



Pharmacognosy and Phytochemistry

Alkaloids-Part 8

B. Pharm. Semester-1

Course Code: 0510221; Session: 2022-2023

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Learning Outcomes

At the end of this lesson, students will be able to explain

Imidazole group of alkaloids: Pilocarpine

Xanthine alkaloids: Caffeine, Theophylline, Theobromine

Benzophenanthridine alkaloid: Sanguinarine

Bisindole alkaloid: Toxiferine

Objective

The objective of this course is to give to the students of pharmacy the basic knowledge about the alkaloids as major phytoconstituents.

Imidazole group of alkaloids: Pilocarpine

Pilocarpine

Botanical sources: *Pilocarpus jaborandi*

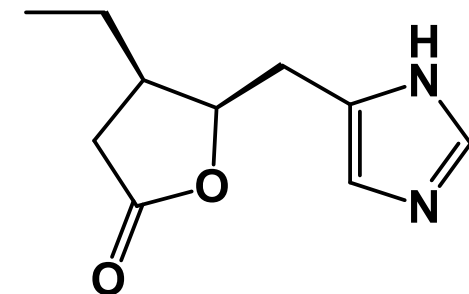
Family: **Rutaceae**.

الفصيلة السذابية هي فصيلة نباتية تشمل مجموعة الحمضيات.

Pharmacological effect: parasympathomimetic.

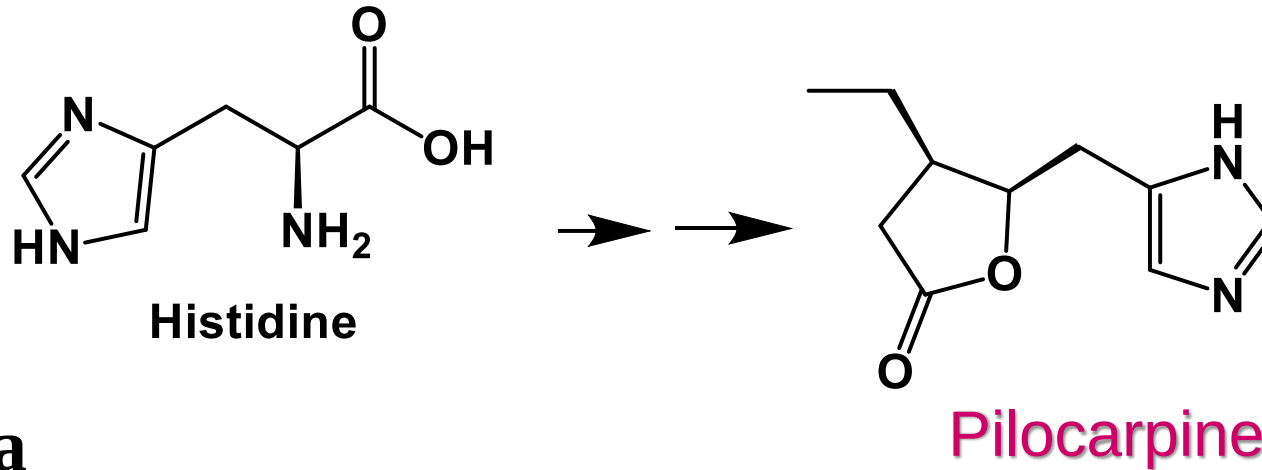
Uses: in glaucoma (wide and narrow angle Glaucoma).

Side effect: bronchoconstriction (bronchial contraction), bradycardia, It is not the first choice for glaucoma because of headache and increase in lacrimation.



Pilocarpine

Uses of Pilocarpine



1. Glaucoma

2. Xerostomia

(a subjective feeling of a dry mouth) for example after radiotherapy.

3. Sjogren's syndrome, which is an autoimmune disease characterized by dysfunction of the lacrimal and salivary glands.



Xanthine Alkaloids

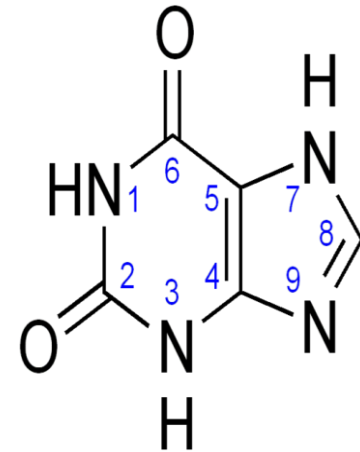
❖ The most important alkaloids in this group are the alkaloids derived from the xanthine nucleus (oxidized purine), and these are:

1. Caffeine, 2. Theophylline and 3. Theobromine.

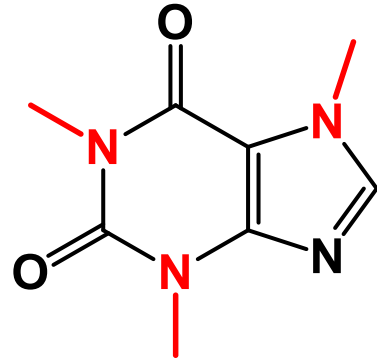
Botanical sources:-

1. *Cola nitida* (from coat of seeds).
2. *Thea sinensis* or *Camellia sinensis* (from leaves).
3. *Coffea arabica* (from seeds).
4. *Guarana* (from seeds).
5. *Theobroma cacao* (from seeds). (notice the difference between coca and cacao).

Xanthine nucleus



Xanthine Alkaloids: Structures

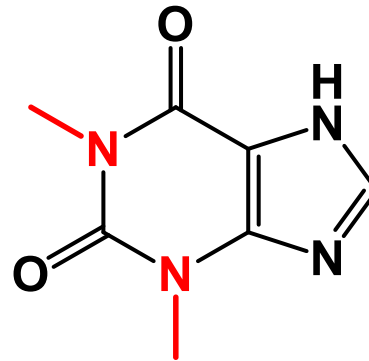


Caffeine

(1,3,7-trimethylxanthine)



Mainly: CNS stimulant

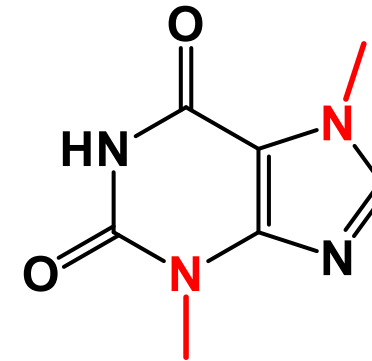


Theophylline

(1,3-dimethylxanthine)



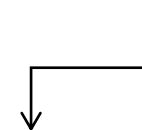
**Mainly: Bronchodilator
and Diuretic**



Theobromine

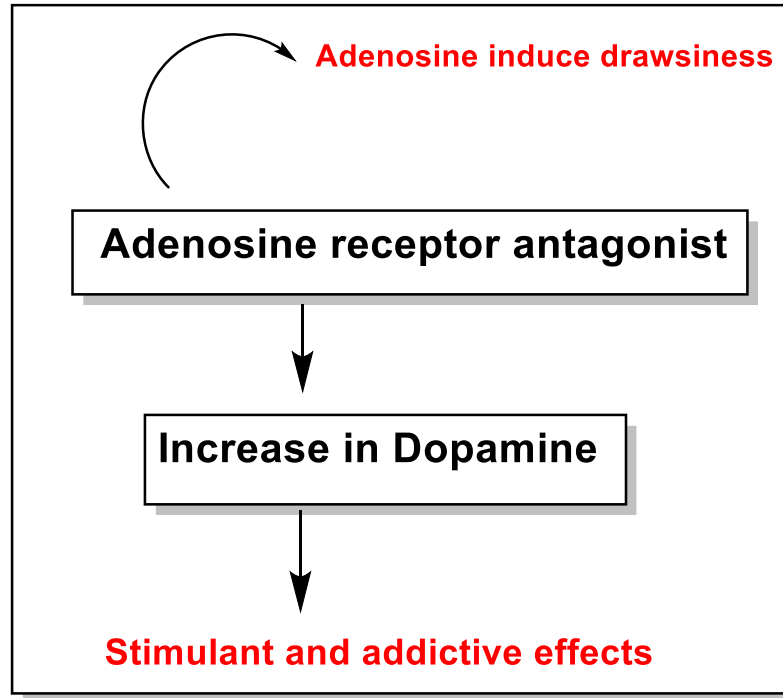
(3,7-dimethylxanthine)

Mainly: Diuretic

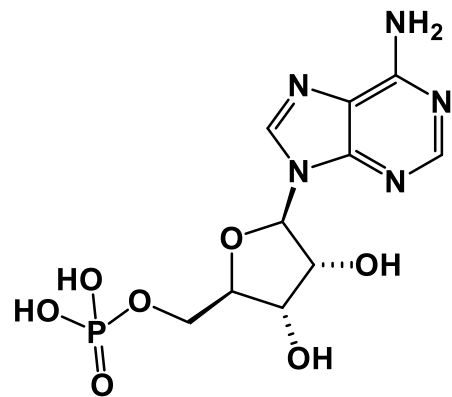
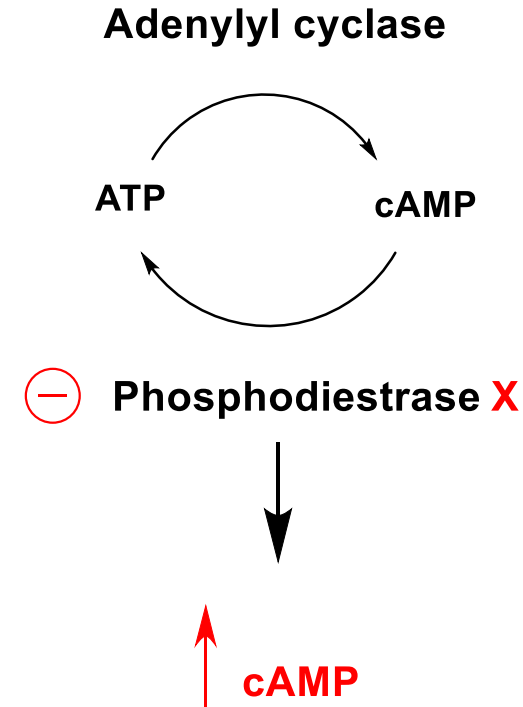


It is the major methylxanthine in mature seeds
of **Theobroma cacao** (cacao)

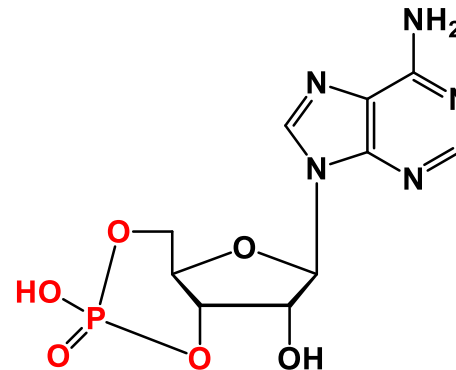
Mechanism of action



Synergism with catechol amines



adenosine monophosphate



cyclic adenosine monophosphate

cAMP

A second messenger for intracellular signal transduction

Caffeine



Uses of Caffeine:

1. CNS stimulant effect.
2. Smooth Muscle relaxant.

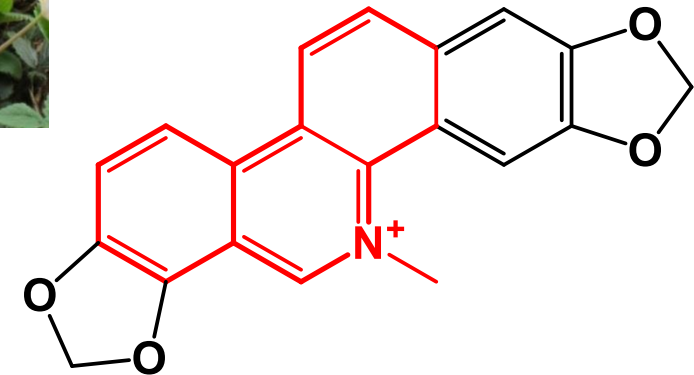
For **cardiac edema** and **angiana pectoris**
(because of the diuretic and vasodialting effects, **especially for theobromine**).



Theobroma cacao

Benzophenanthridine alkaloid: Sanguinarine

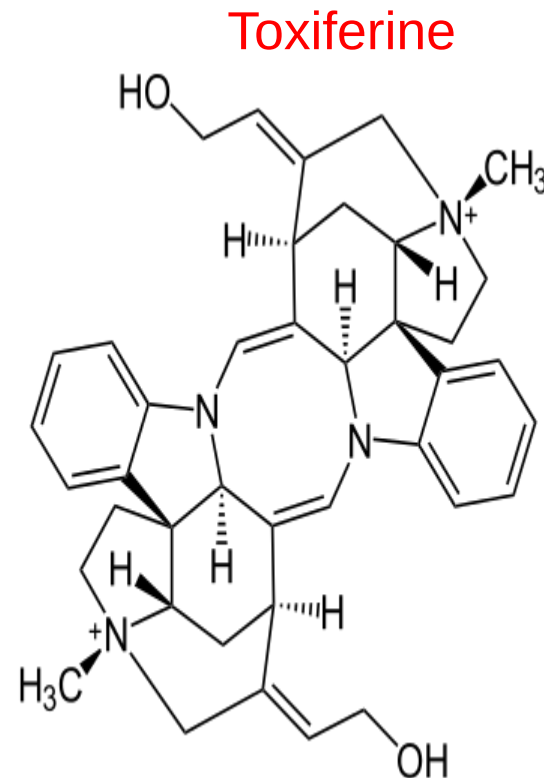
- ❖ Sanguinarine is found in opium poppy seeds
- ❖ Sanguinarine is a toxin that kills animal cells through its action on the Na^+ - K^+ -ATPase inhibition
- Sanguinarine is from the **roots** of *Sanguinaria canadensis* **دموية** (blood root) {Family **Papaveraceae**}.
- Native to America.
- Its effect resembles **colchicine**, i.e. causes doubling of chromosomes number (polyploidy).
- Used for **atonic dyspepsia with hepatic symptoms**.



A benzo-phenanthridine alkaloid.

Bisindole alkaloid: Toxiferine

- ❖ Toxiferine: is a curare toxin.
- ❖ It is a bisindole alkaloid derived from *Strychnos toxifera* and is a nicotinic acetylcholine receptor antagonist.
- ❖ Therefore, it is a muscle relaxant that causes the paralysis of the skeletal muscles.



REFERENCES

Textbooks:

1. Trease And Evans Pharmacognosy, 16th Edition, 2019, Author: William C Evans, Publisher: Elsevier, ISBN: 978-8131261187.
2. Textbook of Pharmacognosy and Phytochemistry 2nd Edition, 2019, Authors: B. Shah, A. N. Kalia, Publisher: Elsevier, ISBN: 978-978-9386217738.
3. Medicinal Natural Products: A Biosynthetic Approach, 2nd Edition, 2002, Author: Paul M Dewick, Publisher: John Wiley and Sons Ltd, ISBN: 0471496405.

Supplementary book:

Fundamentals of Pharmacognosy and Phytotherapy. A Guide for Health Care Professionals by Carol A. Newal, Linda A. Anderson and J. David Phillipson. (2010). the Pharmaceutical Press, London, UK; ISBN: 0 85369-474-5.