Stimulates growth of smooth muscle and proliferation of epithelial linings of reproductive tract. In addition:
 - a. Uterine tubes: Increases contractions and ciliary activity.
 - b. Uterus: Increases myometrial contractions and responsiveness to oxytocin. Stimulates secretion of abundant, clear cervical mucus. Prepares endometrium for progesterone's actions by inducing progesterone receptors.
 - c. Vagina: Increases layering of epithelial cells.
3. Stimulates external genitalia growth.
4. Stimulates breast growth, particularly ducts and fat deposition.
5. Stimulates female body configuration development: narrow shoulders, broad hips, female fat distribution (deposition on hips, abdomen, and breasts).
6. Stimulates a more-fluid sebaceous gland secretion (this "antiacne" effect opposes the acne-producing effects of androgens).
7. Stimulates development of female pubic hair pattern (growth, as opposed to pattern, of pubic and axillary hair is androgen-stimulated).

8. Stimulates bone growth and ultimate cessation of bone growth (closure of epiphyseal plates); protects against osteoporosis; does not have an anabolic effect on skeletal muscle.
9. Vascular effects (deficiency produces "hot flashes").
10. Has feedback effects on hypothalamus and anterior pituitary (see Table 19-4).
11. Stimulates fluid retention by kidneys.
12. Stimulates prolactin secretion but inhibits prolactin's milk-inducing action on the breasts.
13. Protects against atherosclerosis by effects on plasma cholesterol (Chapter 18), blood vessels, and blood clotting (Chapter 14).
14. Exerts effects on brain neurons that may enhance learning and memory.

Progesterone

1. Converts the estrogen-primed endometrium to an actively secreting tissue suitable for implantation of an embryo.
2. Induces thick, sticky cervical mucus.
3. Decreases contractions of uterine tubes and myometrium.
4. Decreases proliferation of vaginal epithelial cells.
5. Stimulates breast growth, particularly glandular tissue.
6. Inhibits milk-inducing effects of prolactin.
7. Has feedback effects on hypothalamus and anterior pituitary (see Table 19–4).
8. Probably increases body temperature.

- Saat ovulasi perlu untuk menentukan masa subur (fertil) karena kehamilan terjadi sekitar saat ovulasi
- Ovulasi terjadi \pm 14 hari sebelum haid yang akan datang
- Menentukan saat ovulasi : hitung dari haid yang akan datang (karena stadium sekresi tetap sebaliknya stadium proliferasi berbeda panjangnya)

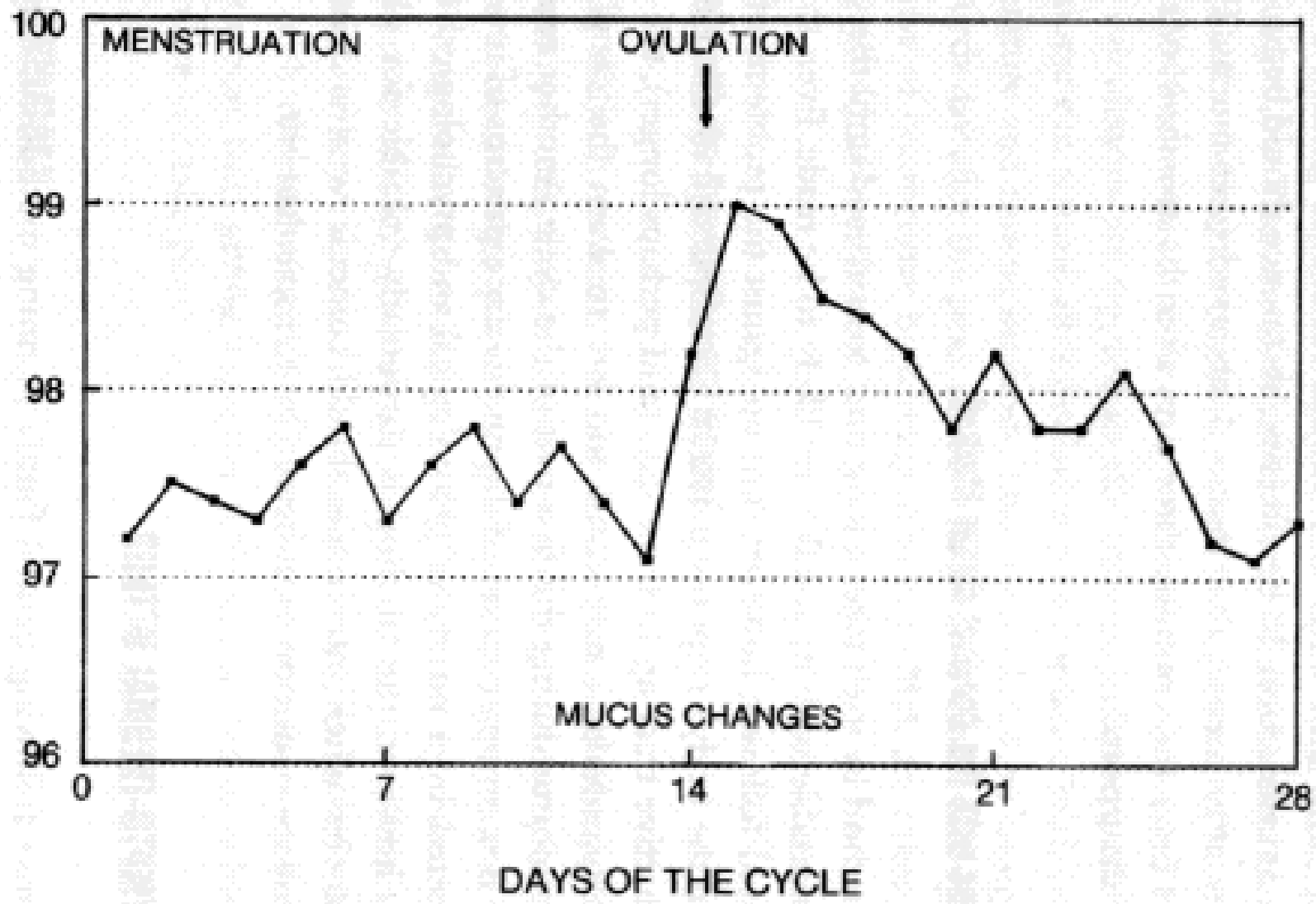
- Menentukan dengan **suhu basal** (temperatur yang diukur pagi hari sebelum bangun tidur per rektal) → suhu lebih rendah pada bagian pertama dari siklus dibanding dengan bagian kedua dari siklus (jadi pada saat ovulasi terjadi kenaikan suhu yang biasanya didahului oleh penurunan suhu)
- 

2. Basal body temperature (symptothermal) method



THE MENSTRUAL CYCLE AND OVULATION

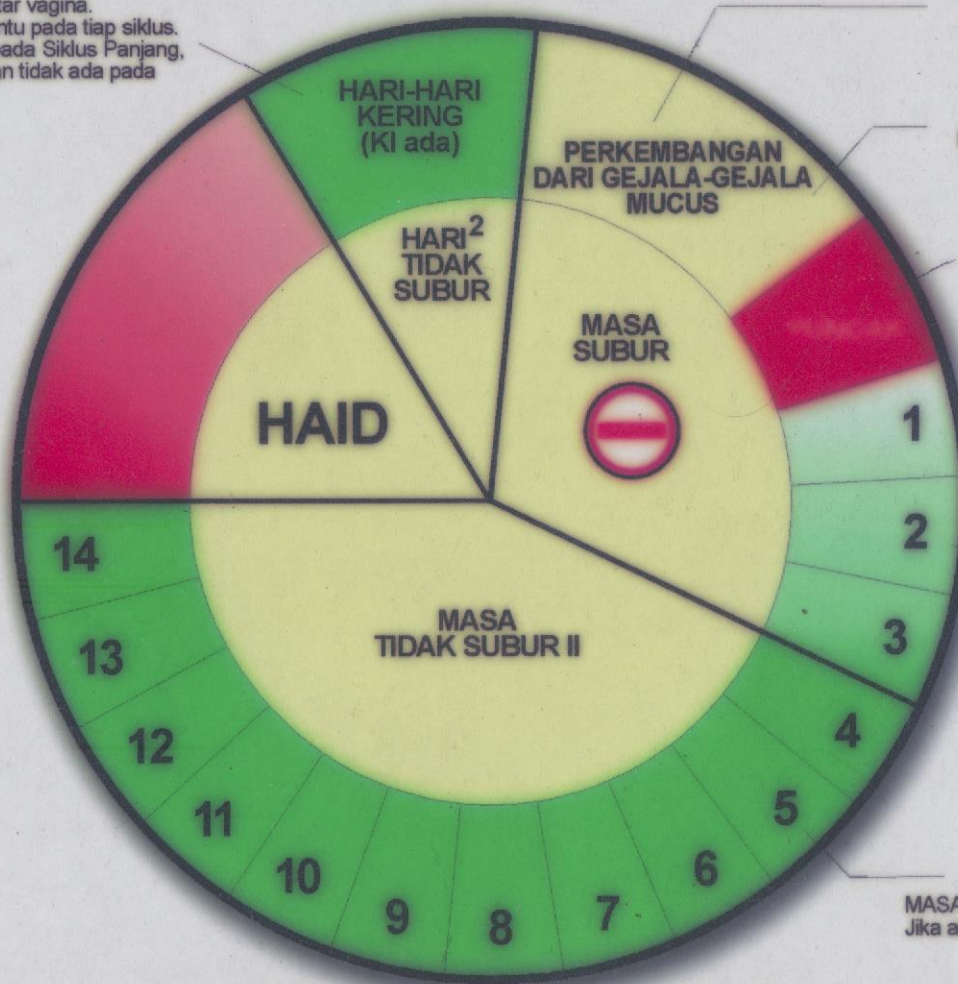
B
A
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Ovulation occurs about 14 days before the beginning of the next menstrual period. Chart shows a 28-day cycle.

METODE OVULASI (DR. J. BILLINGS)

Perasaan kering di sekitar vagina. Jumlah hari tidak menentu pada tiap siklus. Mungkin bisa panjang pada Siklus Panjang, atau bisa pendek/bahkan tidak ada pada Siklus Pendek.



Akhir dari perasaan kering, berarti telah mulai keluar *mucus*. Jika tak terjadi hari kering sesudah haid, berarti sudah mulai dengan Hari *Mucus*.

Mucus memperpanjang hidup sperma. Konsepsi bisa terjadi pada setiap hubungan suami-isteri pada hari-hari *mucus* yang mendekati ovulasi.

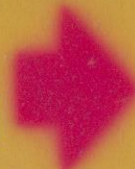
Sifat *mucus* jernih, licin seperti putih telur mentah, terjadi 1-2 hari pada puncak gejala, menimbulkan perasaan licin. Hari akhir dari perasaan tersebut ditandai dengan "PUNCAK". PUNCAK diikuti dengan OVULASI.

Hari ke 1, 2 dan 3 sesudah PUNCAK adalah HARI SUBUR.

Panjang waktu antara PUNCAK s/d. hari haid berikutnya adalah 14 (empatbelas) hari. MASA TAK SUBUR II dimulai hari ke-4 setelah PUNCAK. Jika ada *mucus* yang keluar, maka warnanya akan keruh.

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CARA ALAMIAH UNTUK MENGATUR KEHAMILAN



■ TIDAK BERBAHAYA
■ DAPAT DIPERCAYA

■ BERMORAL
■ TANPA OBAT-OBATAN



Pada hari-hari setelah haid, seorang wanita biasanya mengalami hari-hari kering (tidak ada lendir) dan hari-hari dengan lendir. Adanya lendir menunjukkan mulainya kesuburan. Jumlahnya sedikit, warnanya kekuning-kuningan dan lekat-lekat.



2. Hari demi hari lendir berkembang.

- Lebih banyak
- Kental
- Agak keruh
- Mulai sedikit mulur.



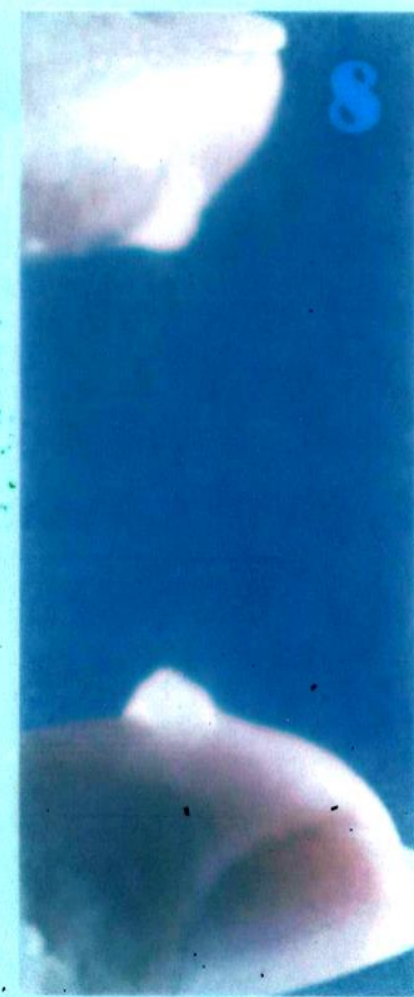
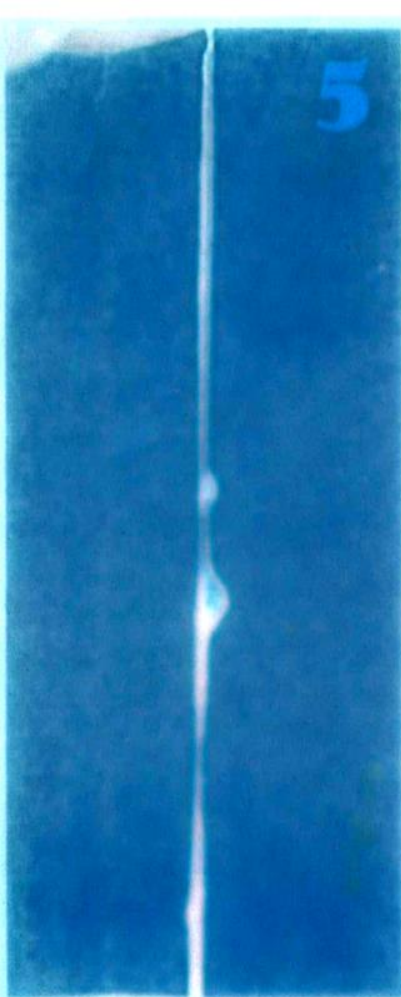
3. Bila direntangkan di antara dua jari, lendir:

- Tampak berserabut
- Kental, agak jernih
- Mulur.



4. Lendir lebih berkembang.

- Jernih
- Mulur
- Mulai terasa basah.



5. Lendir paling berkembang:

- Jernih
- Sangat mulur, licin
- Perasaan paling basah.

Ini menunjukkan gejala puncak. (Lendir paling subur).

Ingat setelah gejala puncak, berpantang 3 hari 3 malam. Malam ke 4 baru aman.

6. Setelah puncak, lendir kembali berubah menjadi:

- Sedikit lebih keruh
- Kental
- Mulur mulai berkurang,

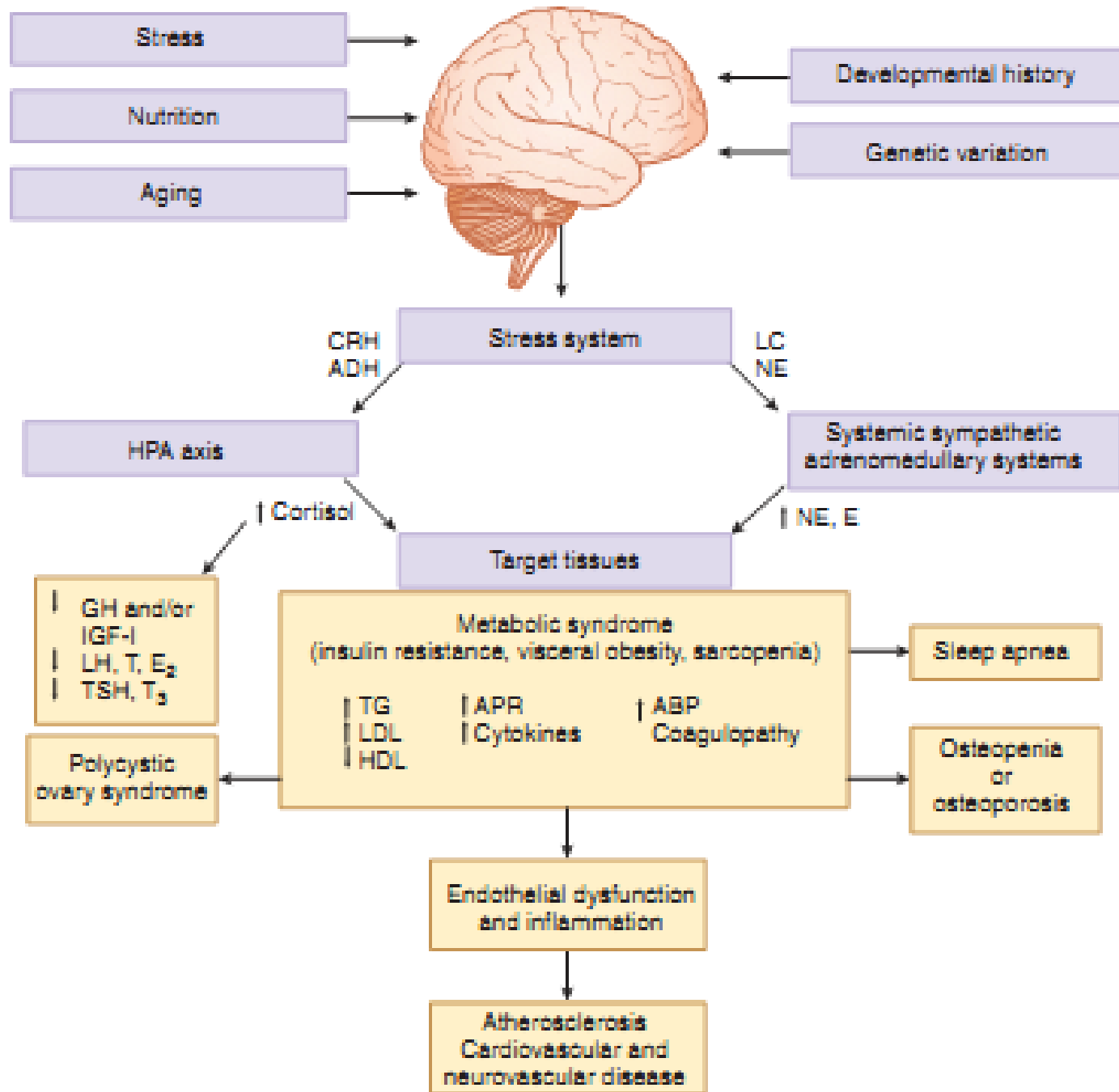
7. Lendir menjadi:

- Keruh
- Kental
- Mulur berkurang.

8. Kemudian lendir menjadi lebih kental, kering dan tidak mulur, kadang-kadang kering sama sekali (tidak ada lendir).

MENOPAUSE & ANDROPAUSE





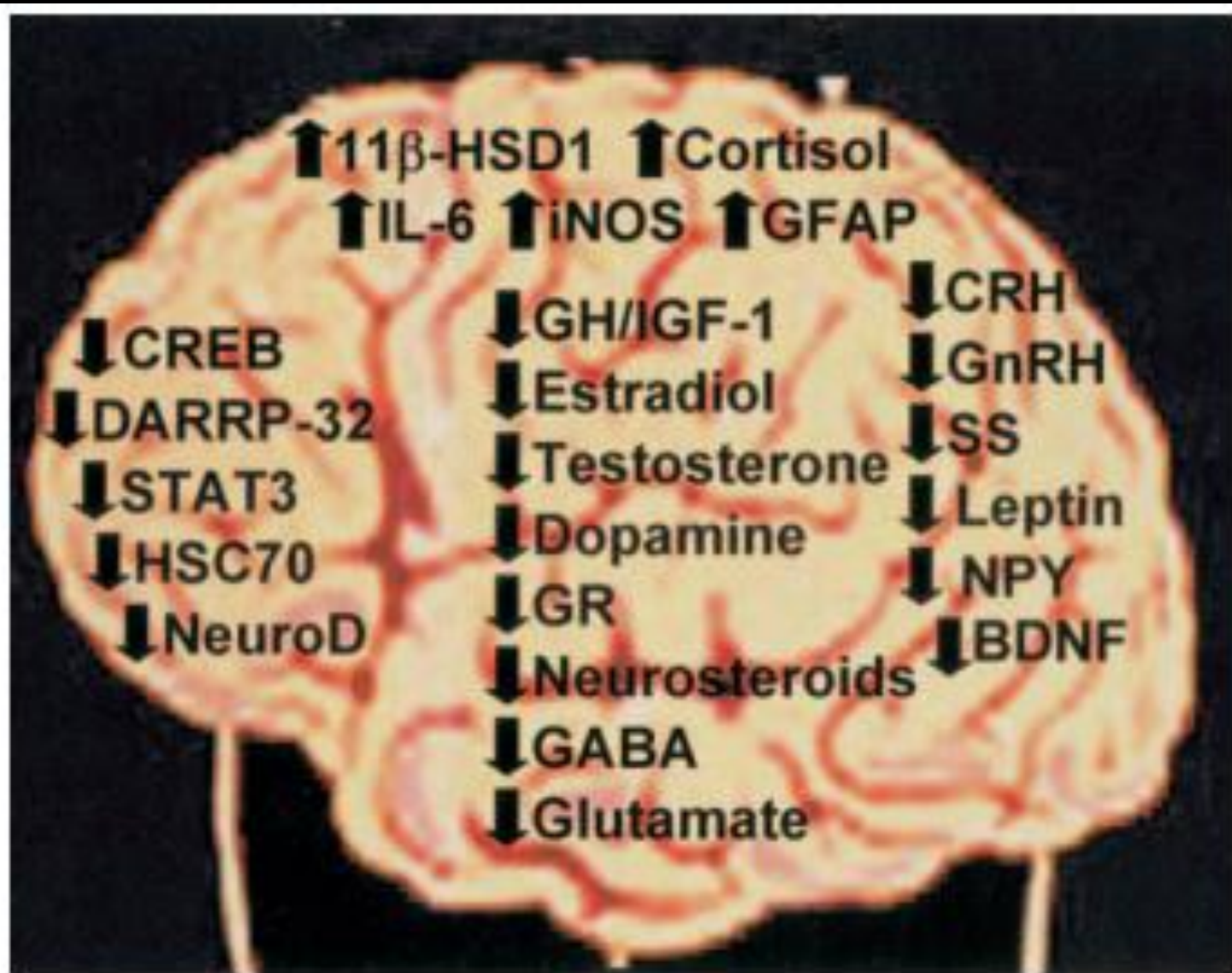
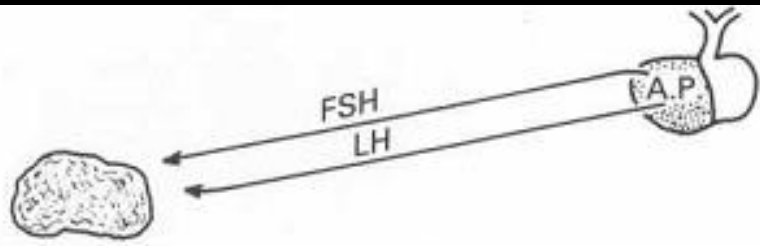


FIG. 12. Summary of the significant age-related changes that have been measured in the CNS: 11 β -HSD1, BDNF, CREB, CRH, dopamine and DARPP-32, GABA, glial fibrillary acidic protein (GFAP), GH/IGF-I, GnRH, GR, HSC70, IL-6, iNOS, NPY, somatostatin (SS), and signal transducer and activator of transcription 3 (STAT3).



Ovarian cycle ————— becomes irregular and finally ceases → Ovary becomes small and fibrosed and no longer produces ripe ova.

OESTROGEN and *PROGESTERONE* levels in blood stream fall.

TISSUES of the body ————— begin to show changes which mark the end of **reproductive life**.



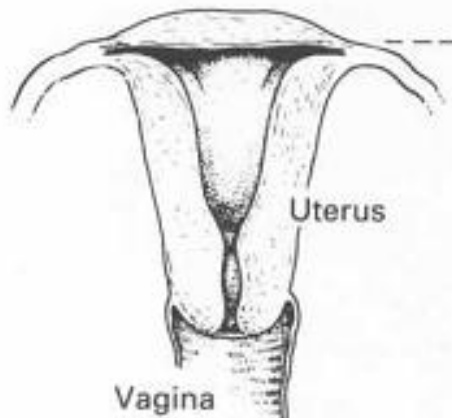
Atrophy

Sometimes final redistribution of fat → less typically feminine distribution.

Regression of secondary sex characteristics.

Breasts shrink.
Hair becomes sparse in axillae and pubis.

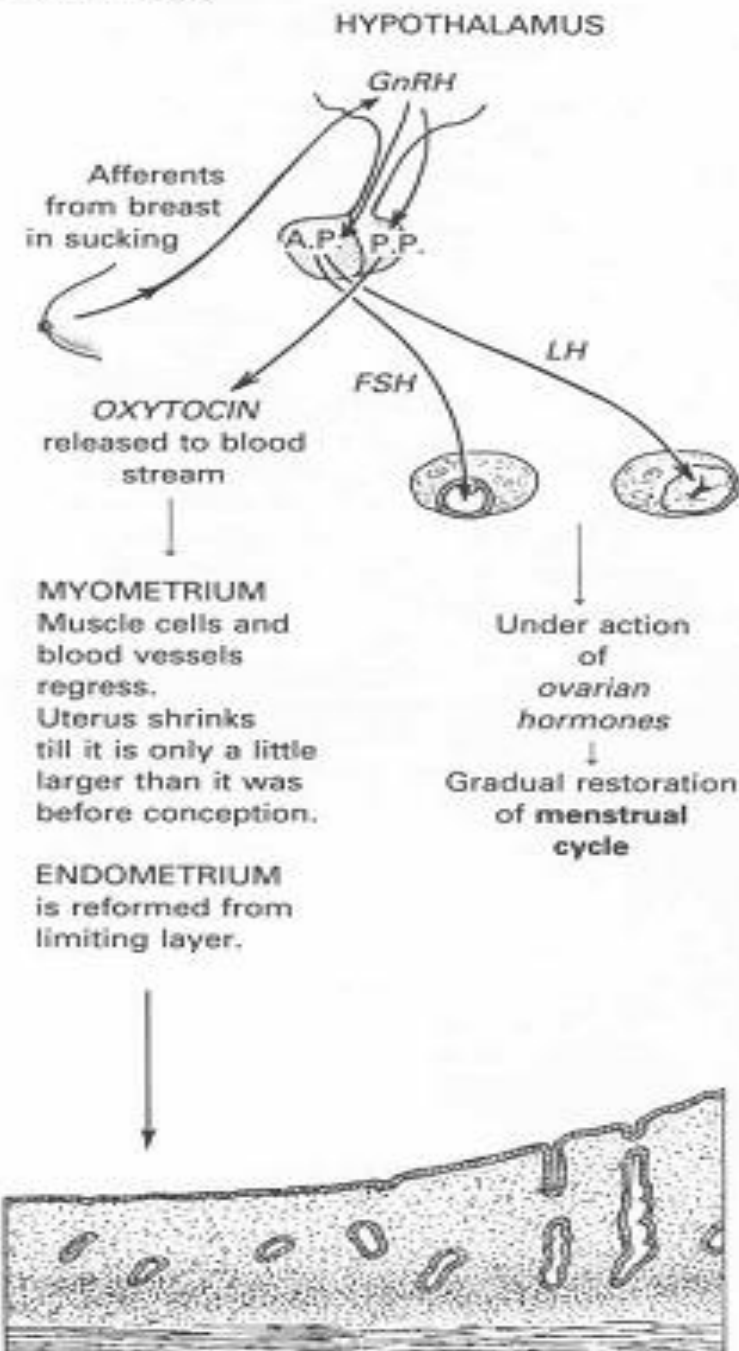
Accessory sex organs atrophy.



Fallopian tubes shrink.
Uterine cycle and menstruation cease. (Muscle and lining shrink).
Vaginal epithelium becomes thin and loses its secretions.
External genitalia shrink.

Psychological and personality changes
Sexual drive is frequently not diminished – may be increased. Irritability and anxiety attacks may occur accompanied by 'hot flushes' (vasodilatation

INVOLUTION

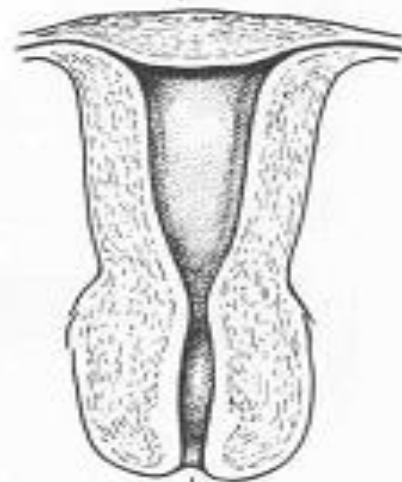


AFTER MENOPAUSE

Ovarian tissue ceases to be responsive to *anterior pituitary gonadotrophins*

↓
Fall in production of *oestrogen* and *progesterone* (accompanied by rise in *LH* and *FSH* due to absence of feedback inhibition of these hormones)

↓
Shrinkage of MYOMETRIUM



↓
Atrophy and shrinkage of glands and stroma of ENDOMETRIUM

↓
Cessation of menstrual cycle

? MENOPAUSE

- Akhir episoda perdarahan haid ♀
- Dasar : ↓nya fungsi siklik ovarium
- Akhir masa reproduktif ♀



Kapan terjadi ?

■ ♀ usia 48 – 55 tahun (rerata : 51 thn)

Konstan dari jaman ke jaman

■ Tidak dipengaruhi :

☞ umur menarche

☞ status perkawinan

☞ sosek

☞ paritas

☞ ras

■ Lebih awal pada : - smokers

- under-nutritional

■ Diperantarai periode klimakterium

masa reproduktif → postmenopause

Klimakterium

- Panjang siklus menstruasi ber< : berkaitan dengan memendeknya fase luteal
- Kadar FSH sec. bertahap ↑ ok :
 - Deplesi folikel ovarium
 - ↓
 - Hilangnya produksi **Estradiol** dan **Inhibin-B**
 - ↓
 - ↓ Estrogen dan Inhibin negative feedback
- Pe↓an sejumlah antral folikel dengan ber+nya usia :
“**ovarian aging**”

Perubahan Status Hormonal

■ Ditandai dengan :

1. Kadar estrogen & progesteron ↓
2. Kadar FSH & LH ↑

■ Karena : ➔ ber<nya jumlah folikel selama masa reproduksi

➔ menopause : < 100

2 Dampak Fisiologis

1). Peran estrogen extraglandular > dominan

☺ kadar estrone plasma ↑

☺ jar. lemak : kemampuan >>

2). Risiko penyakit akibat defisiensi estrogen ↑

★ osteoporosis

★ CVD

Dampak lain: ➤ hotflushes

➤ perub emosi

➤ sakit kepala

➤ daya ingat <

➤ bone-loss ↑

➤ rugae vagina (-)

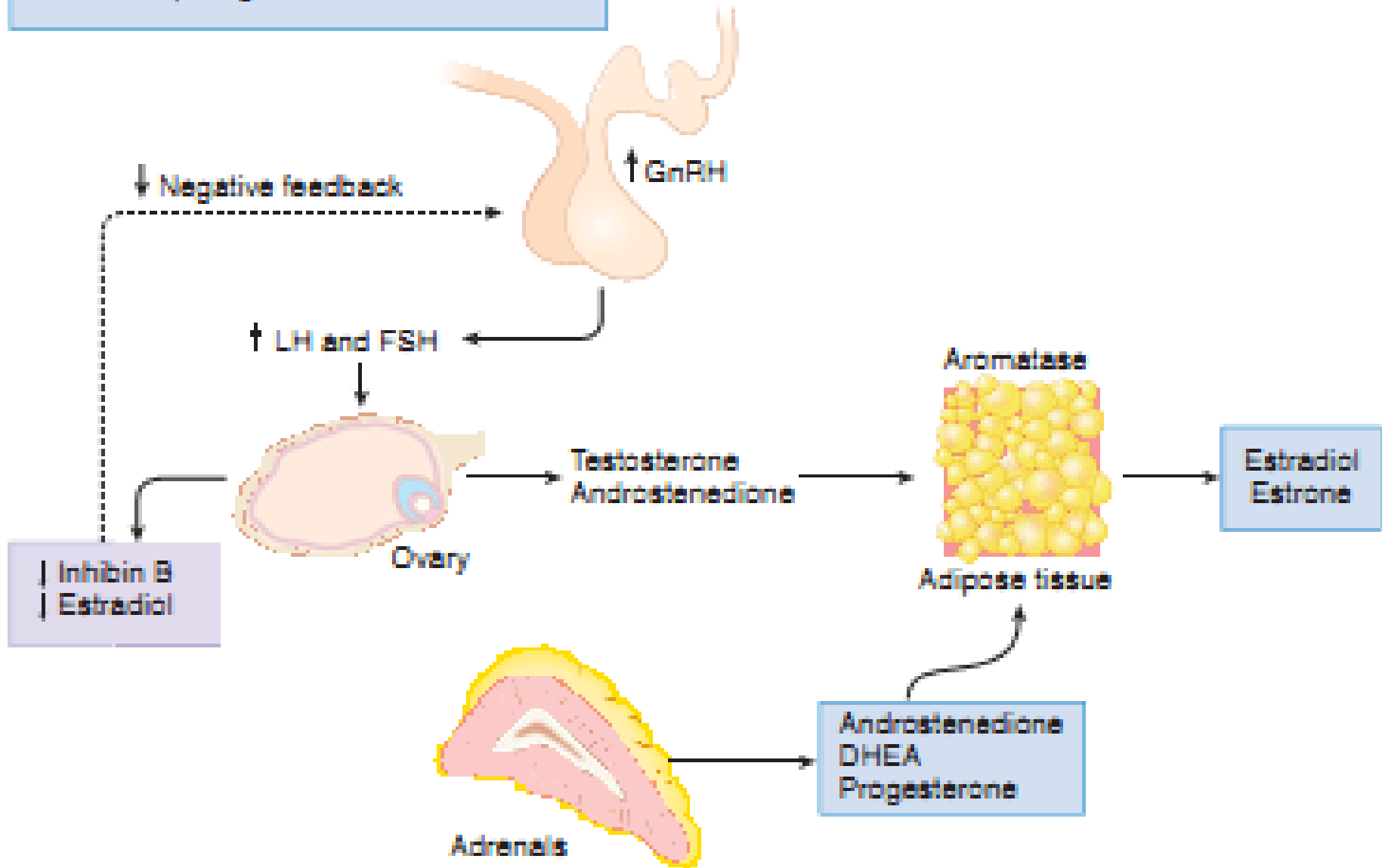
➤ dyspareunia

➤ massa mammae ↓

? tidak menstruasi

- **Menstruation = endometrial bleeding**
Peristiwa siklis ; butuh kendali hormonal ovarium
Dipicu : estrogen & progesteron withdrawal
- **Peran ovarium optimal bila siklus ovar (n)**
 - Fase folikular
 - Fase luteal
- **Siklus ovarium optimal ← jumlah folikel primer cukup ; → umpan balik ke hipotalamus – hipofise**
- **Menopause** : siklus ovarium + siklus endometr tidak optimal

Hormonal changes in menopause
| Ovarian estradiol — | Adrenal estrone
| Androgen: estrogen ratio
| Progesterone levels



ANDROPAUSE

Synonyms:

- Male Climacteric,
- Andropause,
- Viropause,
- ADAM
(Androgen Defc in the Aging Male)
- PADAM
(Partial Androgen Defc in the Aging Male).



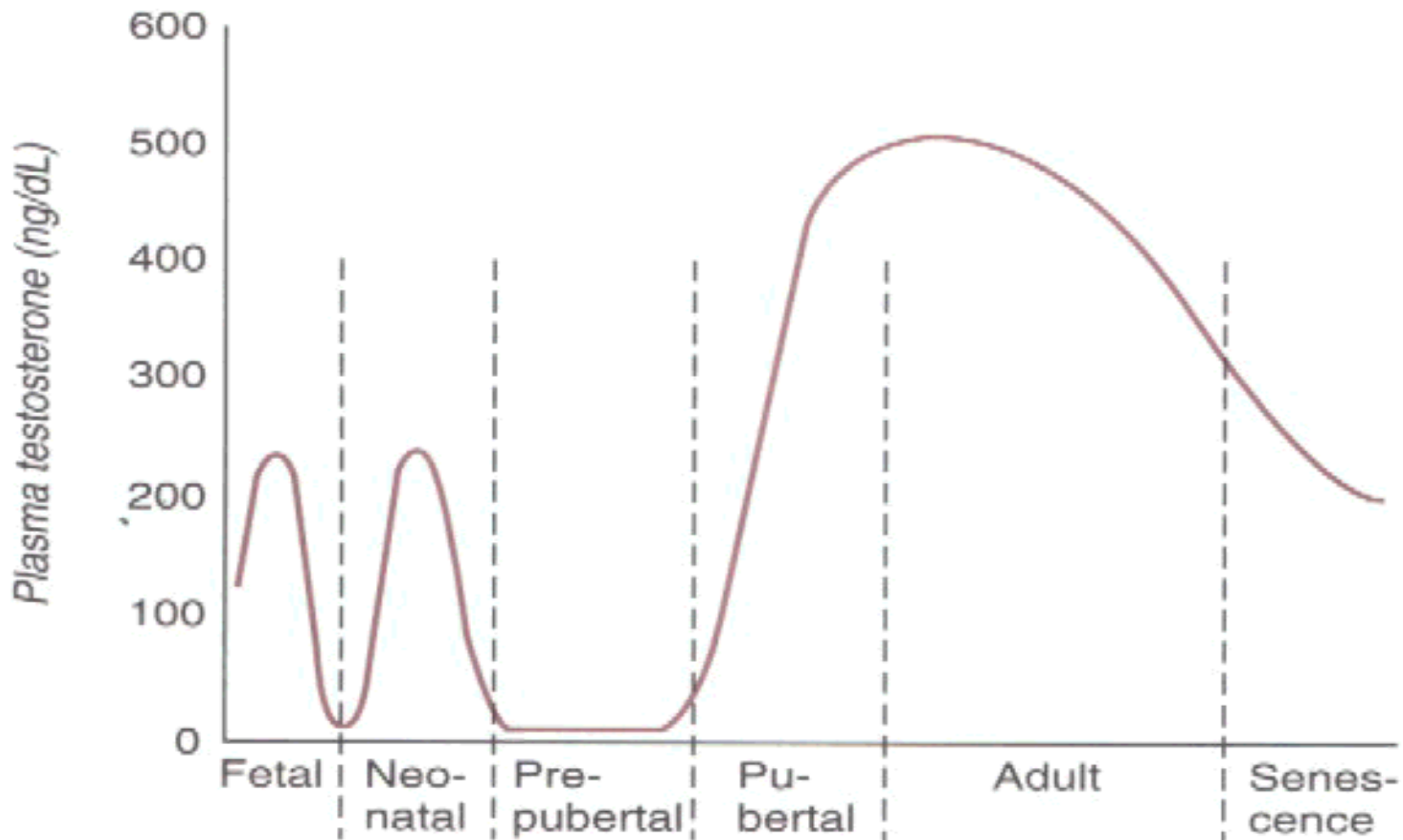


Figure 23–5. Plasma testosterone levels at various ages in males. (Reproduced, with permission, from Ganong WF: *Review of Medical Physiology*, 18th ed. Appleton & Lange, 1997.)

ANDROPAUSE

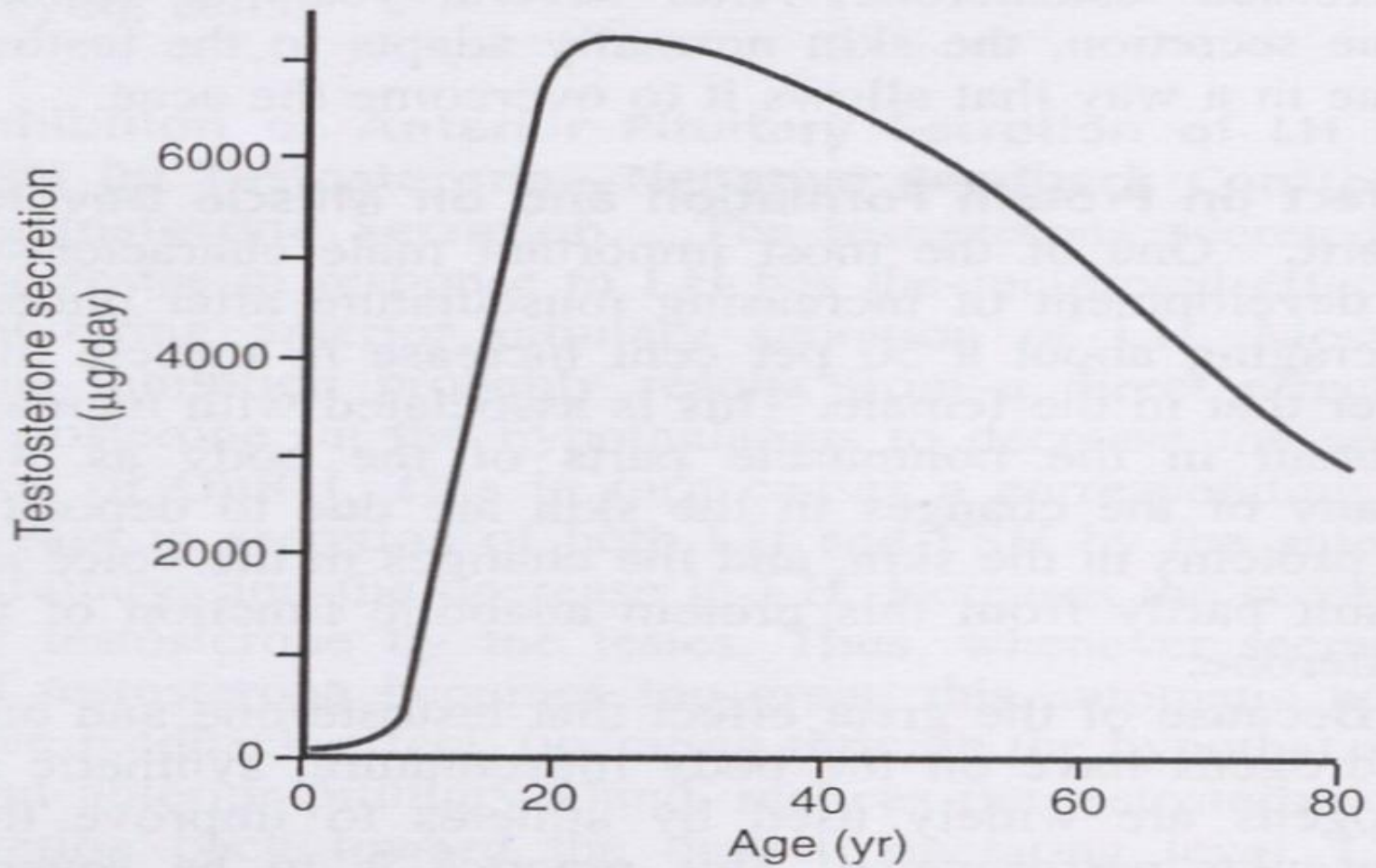


FIGURE 80-8

Approximate rates of testosterone secretion at different ages.

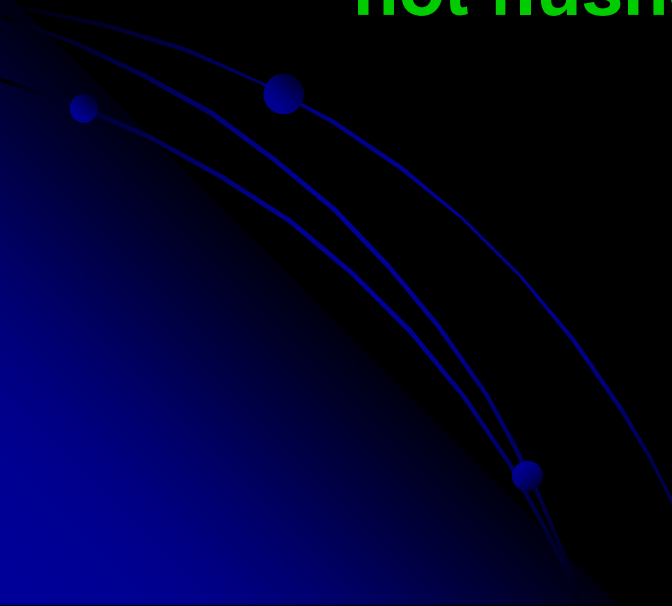


**TESTOSTERONE TAK DI PRODUKSI SPI
UMUR 10-13 TAHUN**

TESTOSTERONE DIPRODUKSI :

- 👍 SAAT PUBERTAS – DEWASA**
- 👍 MULAI < USIA 40AN**
- 👍 ↓ 20% PD USIA 50 AN**
- 👍 ↓ 50% PADA USIA > 80 TAHUN**

40 % ♂ 40 - 60 mengalami al :

- lethargy
 - depression
 - irritability ↑
 - mood swings
 - hot flushes
 - insomnia
 - libido ↓
 - weakness
 - bone mass < (hip fractures >)
 - impotence
- 



Terima kasih

Desain grafis oleh Hamdi Mayulu

