

Dr.Manju Kumari

Sem IV, Paper Ic, Unit II.....

Alkaloids

General methods of structural elucidation of Alkaloids. Structural Elucidation and synthesis of Papaverine, Quinine and Morphine. Stereoselective synthesis of Reserpine. Biosynthesis of Alkaloids.

NATURAL PRODUCTS CHEMISTRY

Definition :

“That branch of chemistry which deals with the isolation, identification, structure elucidation, and study of the chemical characteristics of chemical substances produced by living organisms”

2

Problems with Synthetic Drugs

- Potency
- Cost
- Side effects
- Requires close supervision of clinician
- Resistance
- Unavailability (Sometimes)
- Stability....

4

Source of Natural Products

- **Plants**
- Microorganisms
 - Bacteria, fungus
- Marine organisms
- Animal products

Plant research is at the forefront to find an effective, safe pharmacological treatment of diseases.

WHO estimates 65-80% of world population use traditional medicine & 80 % of these involves plant extracts.

5

Metabolites

Primary metabolites

(needful for the cell survival and present in all living system, plants and animals)

- Carbohydrates
- Lipids
- Proteins
- Organic acids
- Vitamins
- Chlorophylls

Secondary metabolites

(synthesized from primary metabolites; they are not needful for the cell survival, but contribute to the survival of the whole organism)

- Glycosides
- Phenolic compounds
- Terpenoids
- Alkaloids

ALKALOIDS

Alkaloids are naturally-occurring organic compounds containing nitrogen moiety, and are usually heterocyclic in nature. They are nitrogen based organic compounds, with nitrogen enclosed in an heterocyclic ring.

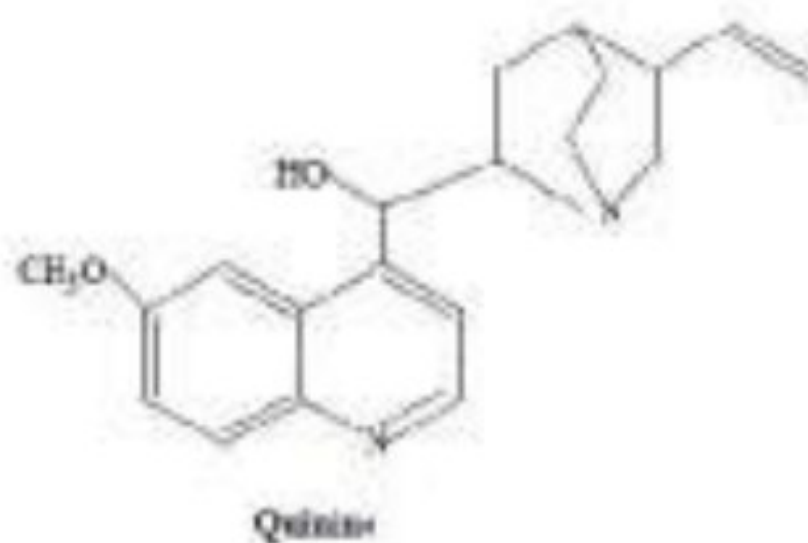
The alkyl amines are referred to as proalkaloids.

Characteristics of alkaloids

- (1) They are basic in nature due to the presence of nitrogen in their ring.
- (2) They have complex structures.
- (3) They have bitter principles.
- (4) They are mostly obtained from plant materials.
- (5) They have high pharmacological and physiological activities.

Examples of alkaloids are:

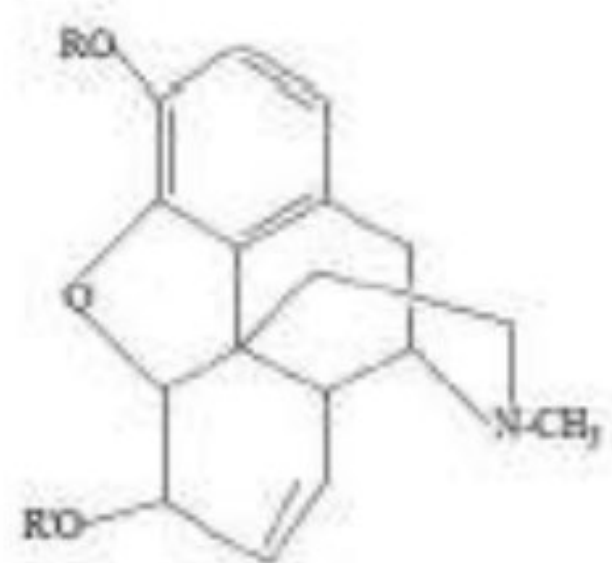
(1) Quinine — an antimalarial drug isolated from a plant called *Cinchona officinalis*



Quinine is an antipyretic alkaloid. Its molecular formula is C₂₀H₂₄N₂O₂.

Functional groups present in quinine are: methoxyl – OCH₃, hydroxyl – OH, tertiary amine group, etc.

Other examples of alkaloids are: morphine, cocaine, heroine, etc. Most are highly narcotic in nature.



R = R' = H Morphine alkaloid

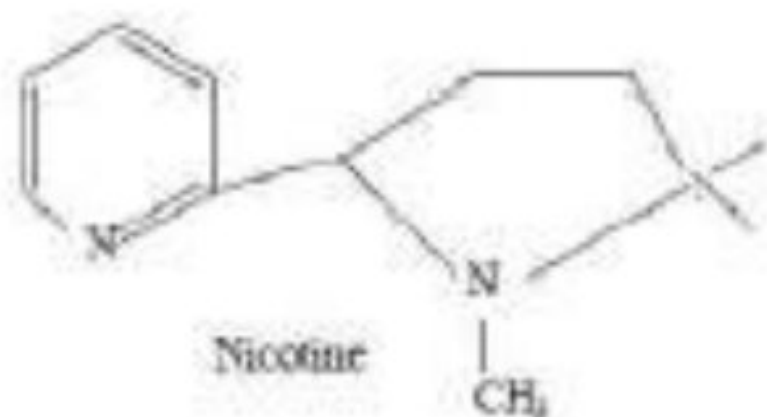
R = H, R' = CH₃ Codeine

R = R' = COCH₃ Heroine

Morphine is highly narcotic, analgesic and is isolated from the plant *Papavera omniferous*

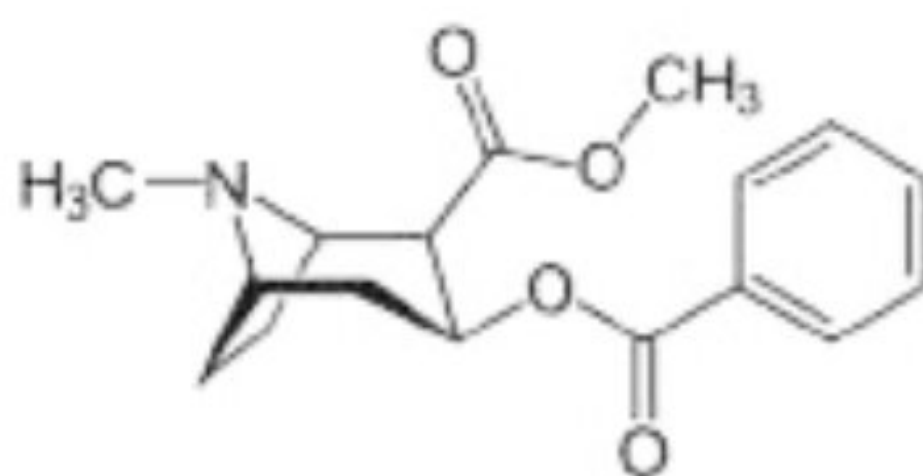
□ Morphine is an opium alkaloid.

Nicotine is another example of alkaloid

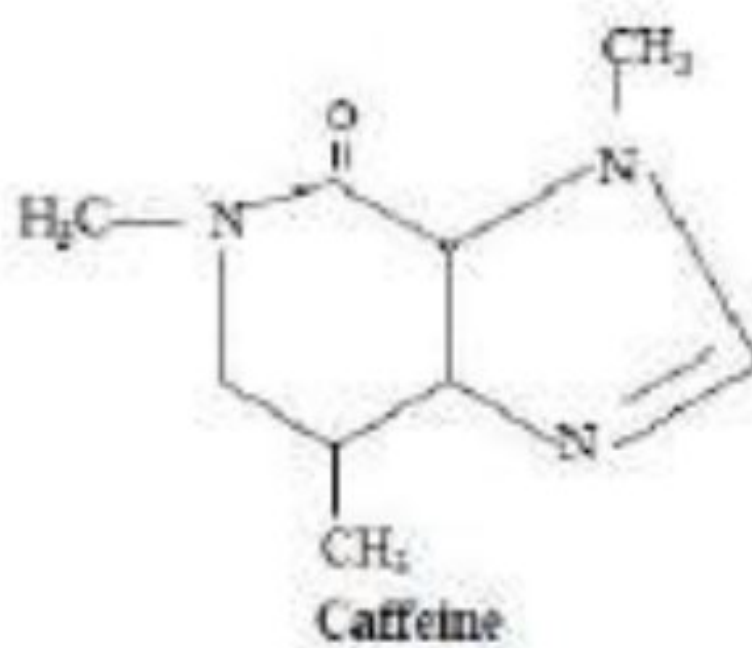


Cocaine -

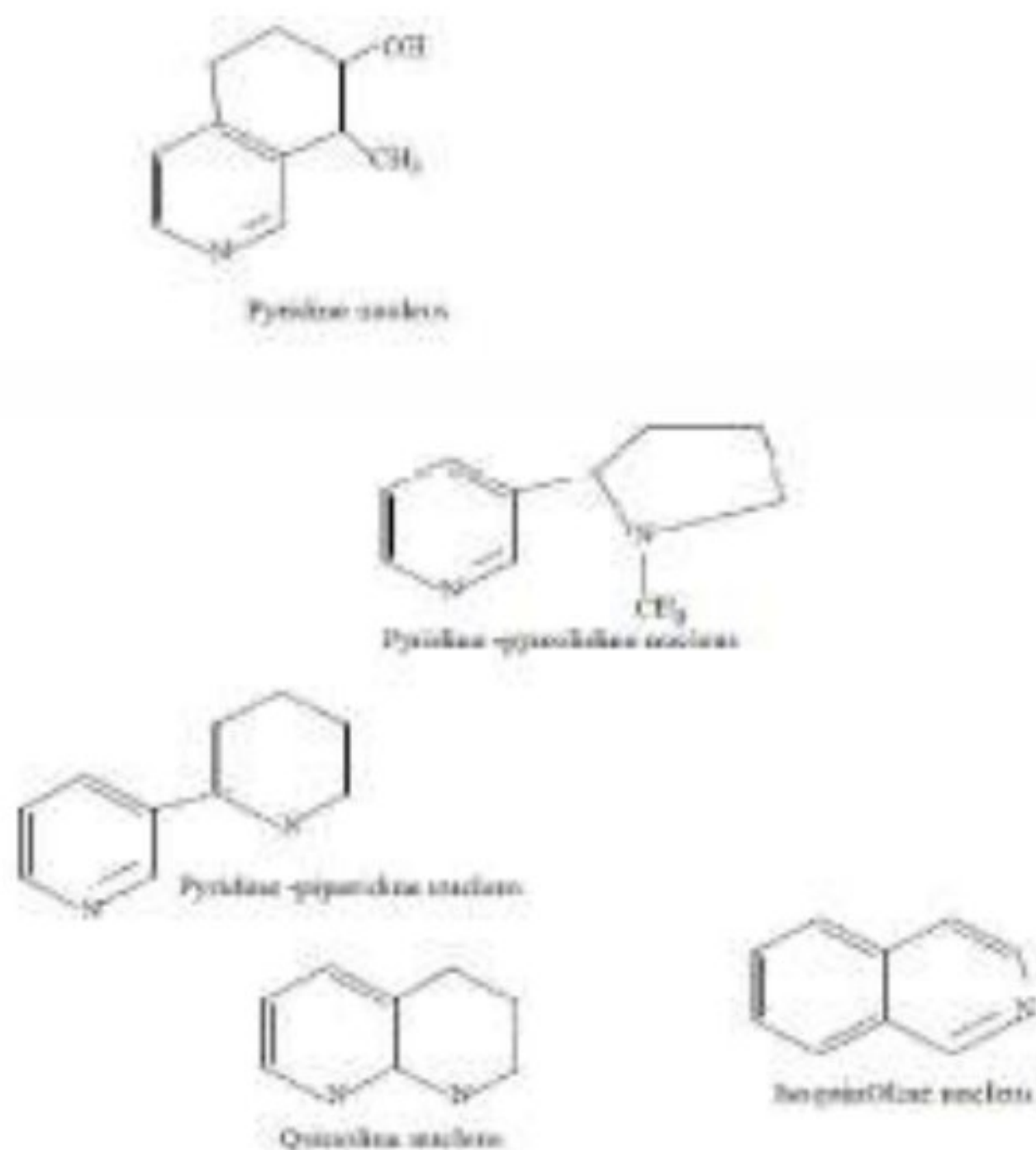
- Cocaine is obtained from coca leaves,
- Cocaine is the first local anaesthetic ever discovered by man,
- Cocaine is highly narcotic and stimulates the central nervous system i.e. CNS depressant,
- Cocaine can lead to psychiatric problem when taken in high dose or when addicted to it.

**Cocaine**

Caffeine is an alkaloid obtained from coffee, tea. It is also a strong stimulant which can increase alertness, thereby causing insomnia when the body gets addicted.

**Caffeine**

Structures of the various classification based on chemical structures are illustrated below



Extraction method for Alkaloids

The extraction procedure often used in the isolation of alkaloid is summarized in the table below.

