

Drugs acting on Endocrine system

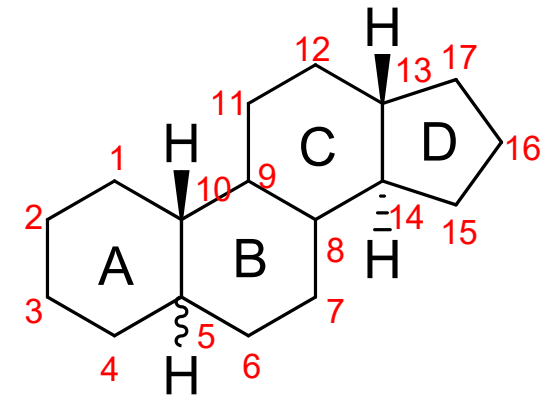
**Classification, Nomenclature,
Stereochemistry and metabolism
of steroids**

A **steroid** is a biologically active organic compound with four rings arranged in a specific molecular configuration.

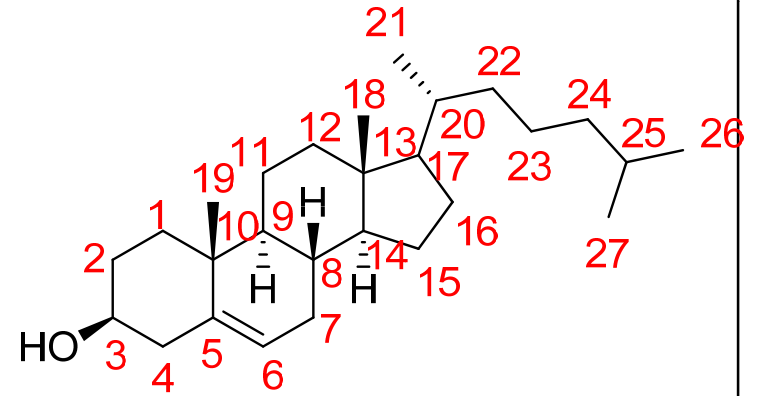
- The steroid core structure is typically composed of **seventeen carbon** atoms, bonded in four "fused" rings: three six-member cyclohexane rings (rings A, B and C) and one five-member cyclopentane ring (the D ring).
- Steroids vary by the functional groups attached to this four-ring core and by the oxidation state of the rings.
- Sterols are forms of steroids with a hydroxy group at position three and a skeleton derived from cholestane (e.g. Cholesterol).

Nomenclature




○ The simplest steroid and the nucleus of all steroids and sterols is known as Gonane, also known as steran or cyclopentanoperhydrophenanthrene

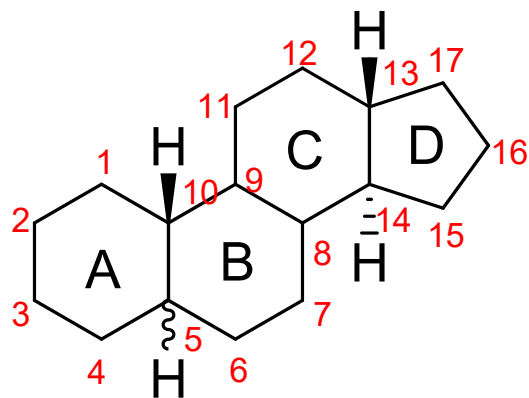


○ When the two methyl groups and eight carbon side chains (at C-17, as shown for cholesterol) are present, the steroid is said to have a cholestane framework.



Stereochemistry

- When the rings of a steroid are projections onto the plane of the paper, as in the figure.
- An atom or group attached to a ring is termed (alpha) if it lies below the plane of the paper or (beta) if it lies above the plane of the paper.
- In formulae, bonds to atoms or groups lying below the plane of the paper are shown as broken lines (), and bonds to atoms or groups lying above the plane of the paper () are shown as solid lines (preferably thickened). Bonds to atoms or groups whose configuration is not known are denoted by wavy lines ().

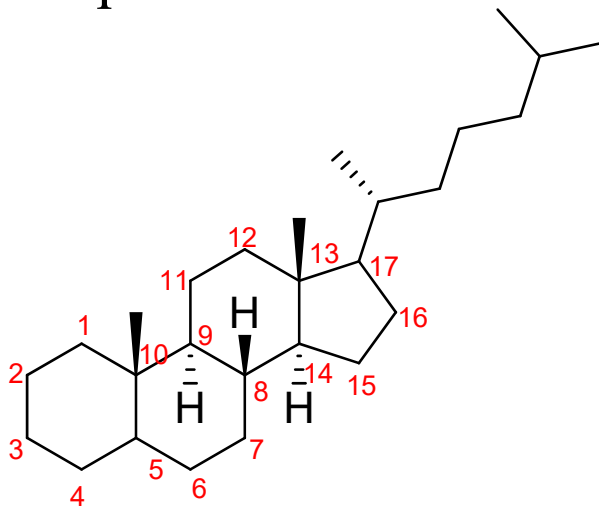


Steroids can be classified based on their chemical composition

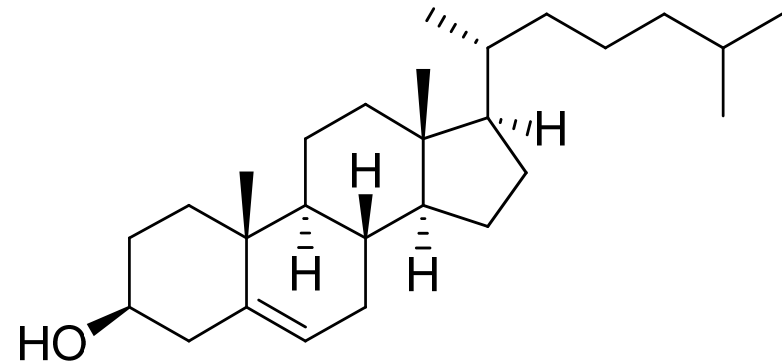
1. Cholestanes

When the two methyl groups and eight carbon side chains (at C-17) are present, the steroid is said to have a cholestane framework. (Number of carbon atoms 27)

Example-Cholesterol



Cholestanes

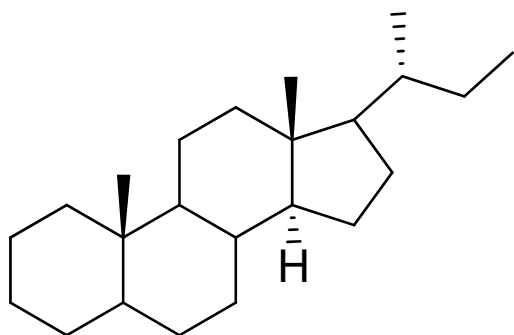


Cholesterol

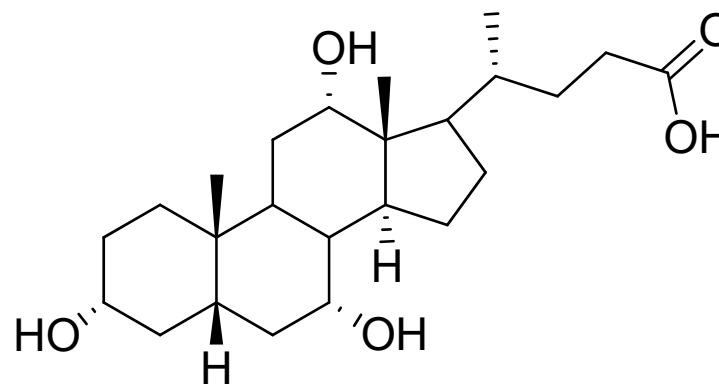
2. Cholanes

It is a triterpene which contains 24 carbon atoms

Example-Cholic acid



Cholanes

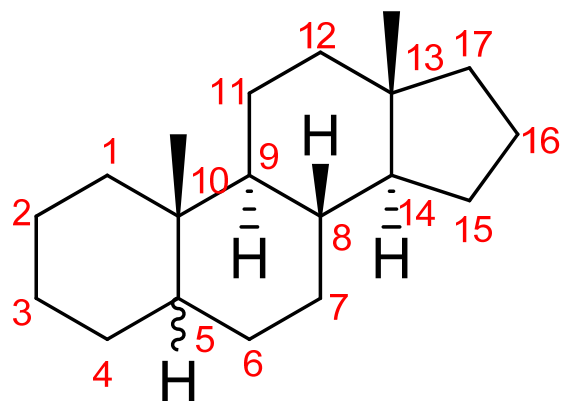


Cholic acid

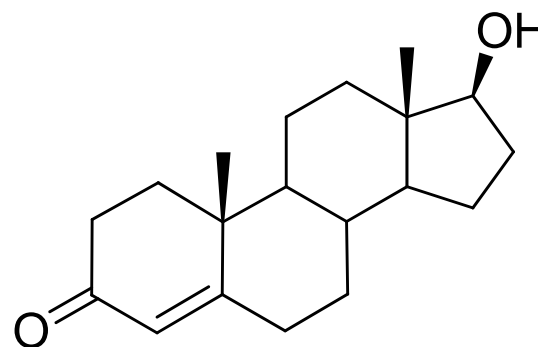
3. Androstane

is a C19 steroid with a gonane core

Example-Testosterone



Androstane

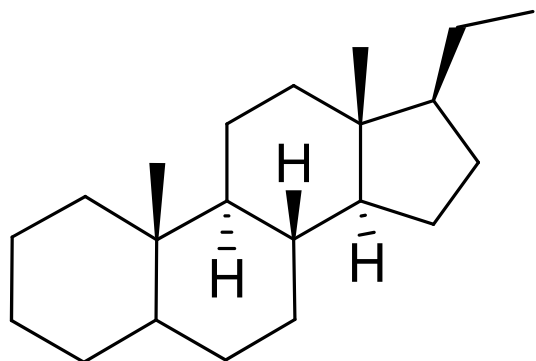


Testosterone

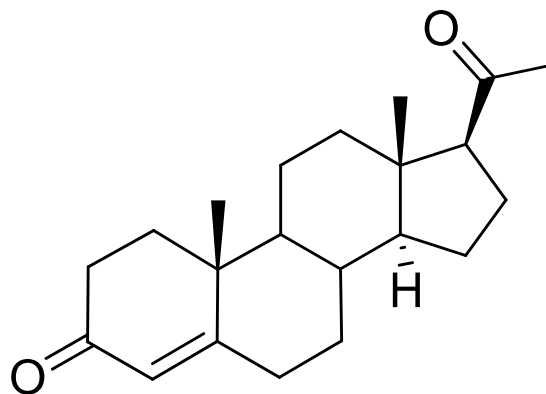
4. Pregnanes

It is also known as 17β -ethylandrostandane. It is a 21 carbon atoms containing steroid.

Example-Progesterone



Pregnanes

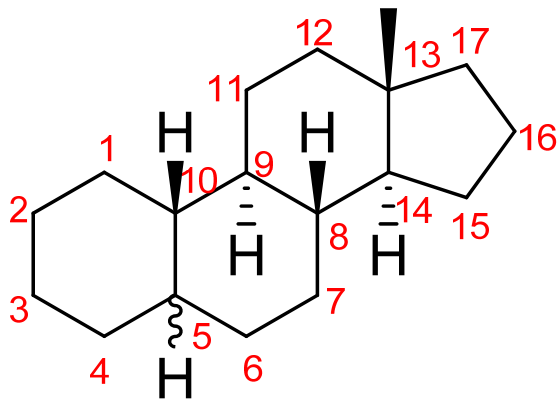


Progesterone

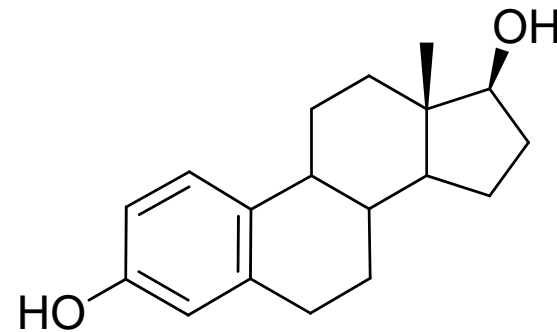
5. Estranes

Estrane is a C18 steroid derivative, with a gonane core.

Example-Estradiol



Estrane



Estradiol

Classification based on function

1. Corticosteroids

Corticosteroids are a class of steroid hormones that are produced in the adrenal cortex of adrenal gland.

a. Glucocorticoids:

Example: Cortisol (a natural glucocorticoid whose functions include immunosuppression), Cortisone, Hydrocortisone, Prednisolone, Betamethasone and Dexamethasone

b. Mineralocorticoids:

Aldosterone, a mineralocorticoid which helps to regulate blood pressure through water and electrolyte balance.

2. Sex hormones (steroids)

a. Progestogens:

Progesterone, which regulates cyclical changes in the endometrial of the uterus and maintains a pregnancy.

b. Androgens:

Testosterone, which contributes to the development and maintenance of male secondary sex characteristics.

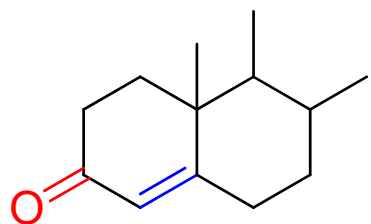
c. Estrogens:

Estradiol, which contributes to the development and maintenance of female secondary sex characteristics.

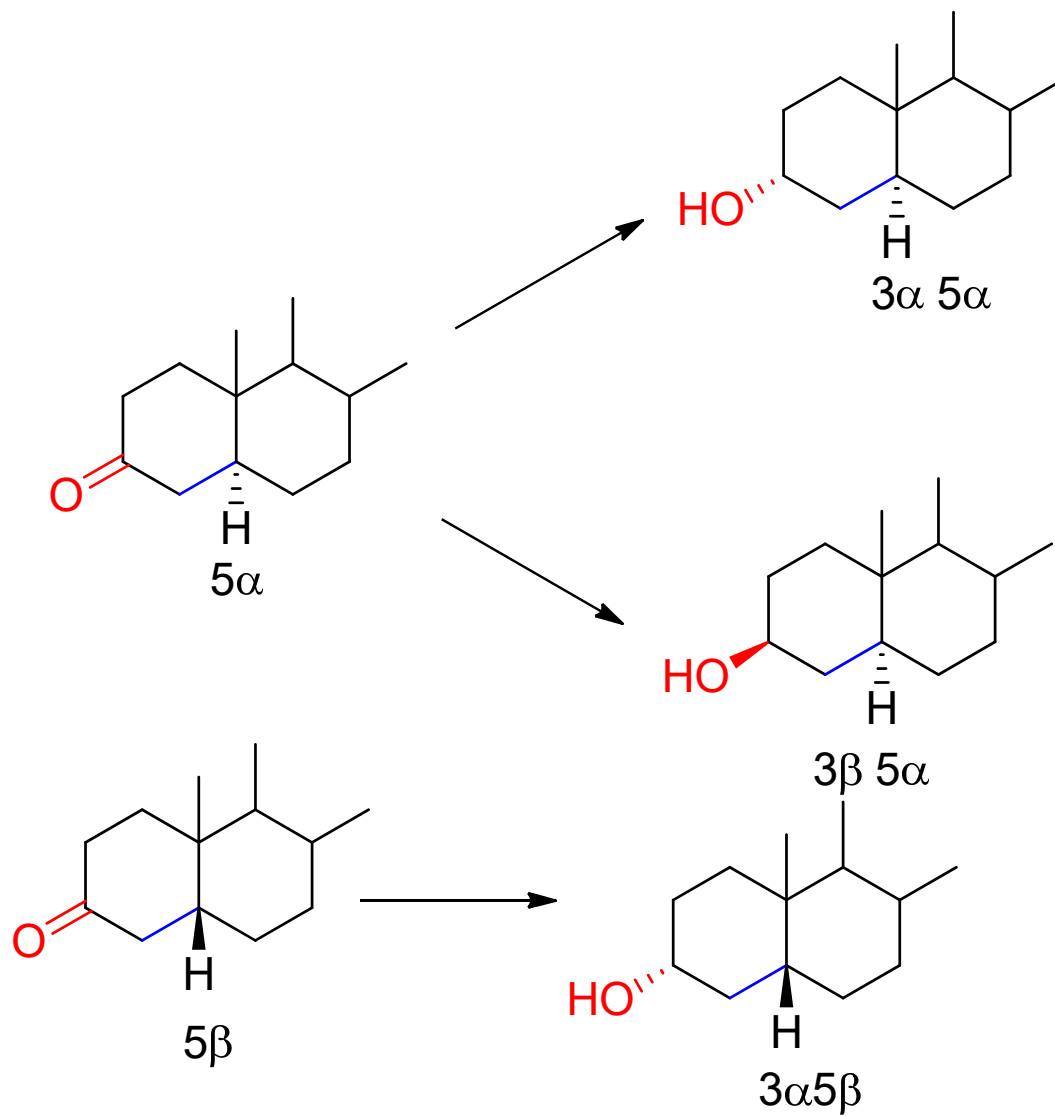
Metabolism of Steroids

Phase-I

- Reduction of the steroid A-ring (3-keto- Δ^4) motif is an essential step for the inactivation of gluco- and mineralocorticoids and controls the peripheral activation and inactivation of androgens.
- A-ring reduction consists of two sequential reductions, namely the reduction of the Δ^4 -double bond followed by the reduction of the 3-keto group to a hydroxy group.
- This leads to the production of a $3\alpha/\beta$ -hydroxy- $5\alpha/\beta$ H motif common to the biologically inactive, excreted metabolites.
- 5α -Reduction is catalyzed by steroid 5α -reductase enzymes.



**Testosterone/
Progesterone**



Phase-II

Sulfation and glucuronidation – increase the polarity and water solubility of the steroids and thereby facilitate their excretion in the urine.

