Saponins: Part-1

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Learning Outcomes

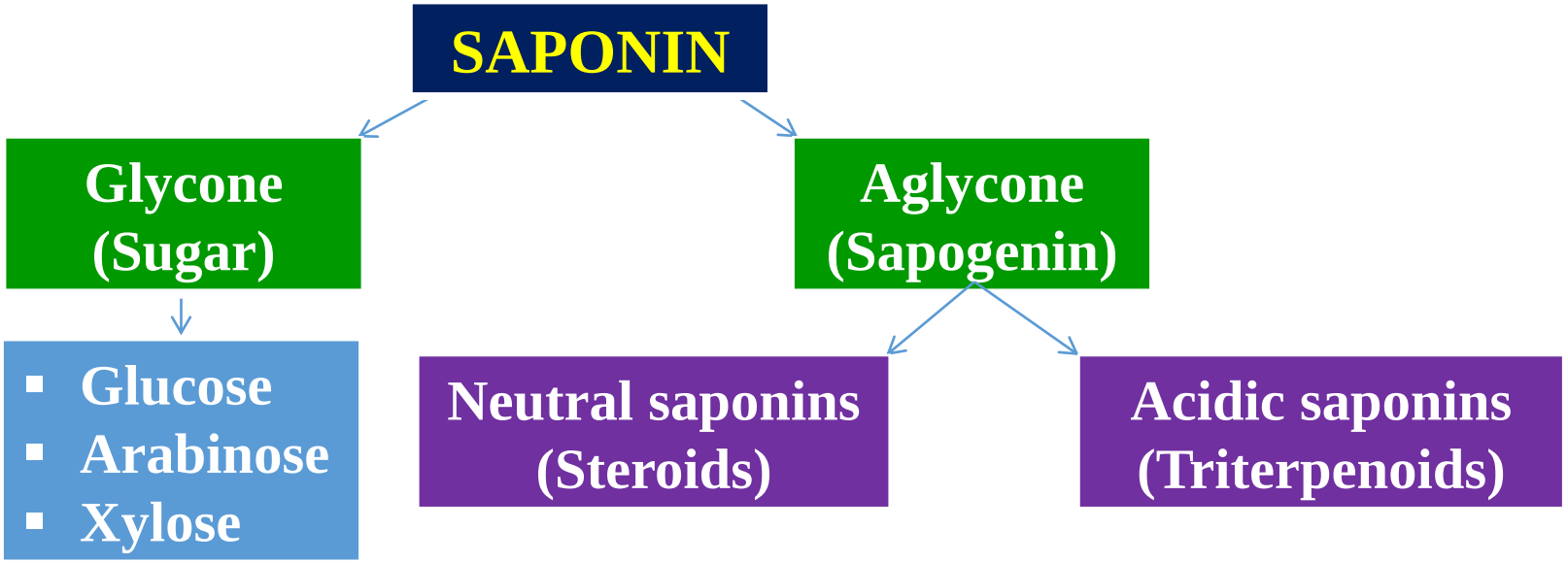
- **At the end of this lesson students will be able to**
  - **Define saponins**
  - **Classify different types of saponins**
  - **Properties of saponins**
  - **Neutral saponins**
  - **Acidic saponins**
  - **Biosynthesis of saponins**

SAPONINS

- Saponins are glycosides
- On hydrolysis yields **sugar** & **aglycone** known as "**sapogenin**".

Classification of Saponins:

- Two (2) types based on the chemical structure of the aglycone
- **Neutral saponins** (Steroidal saponins)
- **Acidic saponins** (Triterpenoidal saponins)



Characteristic Features of Saponins

- Amphiphilic in nature and possess surface-active properties
- Carbohydrate moiety is water-soluble and sapogenin is fat-soluble
- Forms **colloidal solution in water**
- They can **modify and lower the surface tension** and produce **soap-like foam** or **froth of aqueous solutions** when shaken.
  - Used to increase the **foaming of beer**.
  - Used as **detergents** for cleaning industrial equipment
  - **Emulsifier** of certain resins, fats and fixed oils.

Characteristic Features of Saponins

- All saponins can cause **hemolysis of red blood corpuscles (RBC)** and destroy them.
- They are **highly toxic when injected** into the blood stream.
- **BUT harmless when taken by mouth,**
  - because they **cannot be absorbed from the intestinal tract**.
- **Note -** if a plant contains hemolytic substances, it is not a proof that it contains saponins, the action could be due to other plant constituents.

- They are used as **fish poisons**
  - they **accumulate in gills preventing O_2 transfer**
- They are used in **synthesis of corticosteroids like cortisone**.

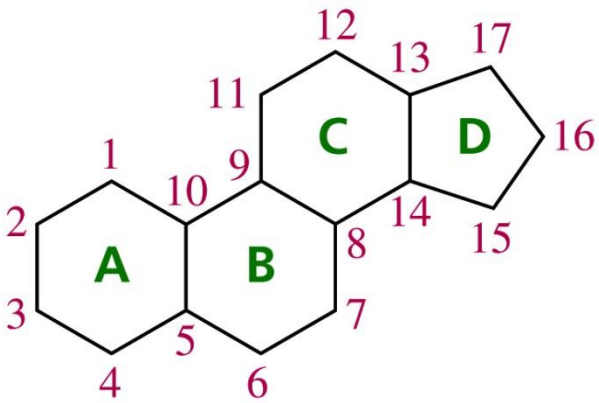
Characteristic Features of Saponins

- **Sarsaparilla** - a soft drink
  - It is originally made from the *Smilax regelii* plant (Jamaican sarsaparilla), **Family**: Liliaceae
  - Sometimes made with artificial flavours ☹
  - It is rich in saponins
  - Preparation of **non-alcoholic beverages**.

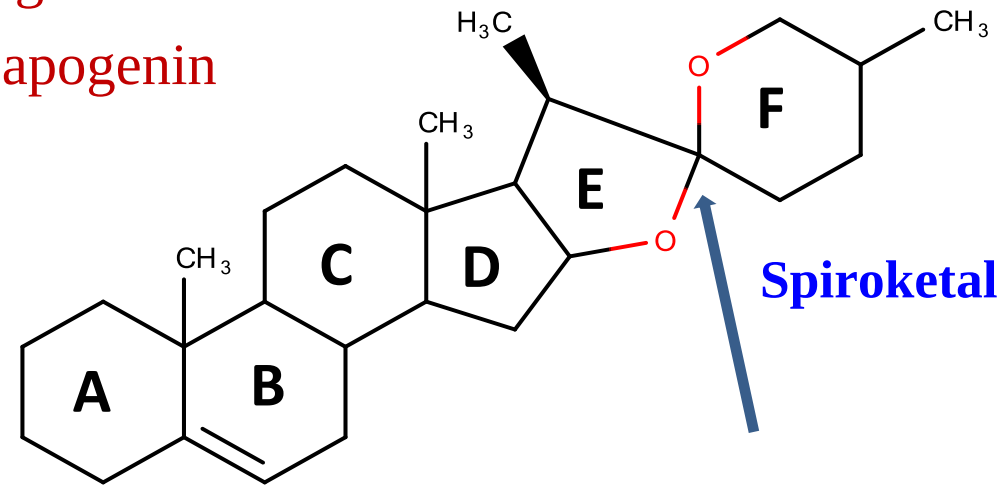
  - **Therapeutic Uses:**
  - Treatment of **syphilis**, **leprosy**, **psoriasis**.
  - Medicinally used part: **ROOT**
  - **Doses:**
    - 0.3 to 2 g/day of the powdered root
  - **Contraindications**:
    - Not yet identified

Neutral Saponins

- **Steroidal saponin glycosides** which contain **spiroketal side chain**.
- Two rings **E** and **F** called **ketal** because they are attached through **two oxygen atoms** and called **spiral** because they are **not on the same level.**
- Less distributed in nature comparing to Triterpenoidal saponins.
- **Used mainly as precursors** for the **partial synthesis of sex hormones and corticosteroids**.
- Drugs containing Steroidal saponins such as:
  - *Discoria* species — Diosgenin
  - *Sarsaparilla* Roots — Sarsapogenin



the steroid ring system

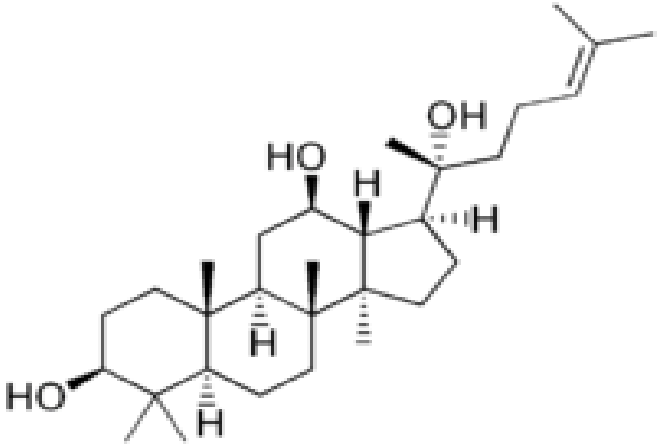


Spiroketal

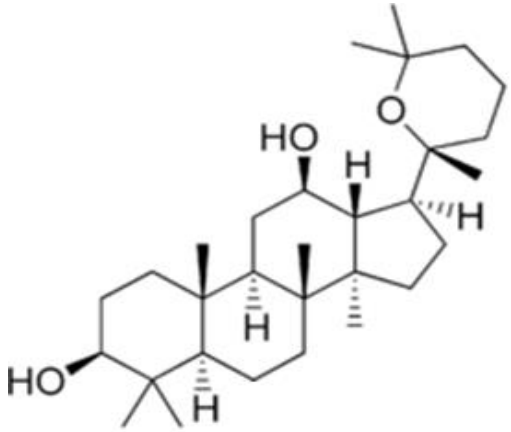
Spiroketal steroid nucleus (Diosgenin)

Acidic Saponins

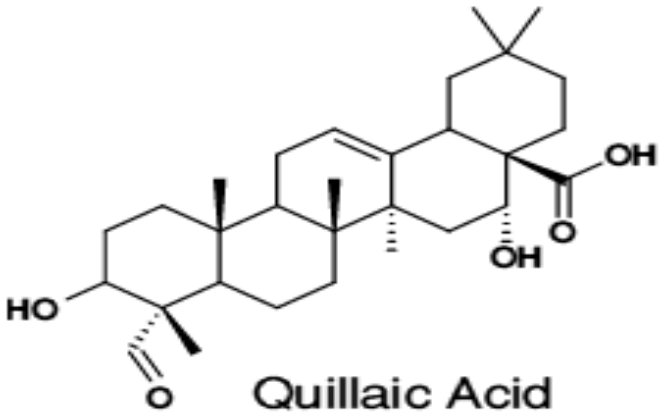
- They are triterpenoidal saponins
  - contain **triterpene structure** with **30 C-atoms**.
- **More distributed in nature** as compared to steroidal glycosides
- Classified into two groups based on the carbon skeletons of their aglycones
  - **Dammarane family:** Dammarane is a **tetracyclic** triterpene
    - Protopanaxadiols, panaxadiols and panaxatriols
  - **Oleanane family:** Natural **pentacyclic** triterpene



Protopanaxadiol



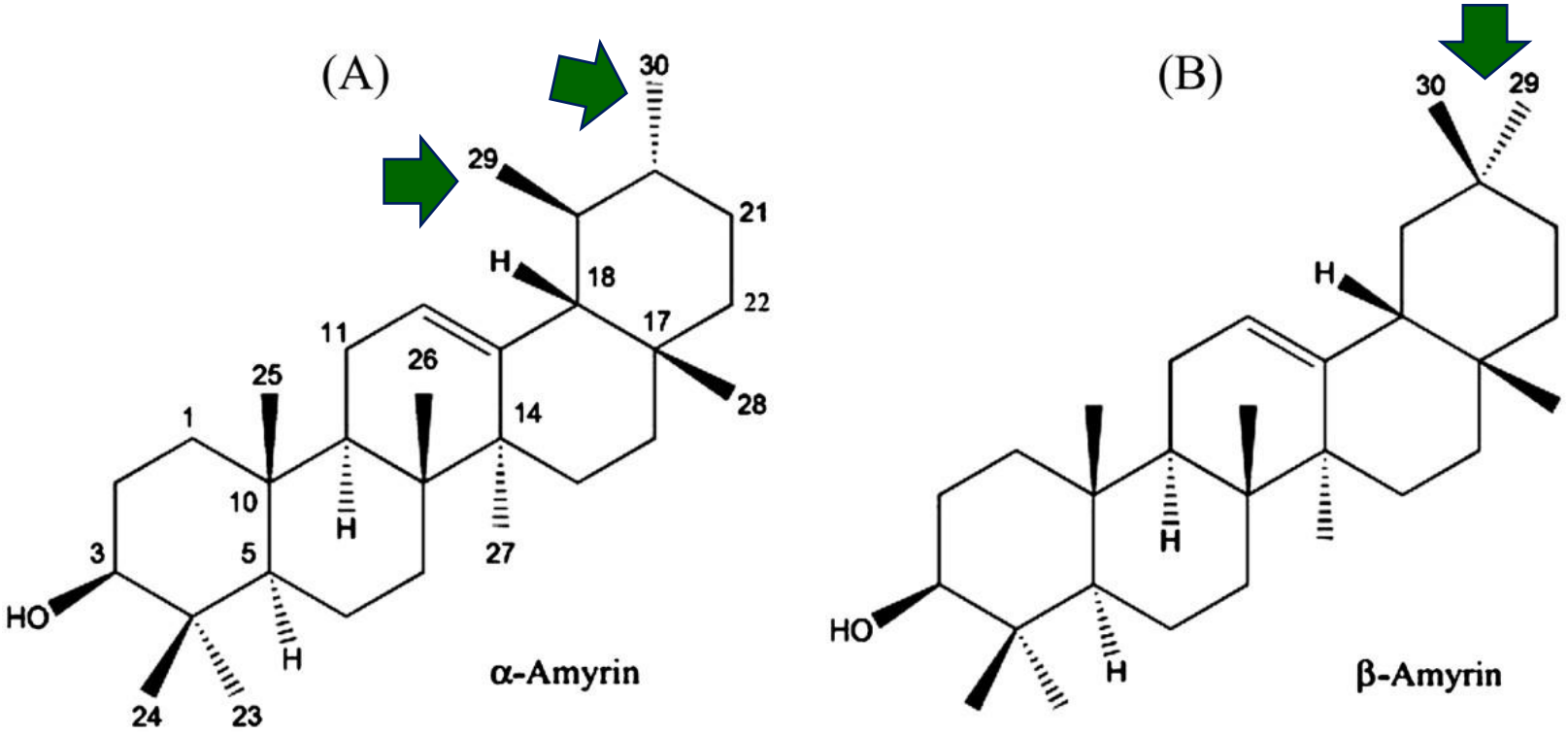
Panaxadiol



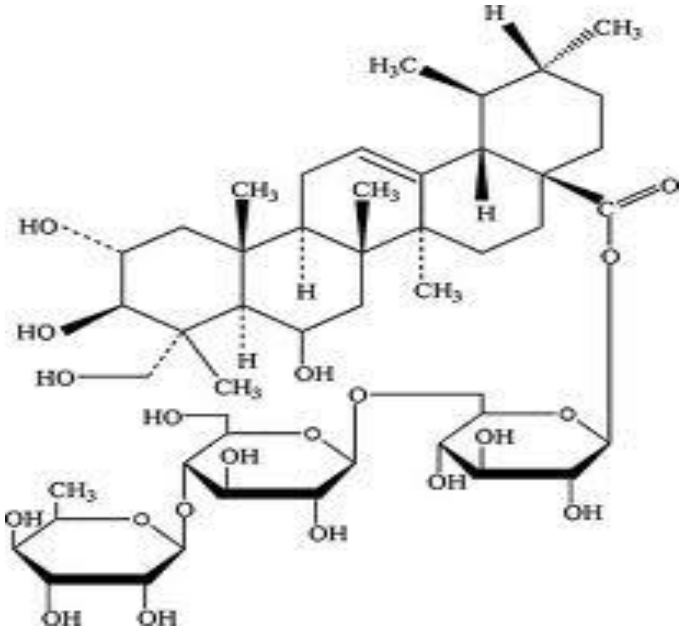
Quillaic Acid

Pentacyclic Triterpenoidal Acidic Saponins

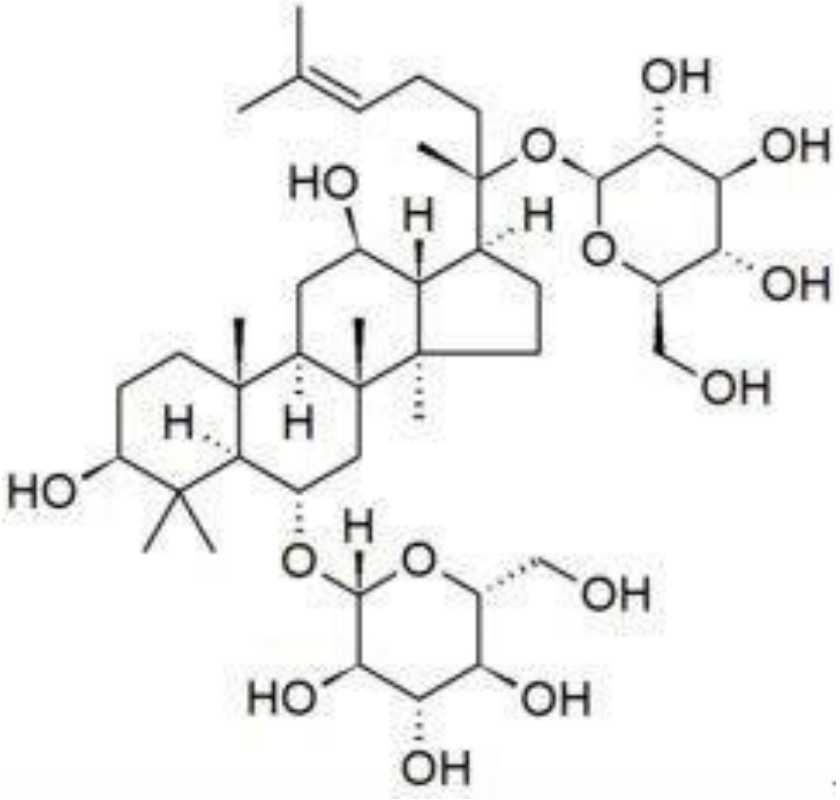
- The are either derivatives of **α and β-amyrin.**
- **Amyrin is** (organic compound) either of two isomeric triterpenoids found in some vegetable oils and resins.



Pentacyclic Triterpenoidal Acidic Saponins (Examples)



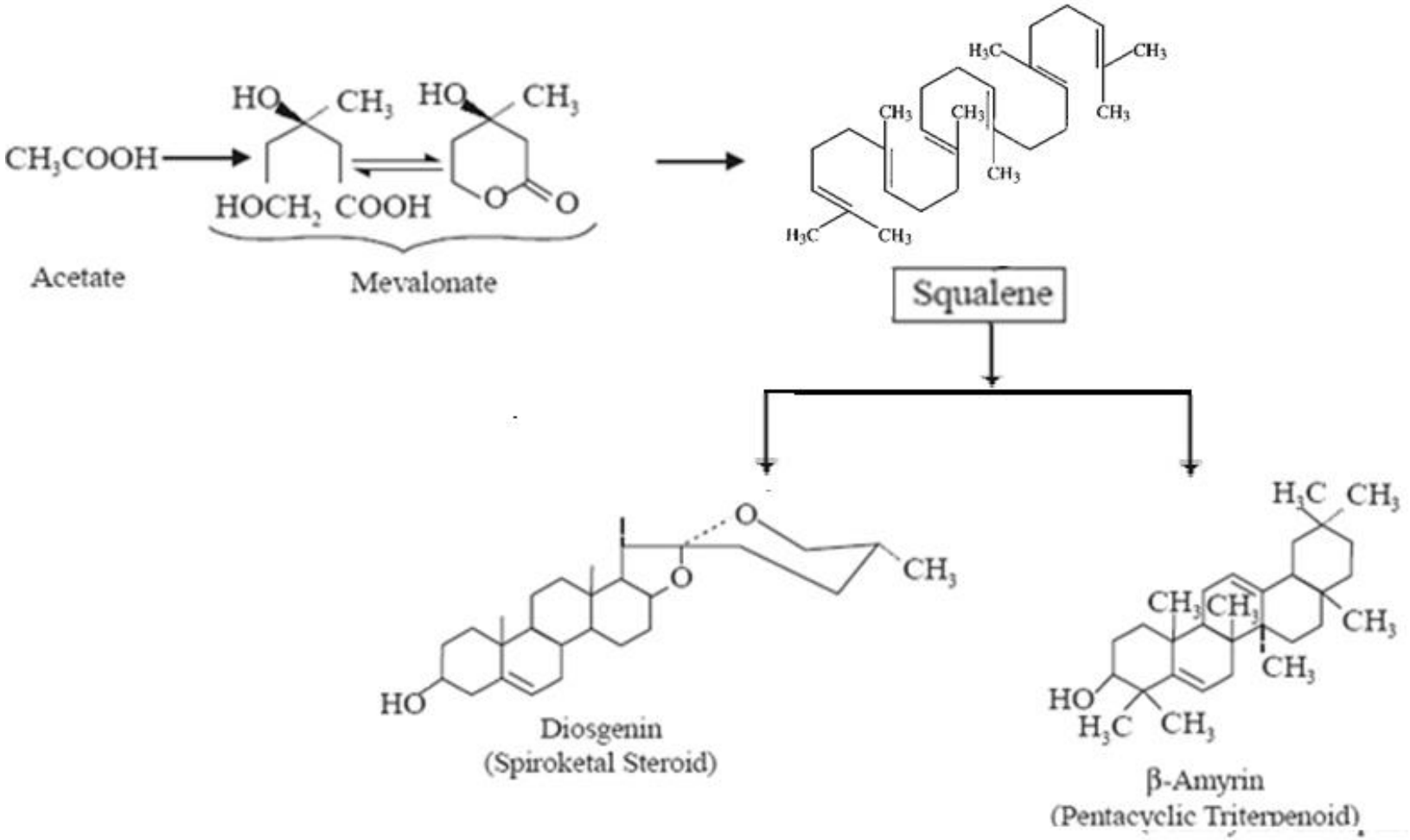
Asiaticoside (Centelloside)



Panaxoside A

Biosynthesis of Saponin Glycosides

- Biosynthesis of saponin glycosides is same as that of cardiac glycosides
- Starts from **acetate** through **mevalonic acid** to **squalene**
- **Squalene** forms by **head-to-tail conjugation** fashion of isoprene units
- Squalene then converts to either **triterpenoid** or **spiroketal** steroids.



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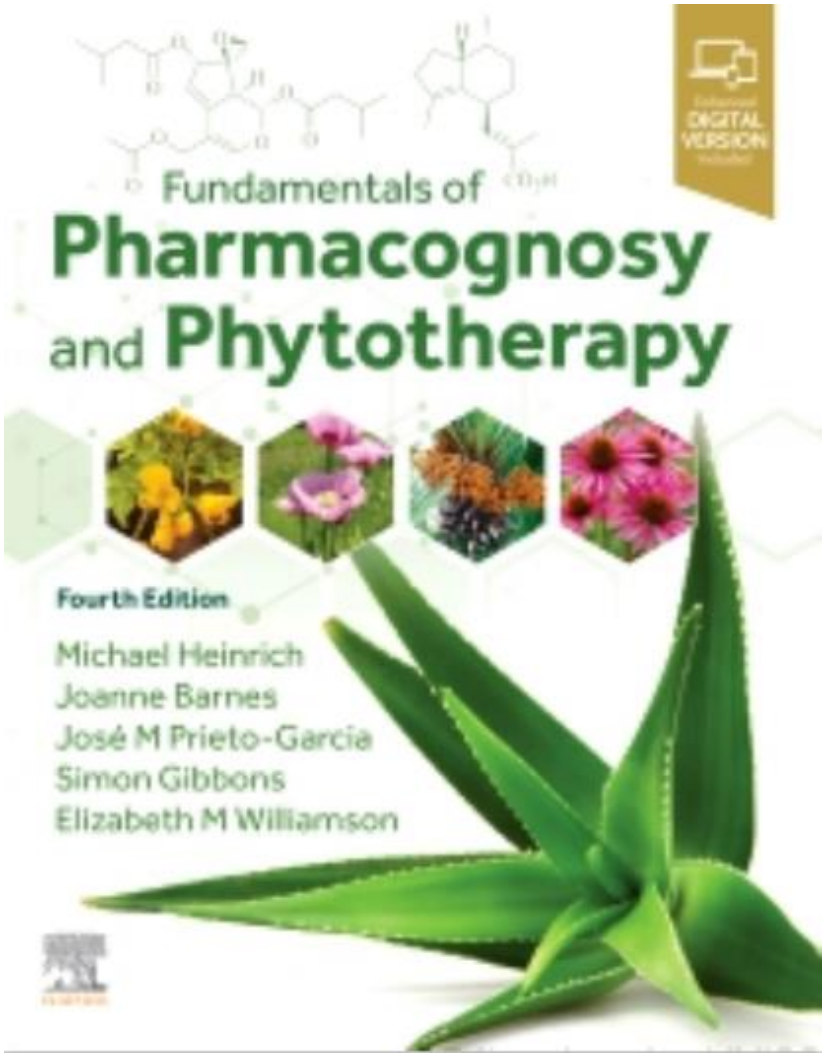
BOOKS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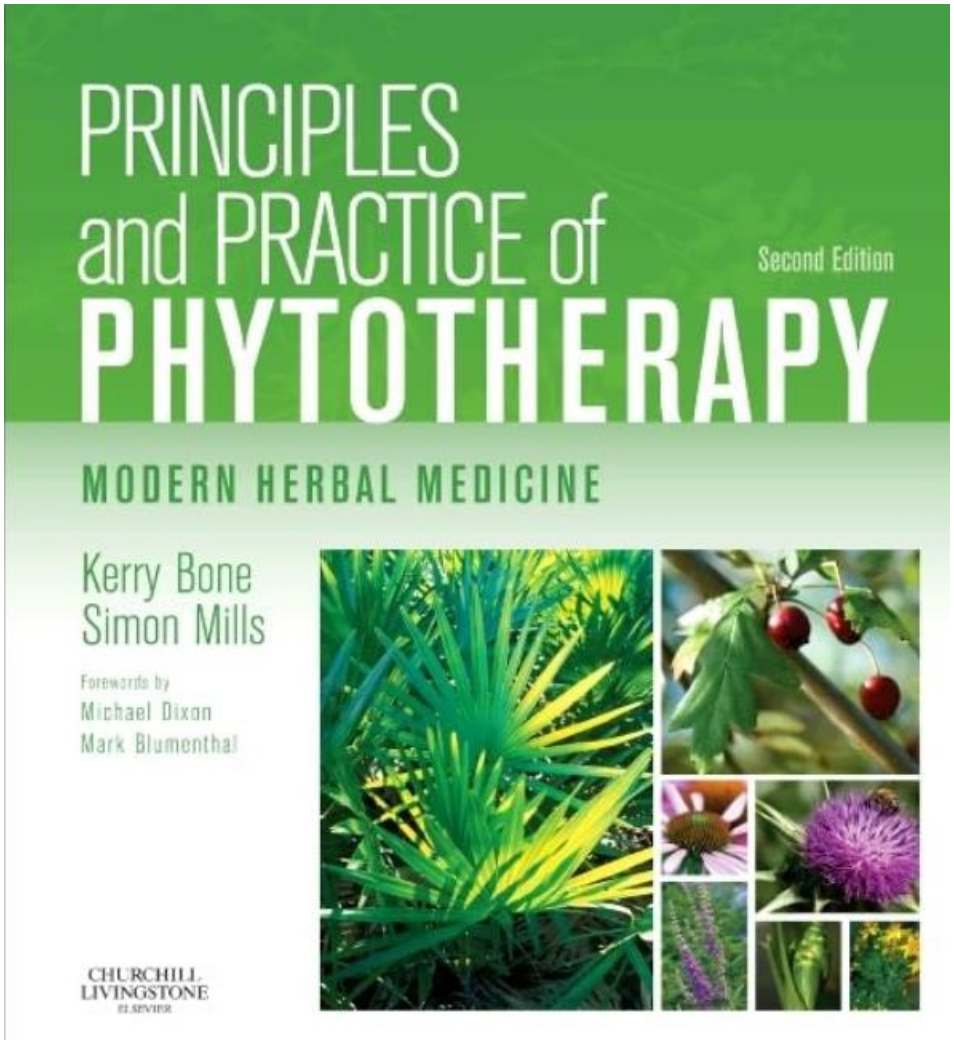
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