Glycosides

Introduction & Classification

By

Dr. Mukul Tailang

Professor

School of Studies in Pharmaceutical Sciences

Jiwaji University

Gwalior (M.P.)

GLYCOSIDES

- Glycosides are the molecules in which a sugar part is bound to some other non-sugar part.
- Glycosides play numerous important roles in living organisms.
- Plants store important chemicals in the form of inactive glycosides; if these chemicals are needed, the glycosides are brought in contact with water and an enzyme and the sugar part is broken off, making the chemical available for use.
- Many such plant glycosides are used as medications.

GLYCOSIDES

- Formally, a glycoside is any molecule in which a sugar group is bonded through its anomeric carbon to another group via a **glycosidic bond**.
- The sugar group is known as the **Glycone** and the non-sugar group as the **Aglycone** or **Genin** part of the glycoside.
- The glycone can consist of :
  - Single sugar group (Monosaccharide) or
  - Several sugar groups (Oligosaccharide).

Glycosidal Sugars:

Sugars found in glycosides may be

- **Monosaccharides**
  - **Glucose**
  - **Rhamnose**
  - **Fructose**
- **Deoxysugars (more rare)**
  - **Cymarose**
    - **found in the cardiac glycosides**

TERMS USED TO DESCRIBE GLYCOSIDES

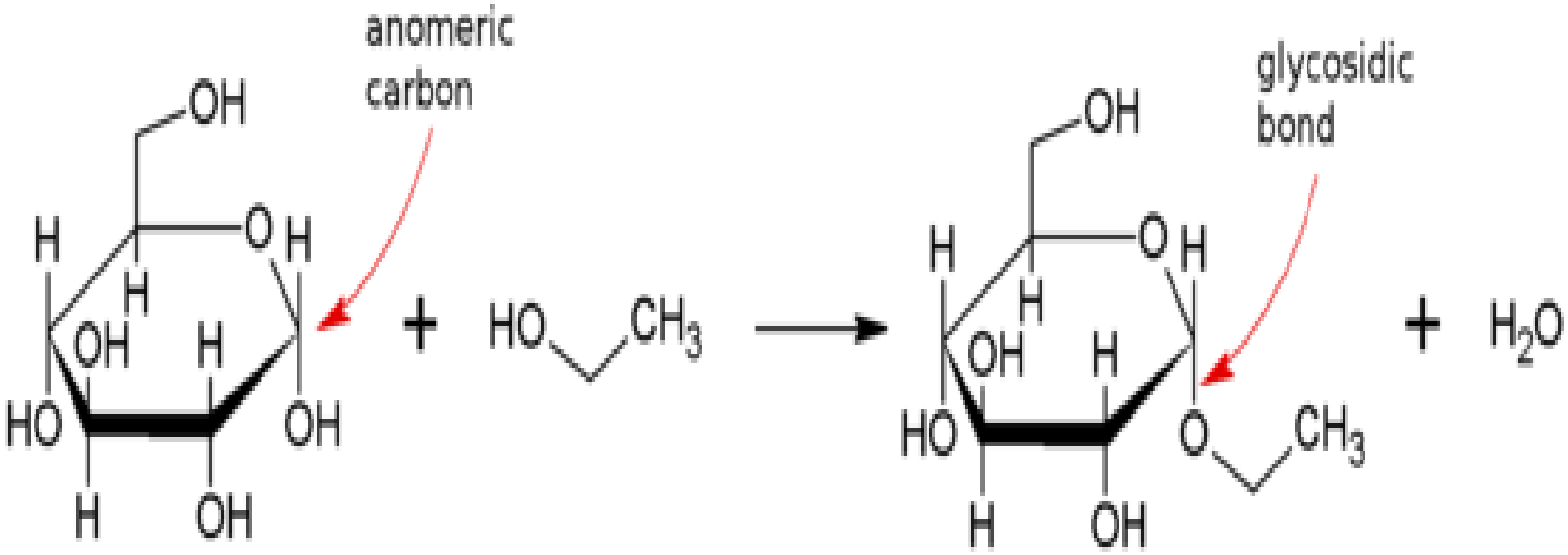
A Glycoside is a

- **Glucoside**
  - **Has glucose as the sugar component**
- **Pentoside**
  - **Has a sugar such as arabinose**
- **Rhamnosides**
  - **Contains rhamnose**
- **Rhanmoglucosides**
  - **Contains both rhamnose and glucose**

Glycosidic bond

- A glycosidic bond is a certain type of a functional group that joins alcoholic group of a Carbohydrate molecule to an aglycone molecule.
- A substance containing a glycosidic bond is a Glycoside.

Glycosidic bond



Classification of Glycosides

Glycosides can be classified by :

- **The nature of Glycone**
- **Number of sugars**
- **Nature of the glycoside**
- **Botanical source**
- **Therapeutic use**
- **The type of Glycosidic Bond**
- **The Glycosidal Linkage and**
- **Chemical nature of Aglycone.**

By Glycones

- If the glycone group of a glycoside is glucose, then the molecule is a **Glucoside**.
- If it is fructose, then the molecule is a **Fructoside**.
- If it is glucuronic acid, then the molecule is a **Glucuronide**.

Number of sugars:

• One sugar	monosides	e.g. Salicin.
• Two sugar	Biosides	e.g. Diosmin.
• Three sugars	Triosides	e.g. Digoxin.

Nature of the glycoside:

- **Primary glycosides:** Originally present in the plant
  - e.g. Purpurea A
- **Secondary glycosides:** Resulted from removal of one sugar from the primary glycosides
  - e.g. Digitoxin

- **Botanical source:**
  - Digitalis glycosides
  - Senna glycosides.
- **Therapeutic use:**
  - Analgesic glycosides.
  - Purgative glycosides.
  - Cardiac glycosides.

Classifications of glycosides according to their therapeutic effects

CHF and cardiac muscles stimulators:

- **Digitalis glycosides: digoxin, digitoxin, gitoxin (Fox glove leaves)**
- **Ouabain: *Strophanthus gratus* seeds**
- **K-strophanthin -*Strophanthus kombe* seeds**
- **Scillaren A,B which isolated from red and white Squill bulbs**
- **Convolloside: *Convallaria majalis* – Lily of the Valley.**

Laxative group of glycosides:

- Sennoside A,B,C,D (Senna leaves and fruits)
- Cascaroside A,B (Cascara bark)
- Frangulin and glucofrangulin (Frangula bark)
- Aloin and barbaloin (Aloe vera and A. barbadensis)

Local irritant group:

- Sinigrin (Black mustered seeds_Brassica nigra)
- Sinalbin (White mustered seeds_Brasica alba)

Analgesics and antipyretics:

- Salicin $\xrightarrow{\text{hydrolysis}}$ Salisylic acid (Willow or Salix bark)

Keeping elasticity of blood vessels like:

- Rutin, Rutoside (Bitter orange peels, Lemon peels)

Anti-inflammatory group:

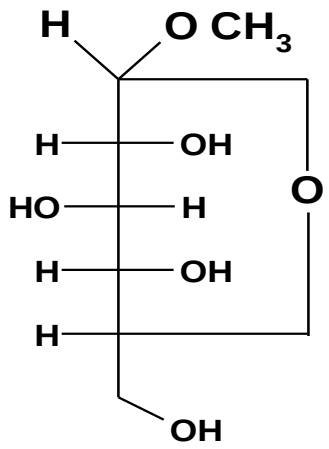
- Aloin for acne &
- Glycyrrhizinin the treatment of peptic ulcer

By type of glycosidic bond

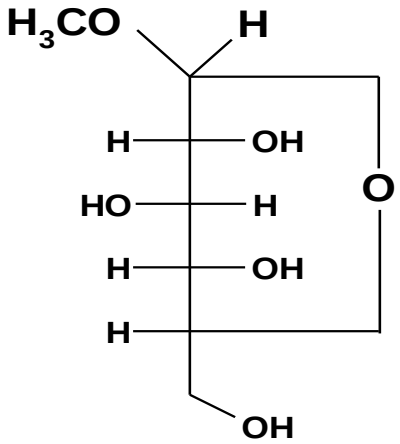
Depending on whether the glycosidic bond lies "above" or "below" the plane of the cyclic sugar molecule, glycosides are classified as:

- **»α-glycosides**
- **»β-glycosides**

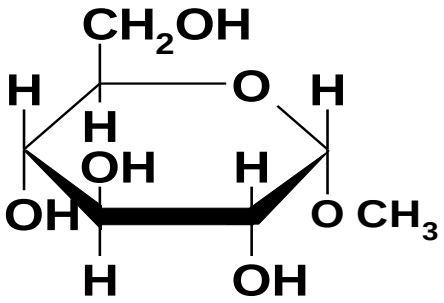
α- & β-glycosides



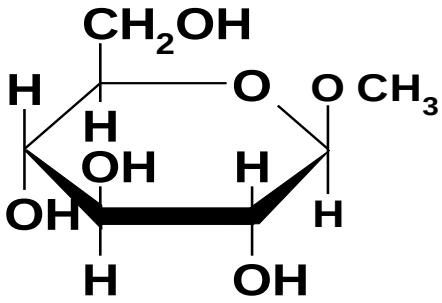
α – methyl glucoside



β – methyl glucoside



α – methyl glucoside

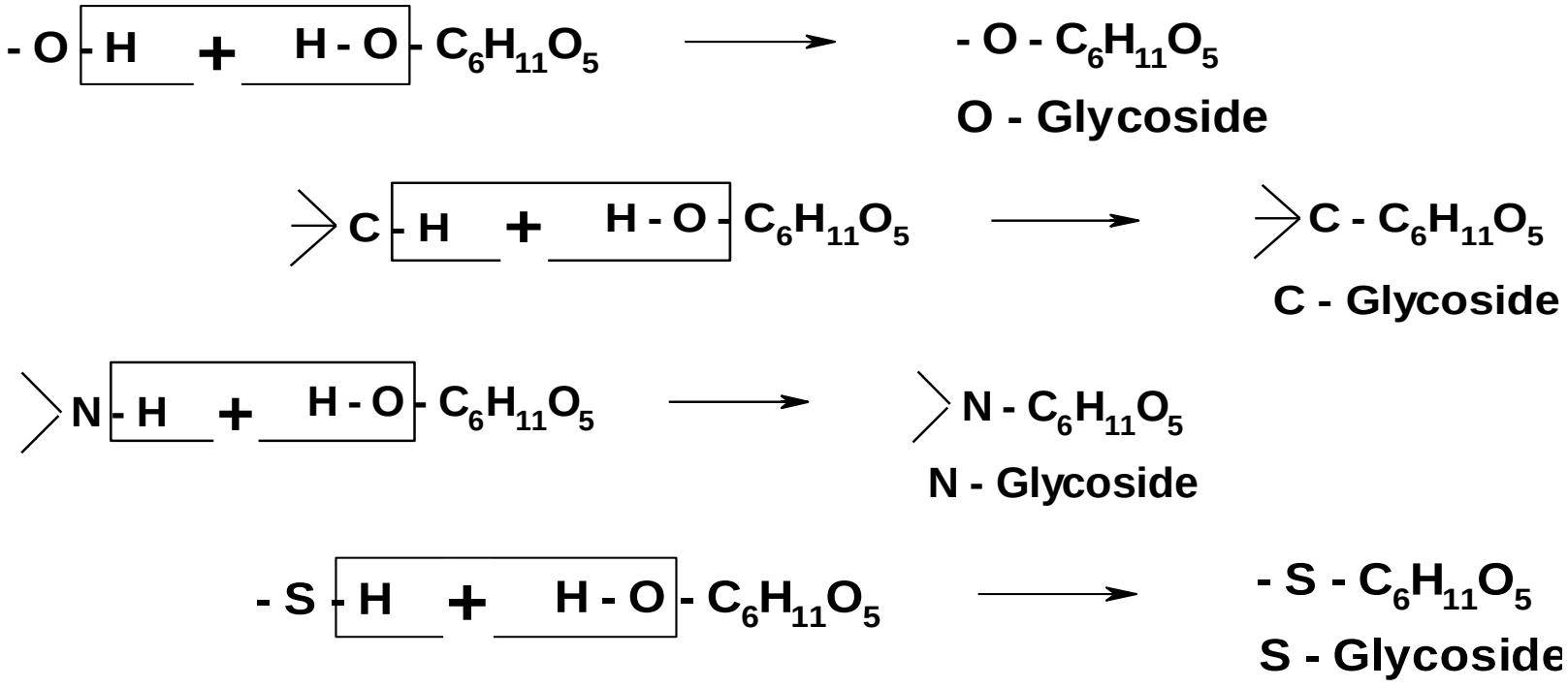


β – methyl glucoside

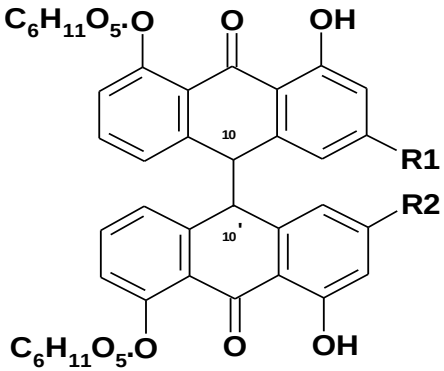
By Linkage

Atom from the aglycone involved in the glycosidic linkage:

Aglycone- O- Sugar	**O-glycosides**
Aglycone- C- Sugar	**C-glycosides**
Aglycone- S- Sugar	**S-glycosides**
Aglycone- N- Sugar	**N-glycosides**

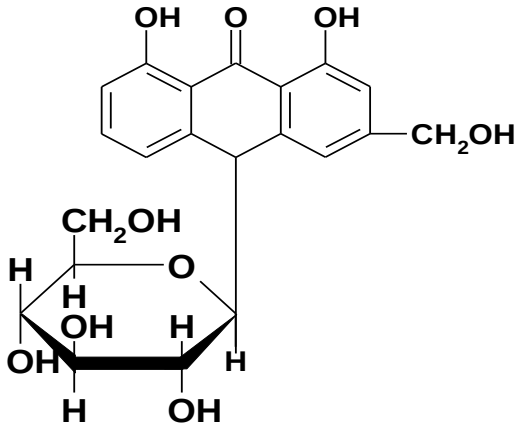


O,C,S & N – GLYCOSIDES



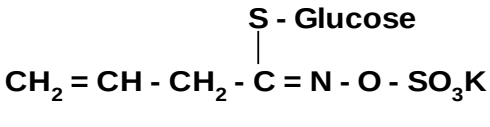
Sennoside

(O - Glycoside)



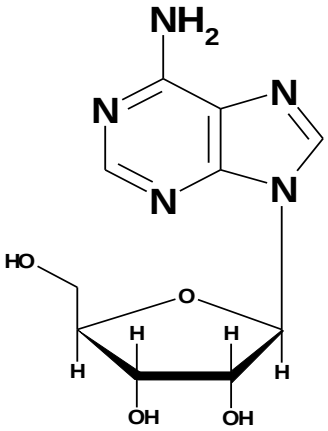
Barbaloin

(C - Glycoside)



Sinigrin

(S - Glycoside)



Adenosine

(N - Glycoside)

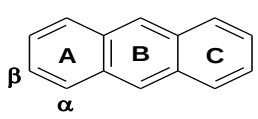
By aglycone

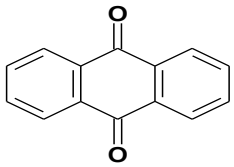
☞Glycosides are also classified according to the chemical nature of the aglycone.

☞For purposes of biochemistry and pharmacology, this is the most useful classification.

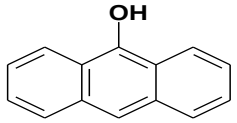
- Anthraquinone glycosides
- Simple phenolic glycoside
- Thioglycosides
- Flavonoid glycosides
- Steroidal glycosides or cardiac glycosides.
- Saponins
- Coumarin glycosides
- Cyanogenic glycosides

Anthraquinone glycosides

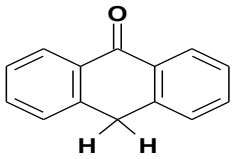




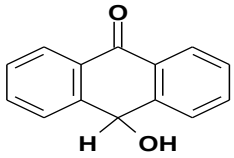
(I) Anthraquinone



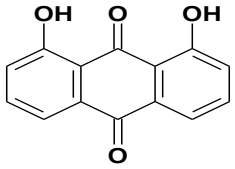
(II) Anthranol



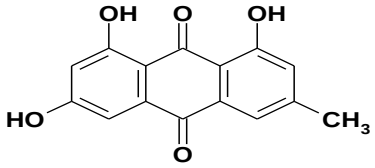
(III) Anthrone



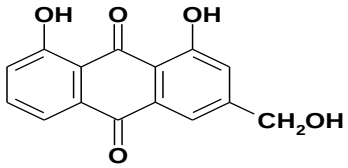
(IV) Oxyanthrone



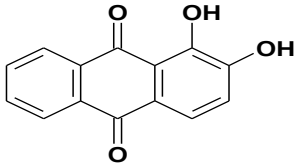
Fizacine



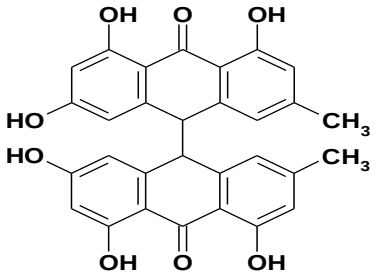
Emodine



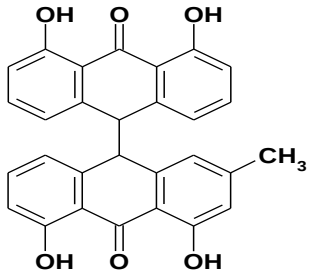
Aloe emodine



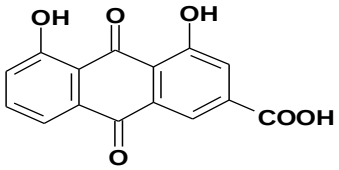
Alizarine



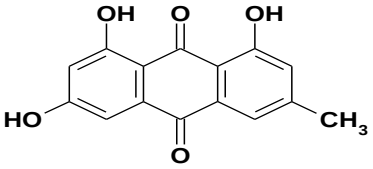
Emodindianthron



Rizofanoldianthron

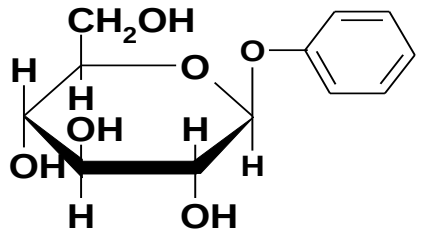


Rhein

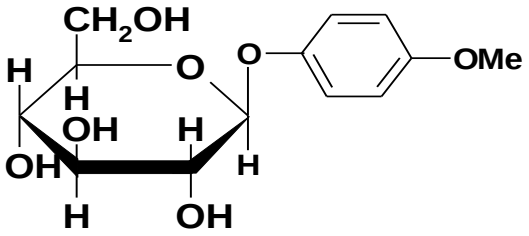


Frangula emodine

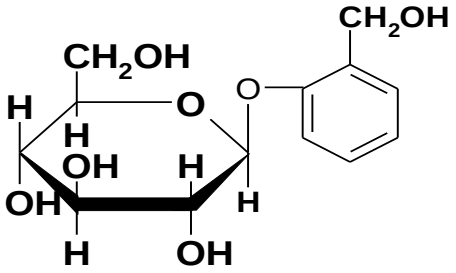
Simple phenolic glycoside



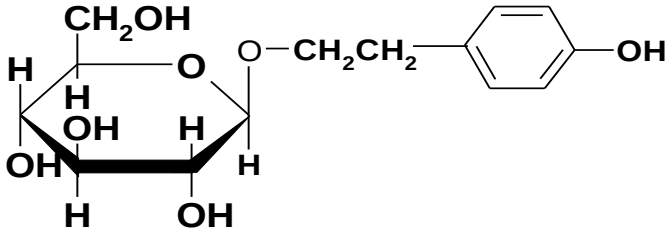
Arbutin



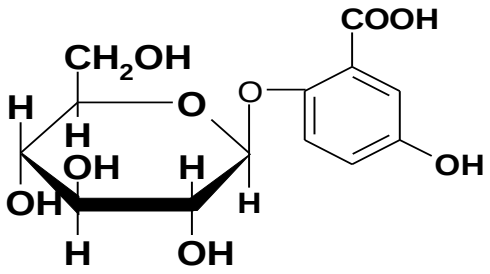
Methyl arbutin



Salicine

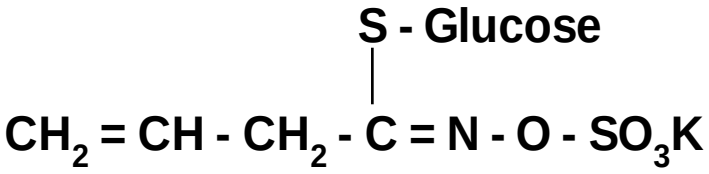


Salidrozine

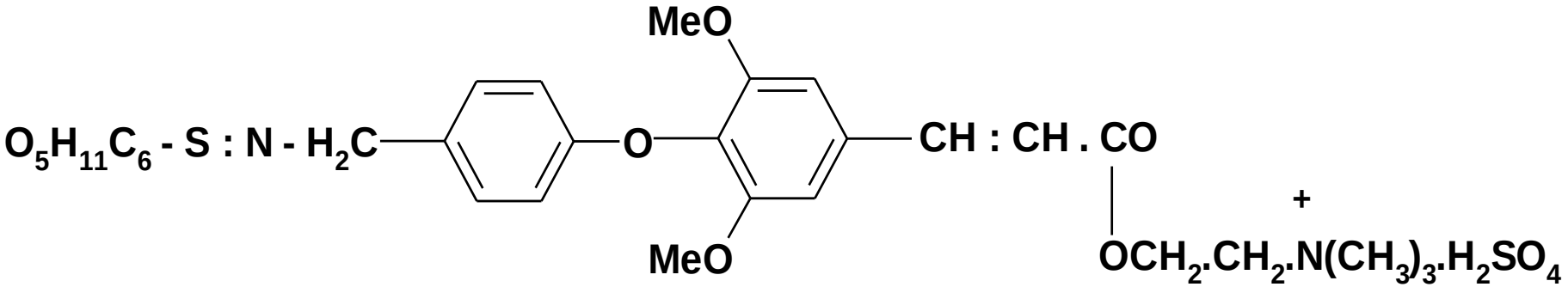


Glycoside of Salysilic acid

Thioglycosides

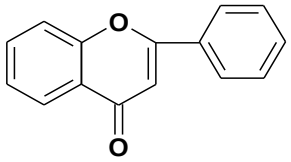


Sinigrin

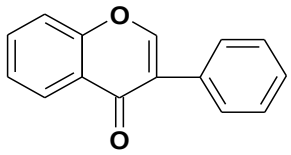


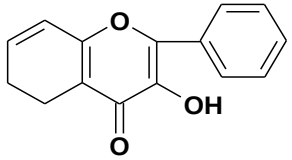
Sinalbin

Flavonoid glycosides

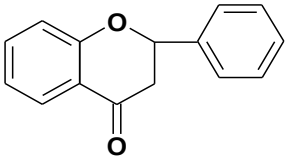


Flavone

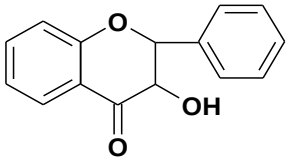




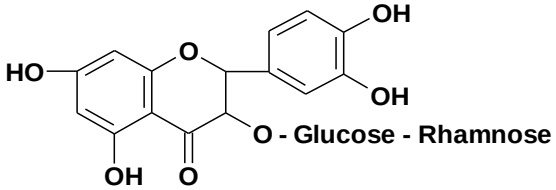
Flavanol



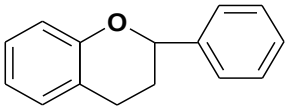
Flavanone



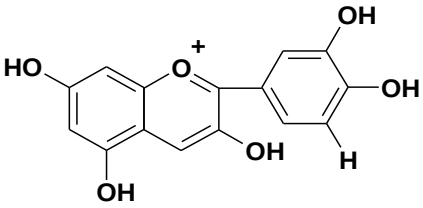
Flavanonol



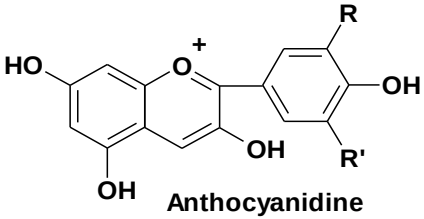
Rutin



Flavan



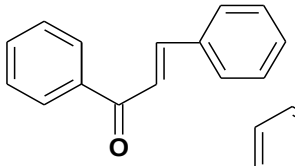
Cynadine



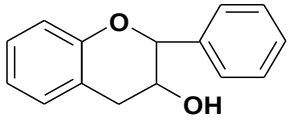
Anthocyanidine

Pelargonidine - R=H, R'=H

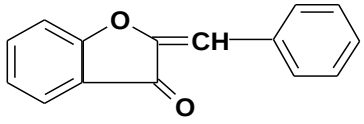
Cynadine - R=OH, R'=H



Chalcone



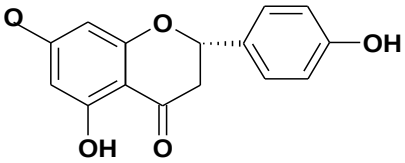
Catechine



Aurones

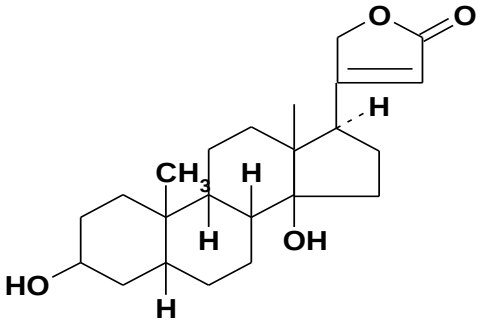
Rhamnose

Glucose - O

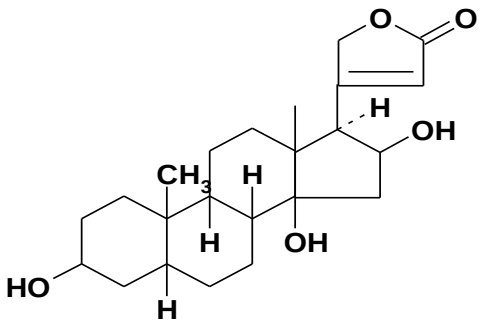


Naringin

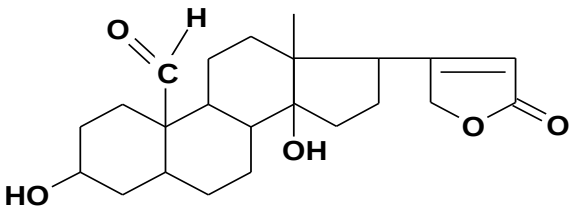
Steroidal glycosides or cardiac glycosides



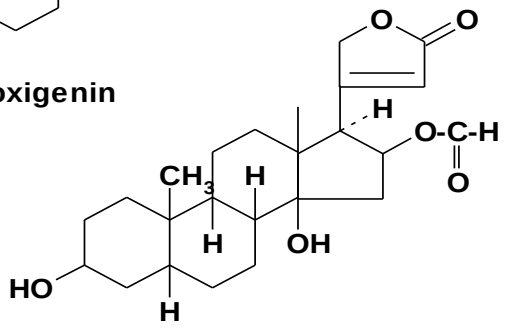
Digitoxigenin



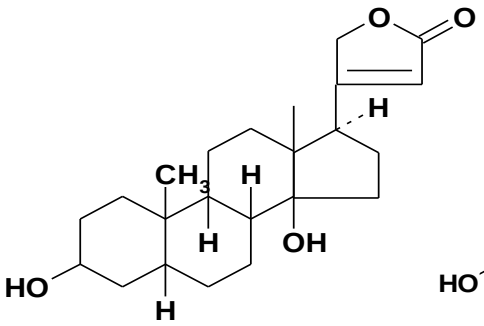
Gitoxigenin



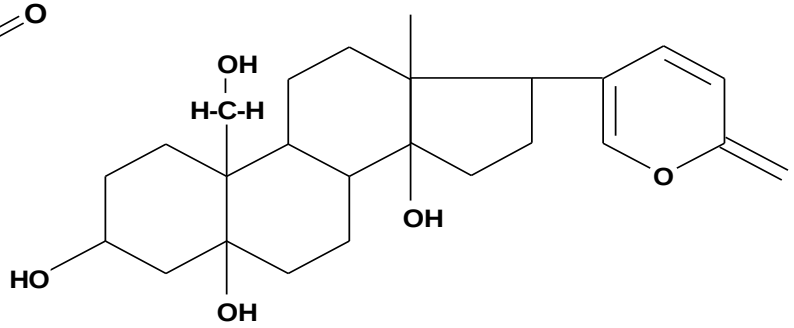
Strophanthidin



Gitaloxigenin

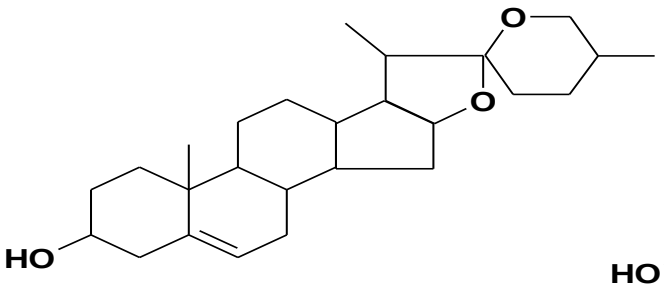


Digitoxigenin

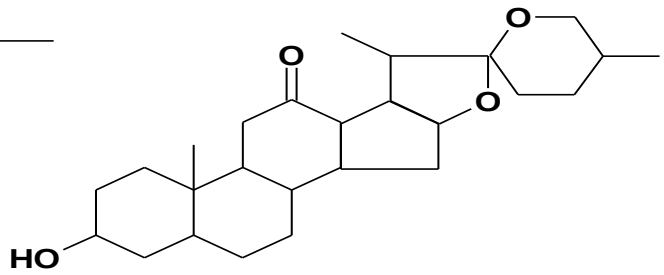


Gellebrigenol

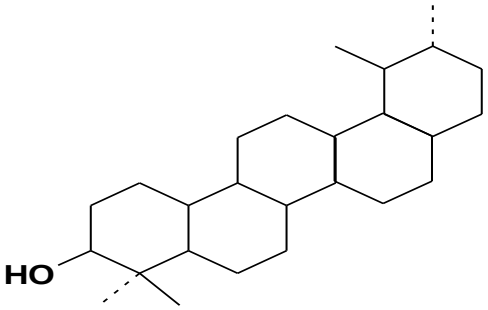
Saponins



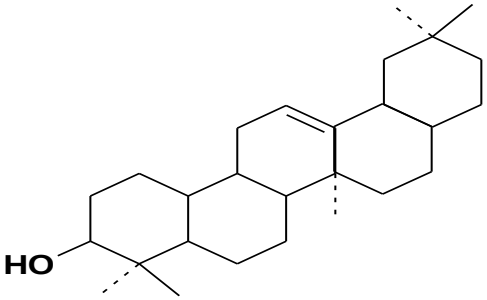
Diosgenin



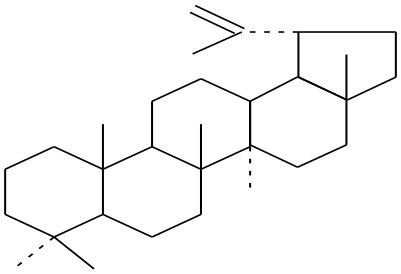
Hecogenin



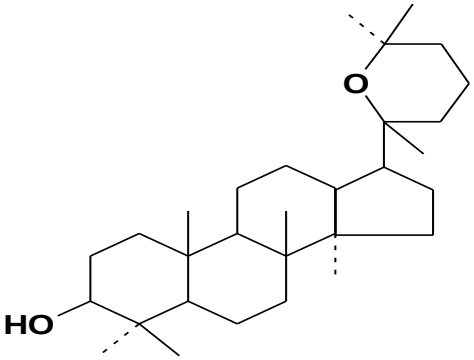
α-amyrin



β-amyrin

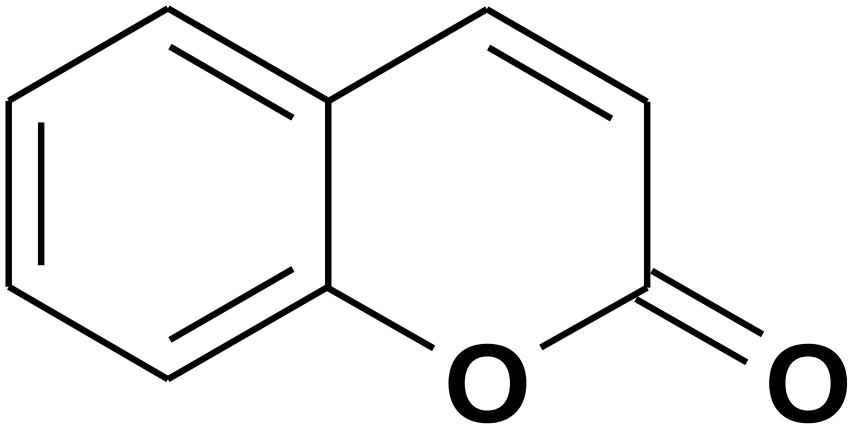


Lupeol



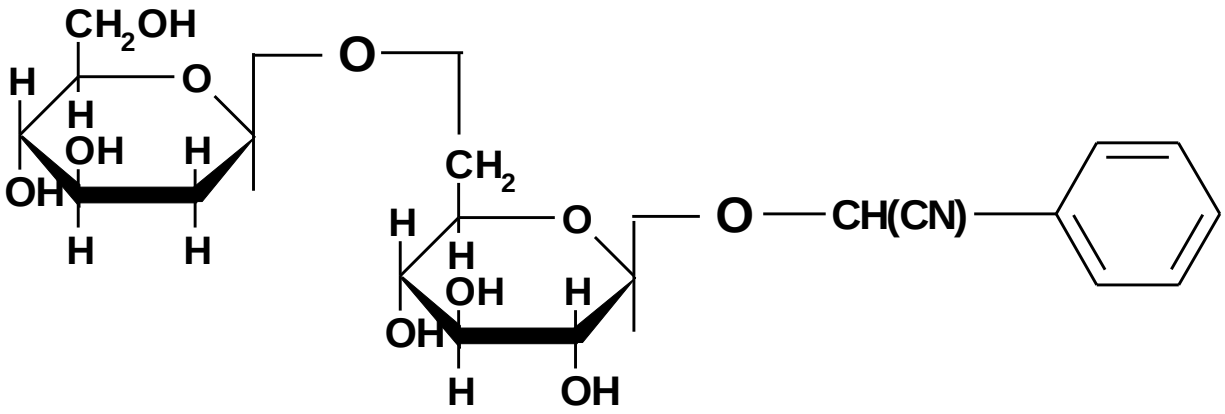
Damaran

Coumarin glycosides

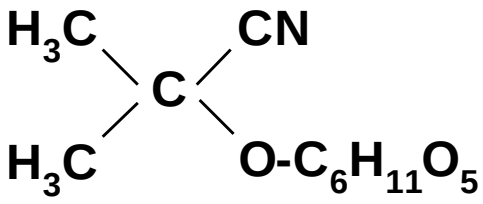


Coumarin

Cyanogenic glycosides



Amygdalin



Linamarin