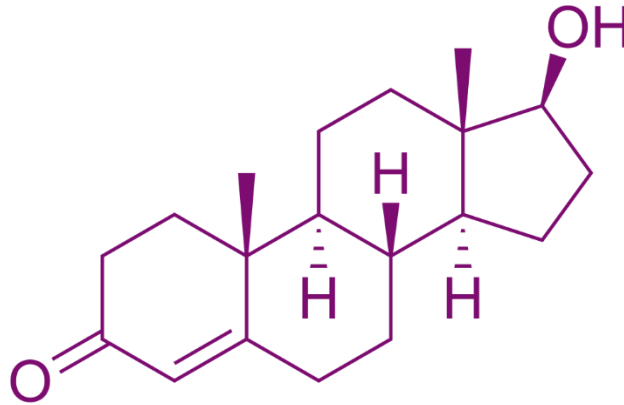


Pharmacology of drugs acting on endocrine system

Androgens

- Androgens are male sex hormones responsible for developing and maintaining male characteristics.
- The primary endogenous androgen is **testosterone**.



Testosterone, the major androgen

Physiological Roles:

- Produced mainly by Leydig cells in the testes and, to a lesser extent, by the adrenal cortex.
- Regulate development of male secondary sexual characteristics, spermatogenesis, and libido.
- Exhibit anabolic effects: Promote protein synthesis, increase muscle mass, and stimulate erythropoiesis.

Physiology of Androgens:

- **Major Androgens:** Testosterone, Dihydrotestosterone (DHT, more potent), and Androstenedione.
- **Regulation:** Controlled by the hypothalamic-pituitary-gonadal (HPG) axis:
 - Hypothalamus releases GnRH → Stimulates anterior pituitary to release LH → LH stimulates Leydig cells to produce testosterone.

Pharmacological Actions:

1. Androgenic Actions:

- Development and maintenance of male secondary sexual characteristics (facial hair, deep voice, etc.).
- Growth of male reproductive organs.

2. Mechanism of Action:

- Androgens bind to **androgen receptors** in target tissues, regulating gene expression and promoting male characteristics.

Pharmacological Agents:

- **Testosterone:** Natural androgen used for hypogonadism, delayed puberty, and breast cancer.
- **Synthetic Androgens:** Methyltestosterone, Fluoxymesterone—enhance androgenic effects and improve pharmacokinetics.

Clinical Uses:

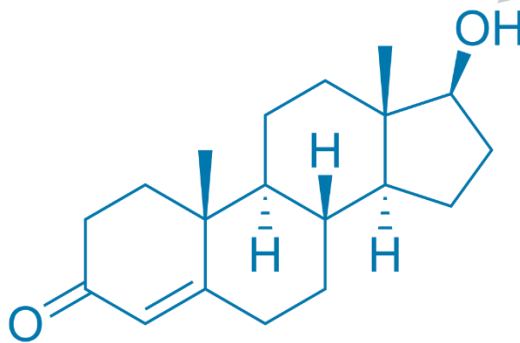
- **Hypogonadism:** Replacement therapy to restore testosterone levels.
- **Delayed Puberty:** Induction of puberty in adolescent males.
- **Anemia:** Stimulates erythropoiesis.
- **Breast Cancer:** Inhibits estrogen-dependent tumor growth.

Side Effects:

- **Androgenic Effects:** Acne, hair loss (male pattern baldness), and increased body hair.
- **Estrogenic Effects:** Gynecomastia due to aromatization of testosterone to estradiol.
- **Other Risks:** Liver toxicity (especially with oral forms), cardiovascular risks, mood swings, and infertility due to suppression of the HPG axis.

Anabolic Steroids

- Anabolic steroids are synthetic derivatives of testosterone designed to maximize anabolic (muscle-building) effects while minimizing androgenic (masculinizing) effects.



Chemical structure of the natural AAS testosterone

Physiological Roles:

- Promote muscle and bone growth with reduced androgenic activity.
- Examples: **Nandrolone, Oxandrolone, Stanozolol.**

Pharmacological Actions:

Anabolic Actions:

- Promote protein synthesis and muscle growth.
- Increase bone density.

- Stimulate erythropoiesis (red blood cell production).

Examples of Anabolic Steroids:

- **Nandrolone (Deca-Durabolin):** Treats anemia and muscle-wasting diseases.
- **Stanozolol (Winstrol):** Used for hereditary angioedema and muscle growth.
- **Oxandrolone (Anavar):** Aids weight gain post-surgery/trauma and relieves bone pain in osteoporosis.

Mechanism of Action:

- Bind to androgen receptors, promoting protein synthesis and muscle hypertrophy.
- Reduce catabolism by inhibiting glucocorticoid hormones.

Clinical Uses:

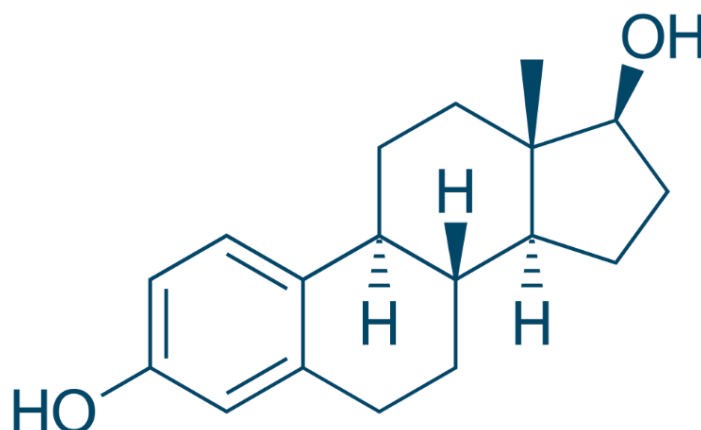
- **Muscle Wasting Diseases:** HIV/AIDS, cancer cachexia.
- **Osteoporosis:** Enhances bone density.
- **Anemia:** Stimulates erythropoiesis.
- **Hormone Replacement Therapy:** Treats testosterone deficiency in males.

Side Effects:

- **Androgenic Effects:** Acne, virilization in females (deep voice, hirsutism).
- **Cardiovascular Risks:** Dyslipidemia, hypertension, increased myocardial infarction risk.
- **Hepatotoxicity:** Especially with oral forms.
- **Psychiatric Effects:** Aggression, mood swings, dependence.
- **Endocrine Disruption:** Testicular atrophy, infertility, suppression of testosterone production.

Estrogens

- Estrogens are female sex hormones essential for reproductive tissue development, breast growth, and bone health.





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