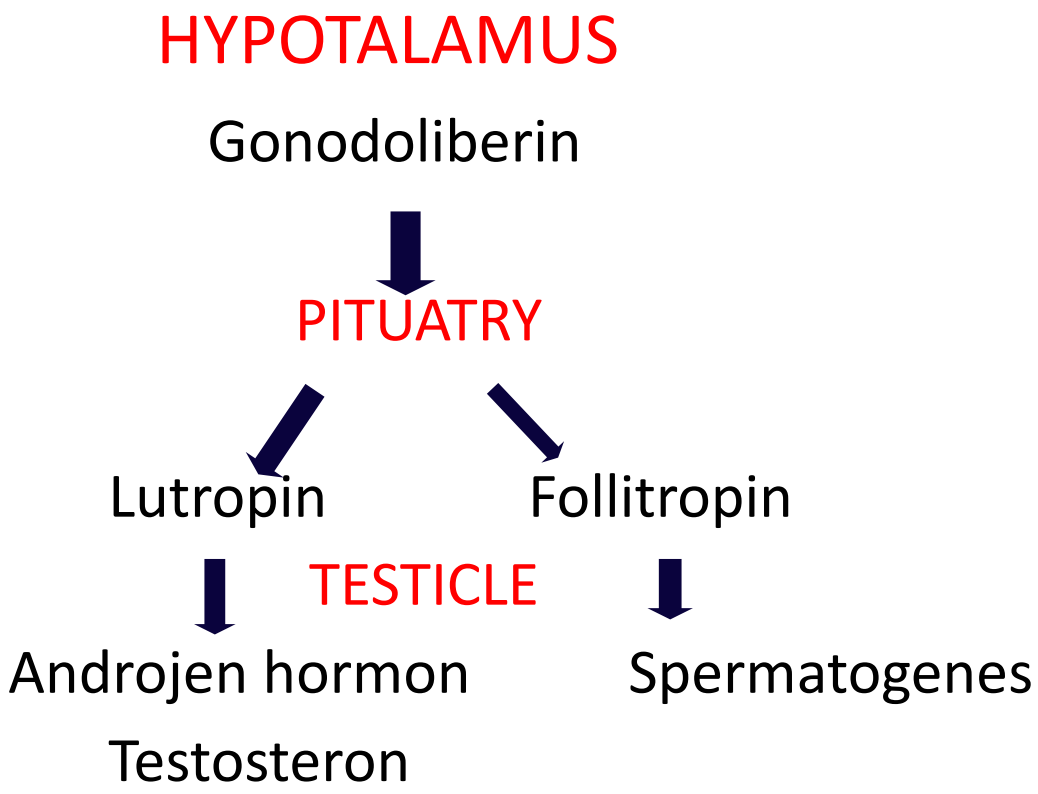
Male Sex Hormones

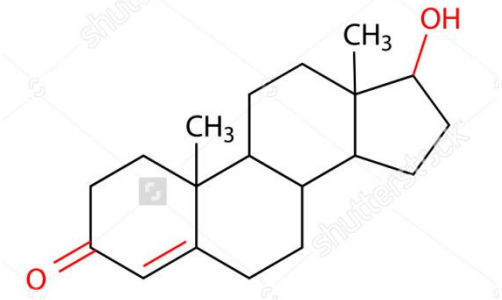
Androgen and Anabolic Steroids

Synthesis and secretion of Testosteron

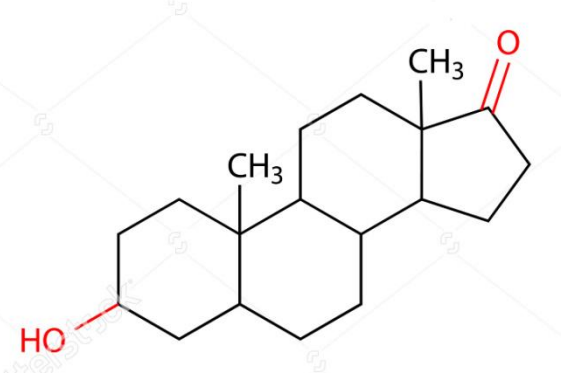


Testosteron➔

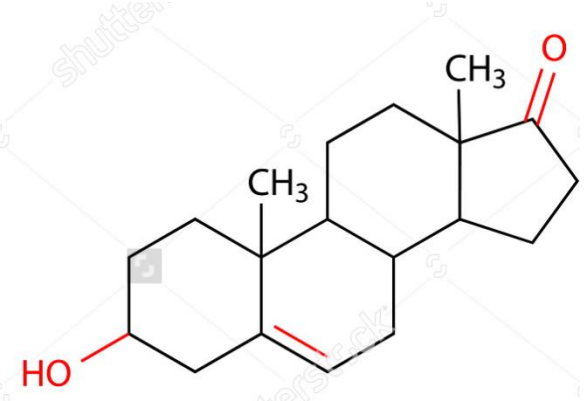
- In puberty term ➔ physical and sexual development,
- In maturity period ➔ regulate sexual life



Testosteron
(Base androgenic hormon)



androsteron

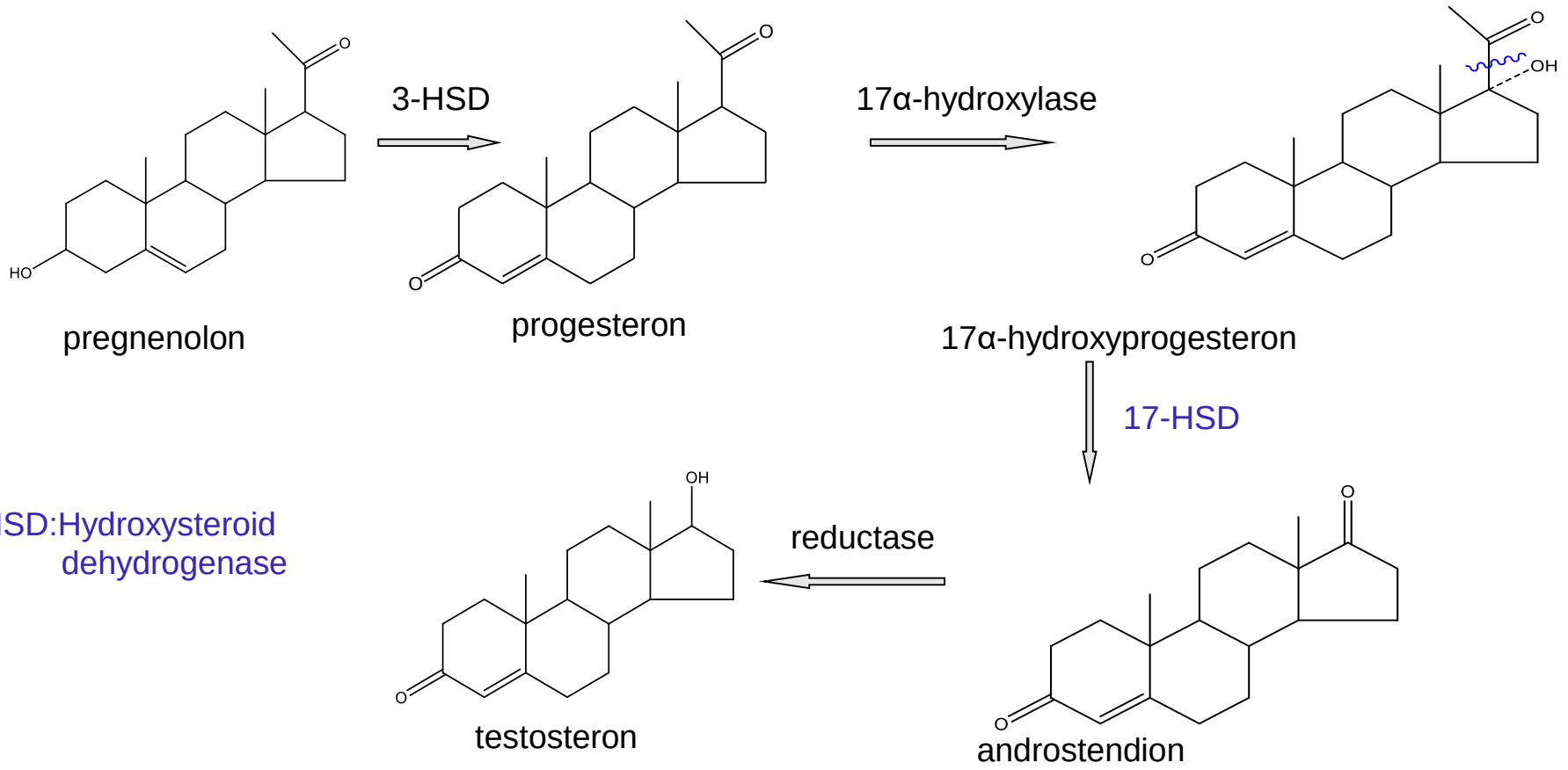


Dehidroepiandrosteron

Testosteron metabolits

Biosynthesis

- It is synthesized in testicles as well as in adrenal cortex.
- In women, a small amount of testosterone is synthesized in the ovaries.



Effects

Testosteron

In puberty term the development of sexual organs,

Allows the development of secondary sexual male characterization

(Volume thickening, mustage and beard formation, body hirsutizm etc.).

In maturity regulates sexual life.

All these effects are called androgenic effect.

Anabolic effect

Nitrogen retention increases in body, increase weight by increasing protein synthesis,

The retention of calcium, sodium, potassium, phosphate, sulfate, chloride causes in body strengthens in the bones.

When androgenic treatment is required Anabolic / androgenic ratio must be small

When anabolic treatment is required anabolic/androgenic ratio must be high.

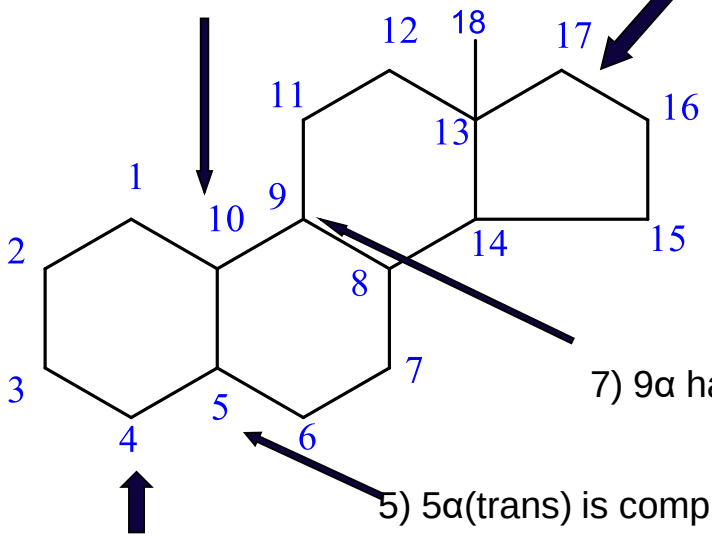
Structure Activity Relationship

9) 17α alkyl➔ protect against to the bacteria and liver enzymes, so it can be used orally

10) 17β OH and esters➔ Duration of activity extends

8) 19 nor➔anabolic activity increase

1) 2-O➔anabolic activity increase



2) Steroidal structure is required for androgenic and anabolic effect.

7) 9α halogen➔ increases both activities

3) Substitution of 3 oxo, 3α OH increases the androgenic activity.

5) 5α(trans) is compulsory

4)Δ^4 anabolic activity increases
4-halogen➔ increases both activity

6) 4 and 6 CH_3 and 4-X➔3 oxo Δ^4 prevent reduction and activity period extend

Uses in therapy

- In men ➔ hypogonadism and impotens,
- In women ➔ uterine bleedding and/or to stop lactation
- In menaupose term used together with estrogens.

For their anabolic effects➔

- Surgical operations, severe infections, burns, recovery period after fractures, tissue production accelerates, appetite and increase weight,
- Used in Osteoporosis ➔ Bone density does not increase, but analgesic activity is provided.

Androgenic hormones and anabolic drugs in therapy;

- Early maturity
- Odema
- Acne
- Nausea
- Advers effect such as in women hirsutism, sound thickening, menstrual disorders

  ➔ some of them are irreversible.

- At low dosage ➔ increases spermatogenesis,
- At high dosage and long period uses ➔ gonadotropin secretion is inhibited and spermatogenis is stoped.

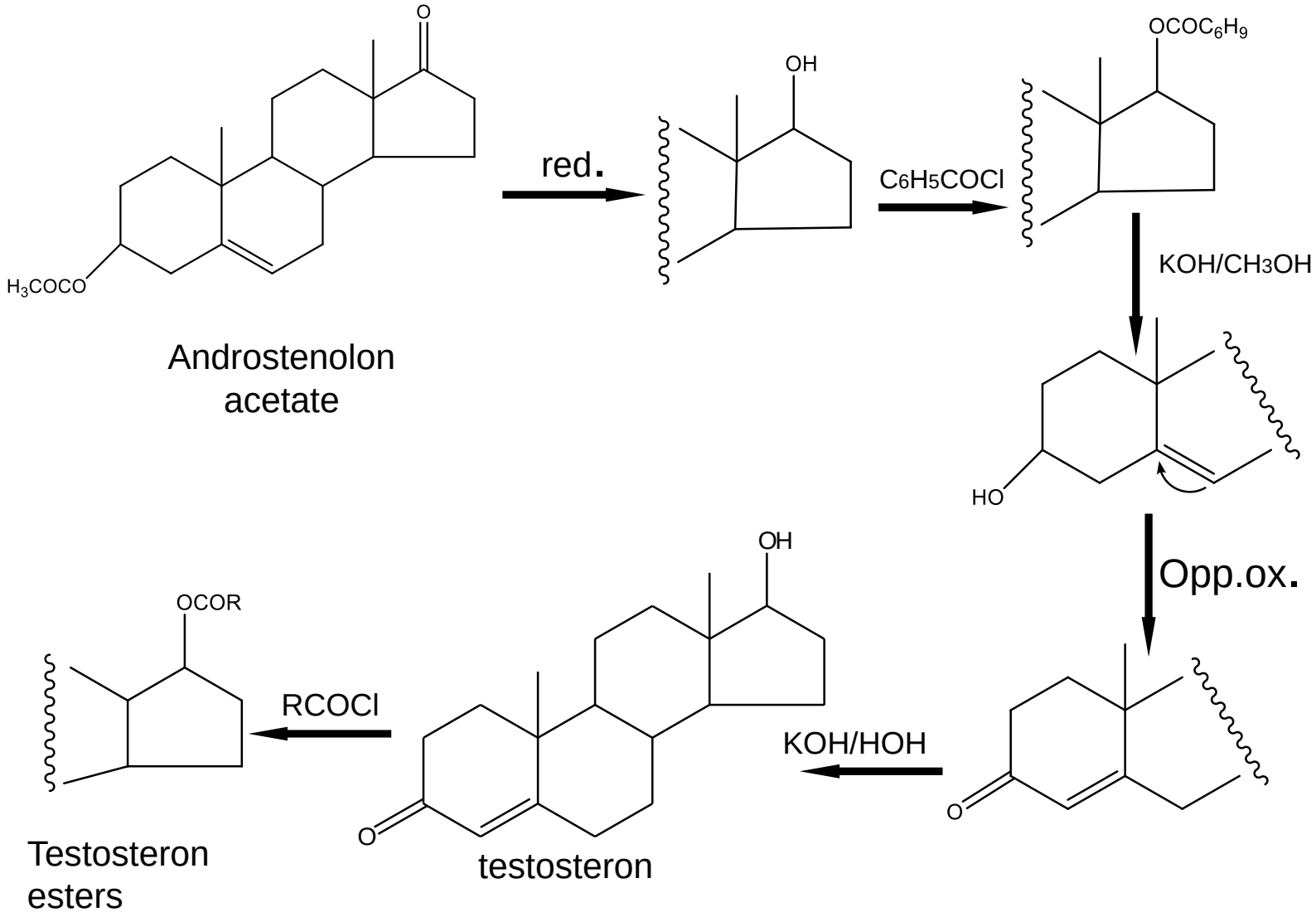
  It is not used in children whose skeletal development has not been completed. With the early epiphysis closure, the elongation of the height stops

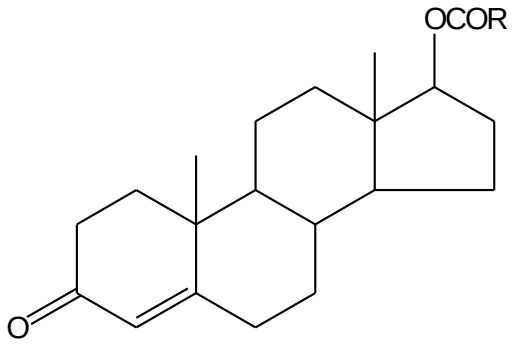
  Not used in prostate and breast cancer in men and pregnant women.
- Kidney and heart disease should be used with caution ➔ Na,Ca and water retention.

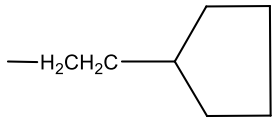
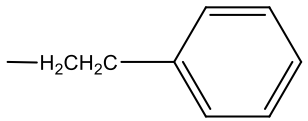
Androgenic-anabolic drugs

Testosteron Testogel®

17β-hydroxyandrost-4-en-3-on





R		
-CH_2CH_3	Testosteron propiyonat	
-$CH_2(CH_2)_{13}CH_3$	Testosteron enantat	
-$CH_2(CH_2)_7CH_3$	Testosteron dekanoat	Sustanon ®
	Testosteron sipiyonat	
	Testosteron fenilpropiyonat	Estandron®

Testosterone

- Testosterone hormone deficiency in males,

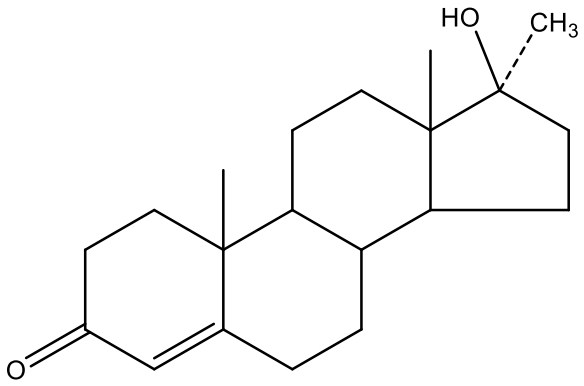
- In gynecological diseases in women,

- Anabolic is used in both sexs.

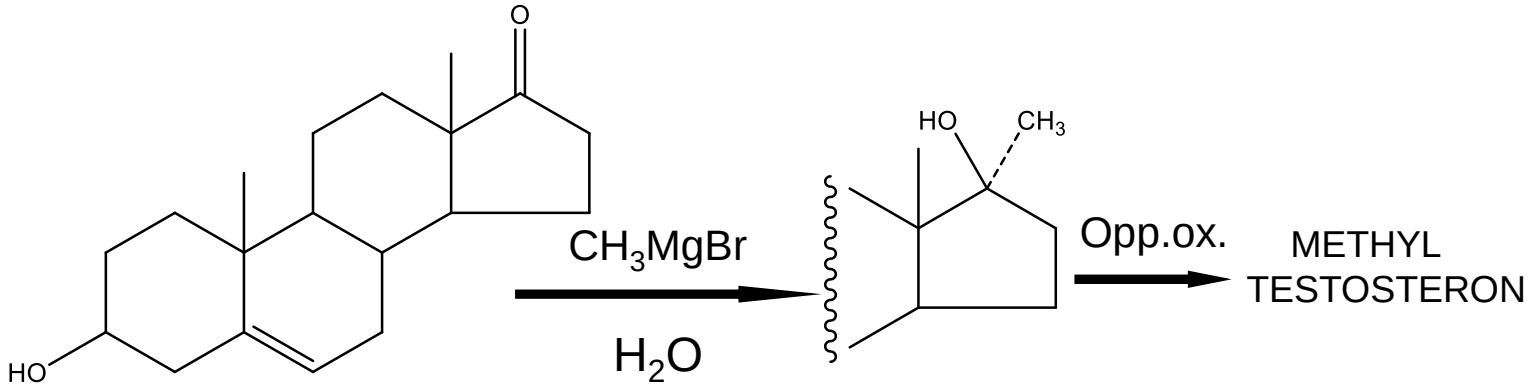
Testosterone Esters

It is longer activity period than testosterone.

Metiltestosteron Afro®



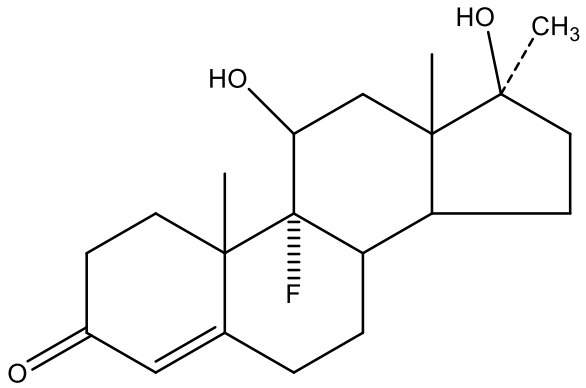
17β-hydroxy-17α-methyl androst-4-en-3-on



androstenolon

17 CH3 ➔ Metabolic inactivity increases, orally avaliable

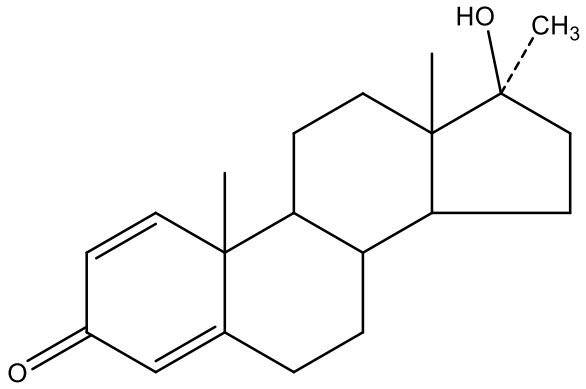
Fluoksimesteron



• High androgenic activity as well as anabolic effect .

9α-fluoro-11β,17β-dihydroxy-17α-methylandrost-4-en-3-on

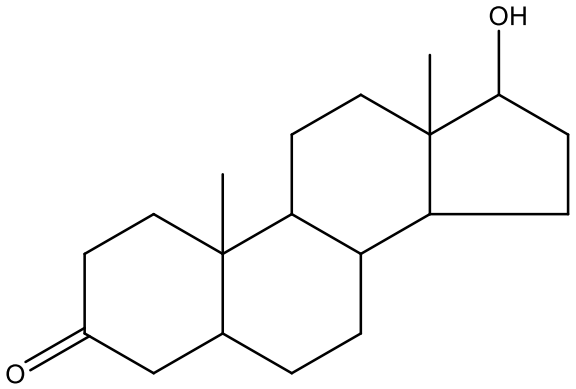
Metandienon (metandrostenolon)



•It ıs used as orally for anabolic effect.

17β-hydroxy-17α-methyl androst-1,4-dien-3-on

Stanolon

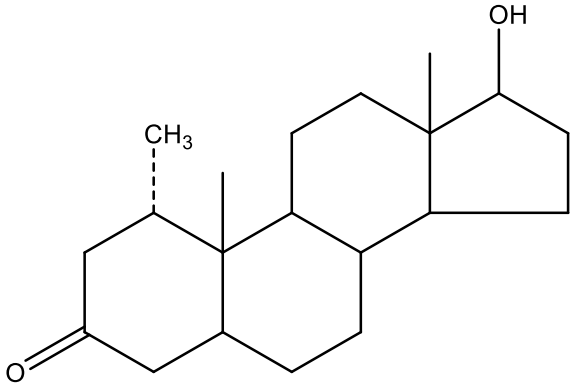


Androgen,anabolic

No uses orally, i.m uses .

17β-hidroksi androstan-3-on

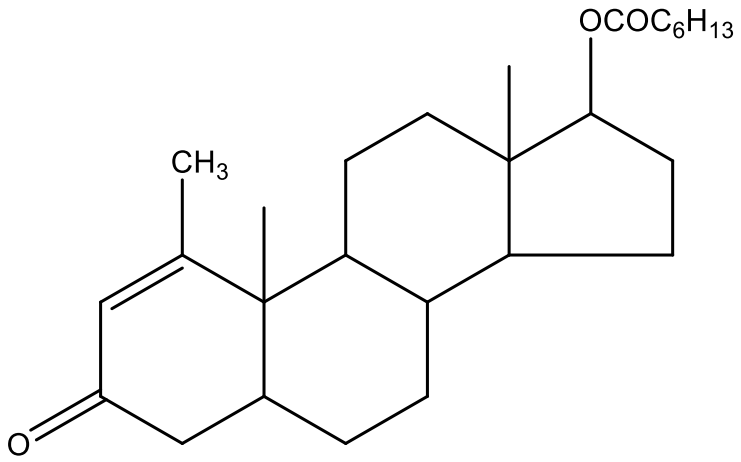
Mesterolon Proviron®



Androgenic

17β-hydroxy-1α-methly androstan-3-on

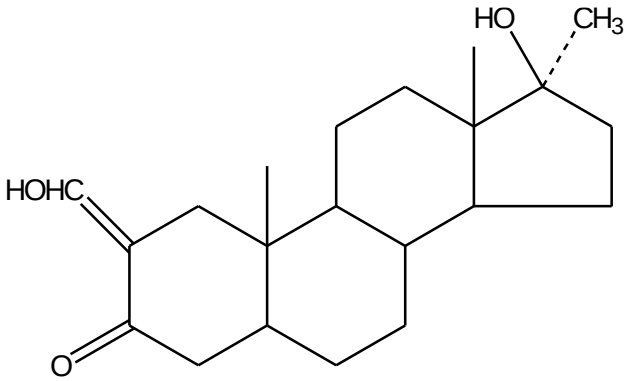
Metenolon enantat Primobolan depot®



Anabolic ➔ İ.M.
High Androgenic effect as well

17β-hydroxy-1-methyl androst-1-en-3-on heptanoate

Oksimetolon Anapolon®

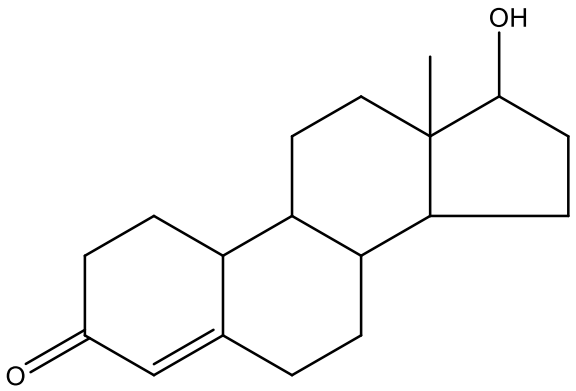


Oral uses

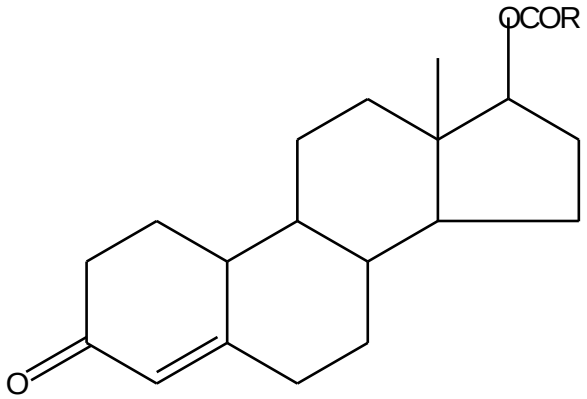
17β-hydroxy-2-hydroxymethylene-17α-methylandrostan-3-on

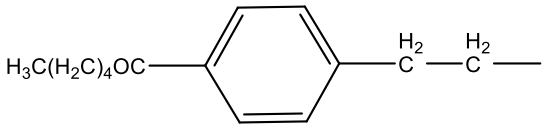
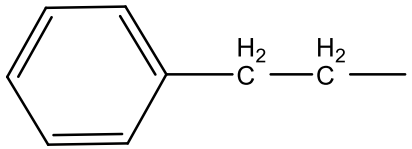
Nandrolon

Decanoate, Phenylpropiyonate and hekzanoilphenyl propiyonate esters are used.



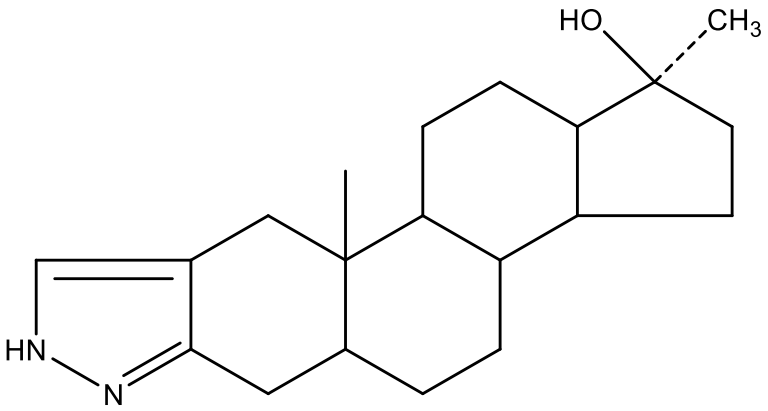
17β-hydroxy-estr-4-en-3-on



R	
$H_3C(CH_2)_7$-CH_2-	**Nandrolon decanoate**
	**Nandrolon hekzanoil phenyl propiyonat**
	**Nandrolon phenyl propiyonat**

Long term effective. I.M uses.

Stanozolol (stanozol)



17β-hidroksi-17α-metil-androstano[3,2-c]pirazole

The pyrazole ring provide to increase anabolic effect, orally avaliable

Androgen Antagonists

Causes to decrease of testosteron effects.

- Diseases such as acne, hair growth due to hyperandrogenism in women,

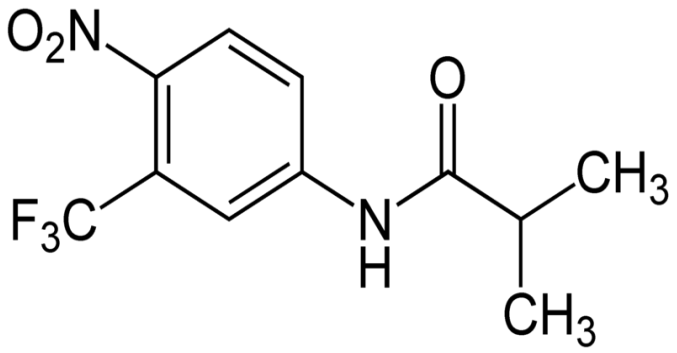
- They are used to suppress prostate cancer and excessive sexual instincts in men.

- Estrojen and progestagens ➔ In men, they show antiandrogenic effect by inhibiting gonadotropin secretion from the pituitary gland.

- However, there may be feminine side effects in long-term use.

Non-Steroidal Androgen Antagonists

Flutamide Andraxan^{R}

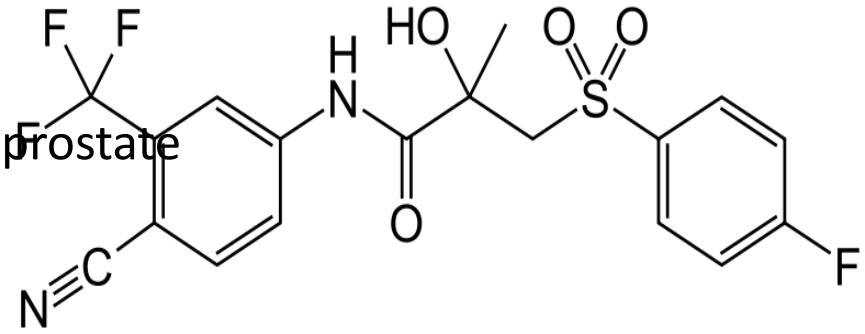


2-Methyl-*N*-[4-nitro-3-(trifluromethyl)phenyl]-propanamide

It is used in metastatic prostate cancer therapy.

Bikalutamide Casodex^{R}

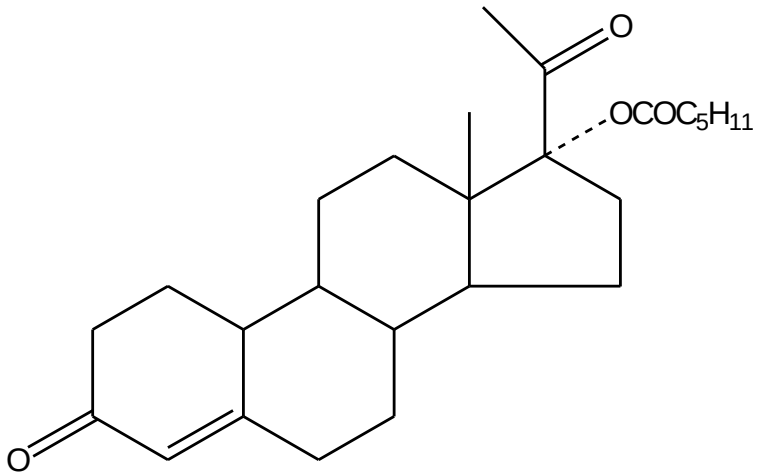
It is used in metastatic prostate cancer therapy



N-[4-cyano-3-(trifluoromethyl)phenyl]-3-[(4-florophenyl)sulfonil]-2-hydroxy-2-methylpropanamide

Steroidal Androgen Antagonists

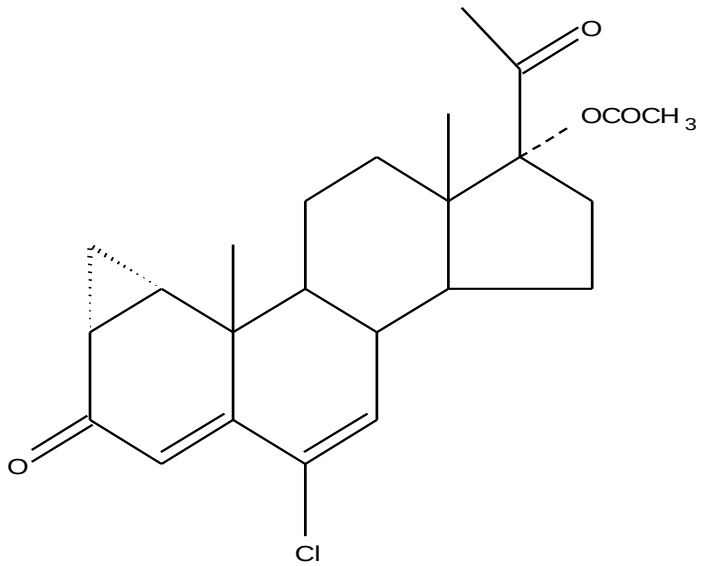
Gestonoron caproate Depostat®



- Prevents testosterone from entering the target cell.
- In men ➔prostate hyperplazi,
- In women ➔endometrium and breast cancer.

17α-hydroxy-19-nor pregn-4-en-3,20-dion hexanoate

Siproteron acetate Androcur ®,Climen®



- It inhibits the secretion of gonadotropins (FSH and LH) by acting on the pituitary,
- It also blocks the target organs by binding to testosterone receptors.

17α-hydroxy-6-chloro-1α,2α-methylene pregn-4,6-dien-3,20-dion acetate

It is used for prostate cancer .

In the treatment of acne and hirsutism due to the superiority of testosterone in women

With severe sexual impulse and sexual deviation (parafili) treatment in men.