

Reproductive and Hormonal Functions of the Male-II

Unit XIV

Chapter 81

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Testosterone and other male sex hormones

- Androgens → masculinizing effects
- Androgen secretion sites

1-testes

2-adrenals (<5% of total androgens in male)

- Interstitial **cells of Leydig** in the testes → secrete androgens (testosterone, DHT & androstenedione)
- Testosterone is the most abundant male testicular androgen
- DHT is the active form of T.

Testosterone and other male sex hormones

- **T is secreted in:**

1- newborn male infant (Only for the first few months of life)

2- adult male after puberty

- Germinal epithelium of the testes is more sensitive for radiation or excessive heat than Leydig cells → impaired spermatogenesis but normal testosterone production.

Testosterone and other male sex hormones

After secretion by testes → T circulates in blood in these states for 30 min-several hours:

- 1-loosely bound with plasma **albumin**
 - 2-tightly bound with **sex hormone binding globulin**
 - 3-Free (3%) → most important biologically
- } 97%

T fate:

- 1-transferred to tissues → converted into DHT (prostate gland in **adult** and the external genitalia of male **fetus**)
- 2- degradation & excretion

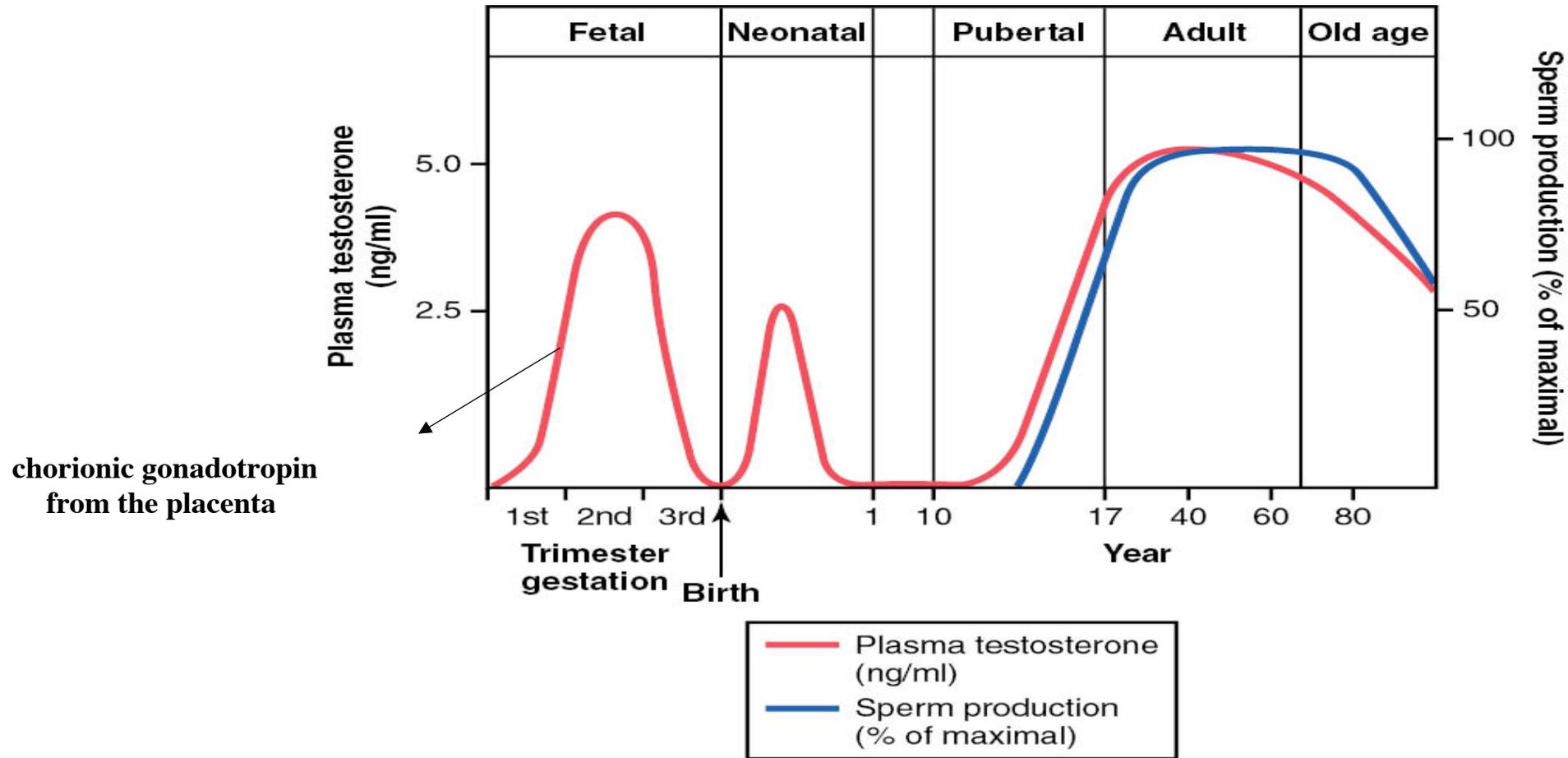
Testosterone and other male sex hormones

Production of Estrogen in the Male.

- small amounts of estrogens are formed in the male
- **Sertoli cells** secrete E. testosterone → estradiol
- high [estrogens] seminiferous tubules
- important role in spermiogenesis

Much larger amounts (80%) of estrogens are formed from T and androstenediol in other tissues of the body, especially the **liver**.

The different stages of male sexual function as reflected by average plasma testosterone concentrations (*red line*) and sperm production (*blue line*) at different ages.



(Modified from Griffin JF, Wilson JD: The testis. In: Bondy PK, Rosenberg LE [eds]: Metabolic Control and Disease, 8th ed. Philadelphia: WB Saunders, 1980.)

Functions of Testosterone During Fetal Development

- seventh week of embryonic life
- testosterone secreted first by the **genital ridges**
- later by the fetal **testes**
- **Functions:**
 - 1-Development of the male body characteristics:
Formation of penis ,scrotum, prostate gland, seminal vesicles, & male genital ducts
at the same time suppressing the formation of female genital organs
NO TESTESTERONE→NO MALE GENITALIA
 - 2-Descends testis to scrotum→ undescended testes→ T/GnRH→stimulates descent when inguinal canal permit that

Functions of testosterone

- Pubertal growth of penis, scrotum, and testes to 8X
- Development of secondary sexual characteristics of the male & spermeiogenesis

Functions of testosterone

secondary characteristics:

1) body hair distribution

(pubis, face, chest, back, linea alba, etc)

Male Pattern Baldness → T ↓ growth of hair on the top of the head (androgen & genetic factors)

2) voice

hypertrophy of laryngeal mucosa and larynx → masculine voice

3) skin

- ↑ thickens skin
- ↑ ruggedness of subcutaneous tissues
- ↑ sebaceous glands secretion and oil production → acne

4) Protein & muscle development

↑ muscle mass ↑ protein

Synthetic androgens

Functions of testosterone

5) Bone

Increases Bone Matrix → due to protein anabolic function & calcium Retention
Earlier closure of epiphyses

Effects of pelvis

narrow the pelvic outlet

lengthen pelvis

cause a funnel-like shape

increase the strength of the entire pelvis for load bearing.

Used in female to treat osteoporosis

Functions of testosterone

6) Increase metabolic rate

7) Increase RBC number

may be due to increase metabolic demands

8) Increase the reabsorption of Na in the distal tubules of the kidneys.

9) acute vasodilation

Testosterone in aging:

decrease slowly after age 40 –
decreased bone formation, muscle mass,
decreased growth of facial hair, appetite,
decreased libido

LH not changed; FSH increased with aging in men

Testosterone role in pathologies

Increase in LDL, decrease in HDL

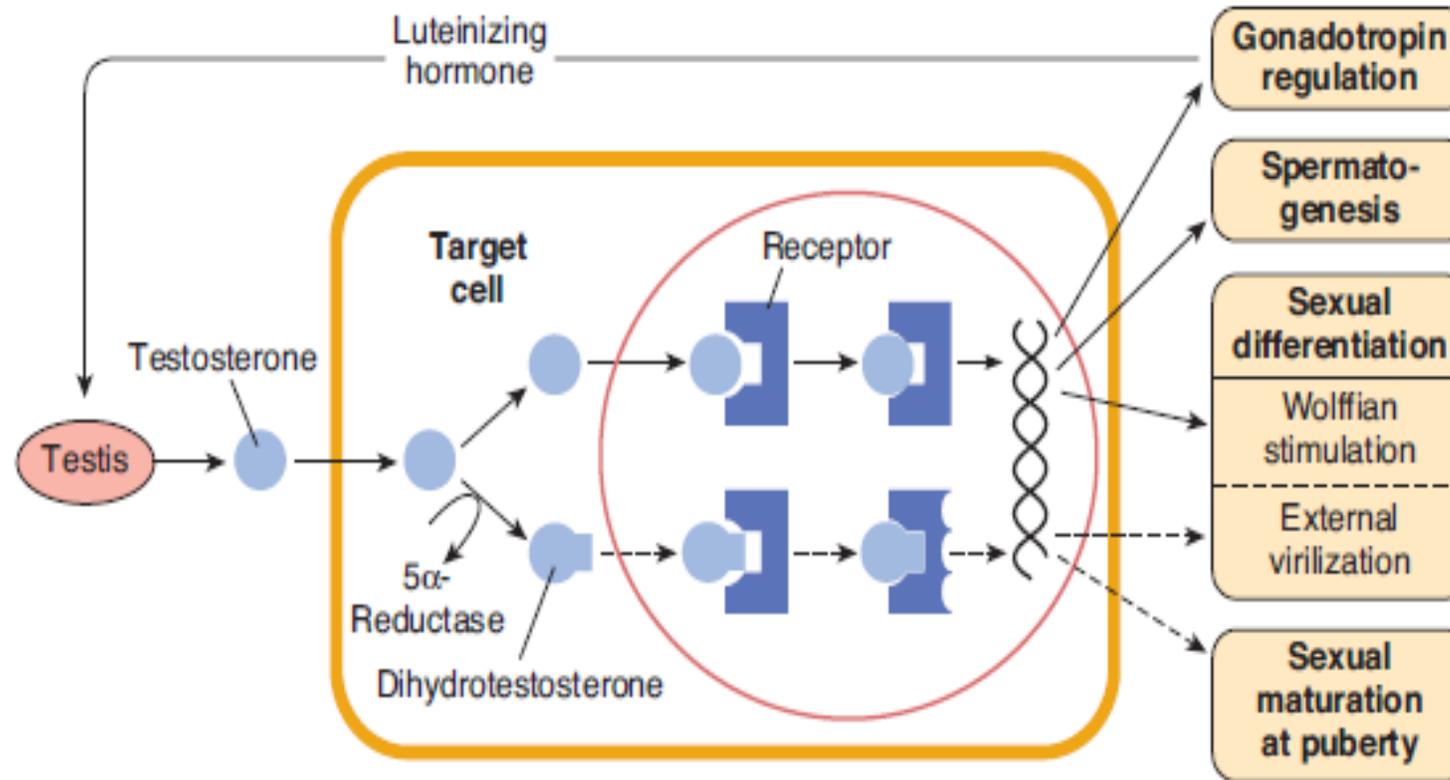
Implicated in coronary heart disease,? hypertension

Dihydrotestosterone (DHT) function

- **Fetal** development of penis, penile urethra, scrotum, prostate
- **Pubertal** growth of scrotum, prostate, pubic hair, sebaceous glands

Prostatic secretion

Schematic diagram of the actions of Testosterone (solid arrows) and Dihydrotestosterone (dashed arrows)



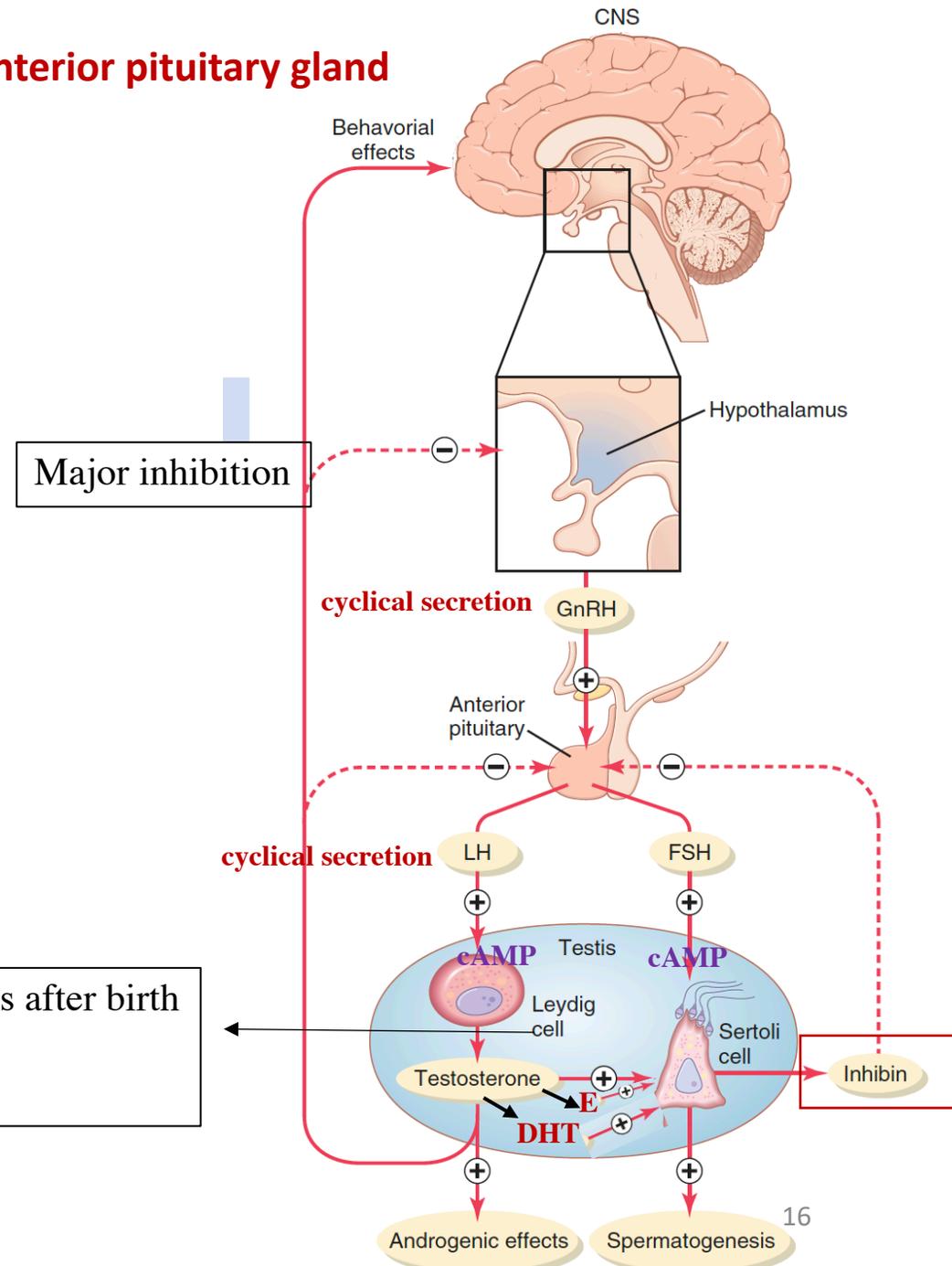
Control of male sexual functions by hormones from hypothalamus & anterior pituitary gland

In **fetal and neonatal** life (till about 10 weeks after delivery) testosterone secretion is stimulated by the placental **chorionic gonadotropins (hCG)**.

same effects on the sexual organs as **LH**.

Thereafter, secretion is extremely **low** till puberty and adulthood and is stimulated by Pituitary gonadotropins.

- At puberty gonadotropin releasing hormone (GnRH) stimulates cells in the anterior pituitary gland to produce luteinizing hormone (LH) and follicle stimulating hormone (FSH).
- LH stimulates cells in the testes to produce testosterone → spermatogenesis.
- FSH stimulates spermatogenesis.



Puberty:

- During childhood → **no** secretion of GnRH
- During childhood, the **slightest** secretion of any sex steroid hormones exerts a **strong inhibitory** effect on hypothalamic secretion of GnRH.
- At puberty, the secretion of hypothalamic GnRH breaks through the childhood inhibition and adult sexual
- life begins.

Pathologies

benign prostatic hypertrophy -- also caused by DH

Urinary obstruction

and treated with 5alpha-reductase inhibitor

cancer of the prostate -- treated with androgen receptor

antagonist, estrogen, radiotherapy, radical prostatectomy

tumors of testis -- interstitial cell tumors: produce large amounts of testosterone

germinal epithelial tumors: teratoma-produce no hormones-hCG

Hypogonadism in males

Causes

1. Congenital nonfunctioning of testes
2. Under-developed testes due to absence of hCG in fetal life
3. Cryptorchidism, associated with partial or total degeneration of testes
4. Castration
5. Absence of androgen receptors in testes
6. Disorder of the gonadotropes (cells secreting gonadotropins) in anterior pituitary
7. Hypothalamic disorder.

SIGNS & SYMPTOMS

Stage	Signs & symptoms
Fetal	<ul style="list-style-type: none">• none of the male sexual characteristics develop. Instead, female organs are formed
before puberty	<ul style="list-style-type: none">• Eunuchism → infantile sex organs & sexual characteristics• height is slightly greater than that of normal man (bone epiphyses are slow to unite)• Thin bone• Weak muscles• Childlike voice• No loss of hair on the head• No normal adult masculine body hair distribution
after puberty	<ul style="list-style-type: none">• Sexual organs regress slightly in size but not to a childlike state• Slight voice regression• Loss of masculine hair production• Loss of thick masculine bones• Loss of the musculature of the virile male.• Sexual desires loss• Erection is conserved• No ejaculation (degeneration of semen forming-organs)

Pathologies

Erectile dysfunction: age 40-70 years, 52% of men

Due to:

Diabetes Mellitus, hypertension, reduced HDL

Radiation, surgery for prostate cancer

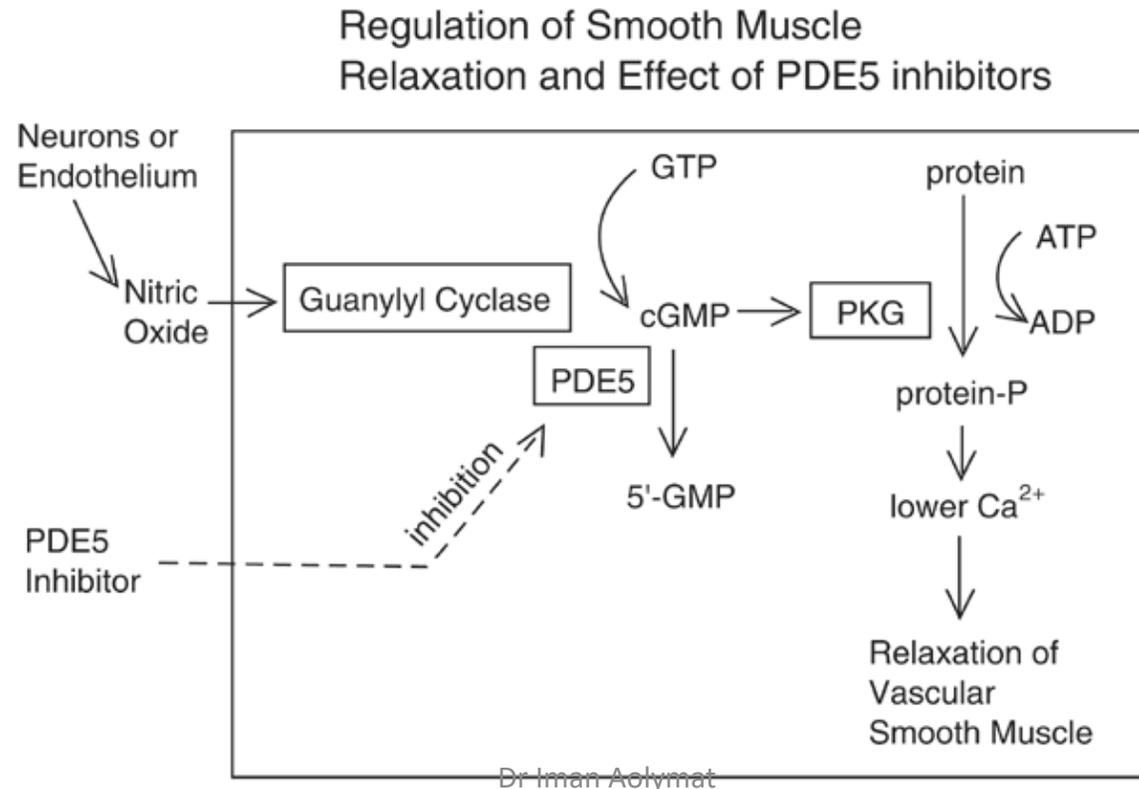
Lower spinal cord injury

stress -- unemployment, performance anxiety

Drugs: diuretics, antidepressants, antilipidemics, antihypertensives, EtOH, cocaine, marijuana

ED Rx:

phosphodiesterase-5 inhibitors: sildenafil citrate, vardenafil, tadalafil



ED Rx:

Androgen therapy

Vacuum constriction devices -- noninvasive
draw venous blood into penis
constriction ring prevents venous return

Injections of PGE1

Surgical implantation of prosthesis

Sex therapy

Good luck