

## Lecture 40

### Role of Biology in Medicine

#### Insects of Medical Importance

- 1) Medical entomologists work in the public health arena, dealing with insects (and other arthropods) that parasitize people, bite, sting, and/or vector disease.
- 2) Some personal pests of May vector pathogens: Lice, Fleas, Bedbugs, Ticks, Scabies mites.

#### The Housefly

The housefly is a very common and cosmopolitan species which transmits diseases to man. The organisms of both amoebic and bacillary dysenteries are picked up by flies from the faeces of infected people and transferred to clean food either on the fly's hairs or by the fly vomiting during feeding. Typhoid germs may be deposited on food with the fly's faeces.

#### The Cockroach

Cockroaches carry disease-causing organisms (typically gastroenteritis) as they forage. Cockroach excrement and cast skins also contain a number of allergens causing responses such as, watery eyes, skin rashes, congestion of nasal passages and asthma.

#### Biting insects

Biting insects are Mosquitoes, Biting Midges, Sandflies, Black flies, Horse Flies, Stable flies. Pathogen infection transmitted by insect or other arthropod vectors.

#### Pharmaceutically Important Insects

- 1) Venom is extracted from insects that sting.
- 2) So that they may test people for allergies.
- 3) Moreover to treat allergies in a series of small injections.

#### Apitherapy

Apitherapy is a branch of alternative medicine that uses honey bee products including honey, pollen, bee bread, propolis, royal jelly and bee venom. Proponents of apitherapy make many wide-ranging claims for its health benefits which are not supported by medical evidence. It helps to treat inflammation in case of Rheumatoid Arthritis, Multiple Sclerosis and Melittin blocks the expression of inflammatory genes.



### **Maggot Debridement Therapy**

Maggot therapy is the controlled, therapeutic use of live blow fly larvae ("maggots") to treat skin and soft tissue wounds. Maggot Debridement Therapy is used to treat for removing dead tissue from wound, preventing infection and speeding healing process.



### **Beetle Juice Therapies**

#### **Cantharidin**

Cantharidin is a substance derived from the blister beetle *Cantharis vesicatoria*. The Chinese have used this ancient medicine for thousands of years for a number of maladies. Cantharidine is a vesicant that causes a blister to form on the wart or growth. This action lifts the wart off the skin and after a few days when the blister has dried the wart will come off. The action of Cantharidin does not go beyond the epidermal cells, the basal layer remains intact hence no scarring.



## Plant-Derived Medicines

All plants produce chemical compounds as part of their normal metabolic activities. These phytochemicals are divided into primary metabolites such as sugars and fats, which are found in all plants; and secondary metabolites compounds which are found in a smaller range of plants, serving a more specific function. For example, some secondary metabolites are toxins used to deter predation and others are pheromones used to attract insects for pollination. Major classes of compounds are

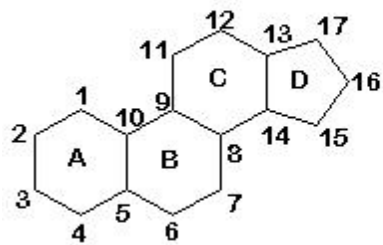
- 1) Steroids
- 2) Alkaloids

### Steroids

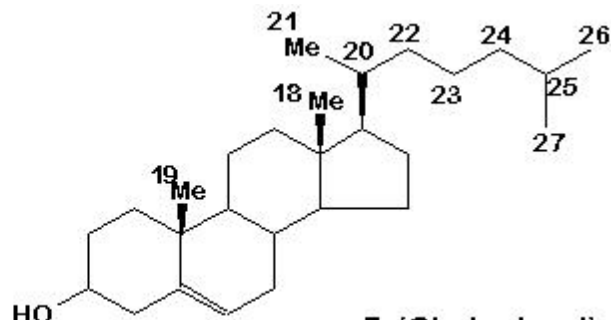
A steroid is an organic compound with four rings arranged in a specific configuration. Examples include the dietary lipid cholesterol, the sex hormones estradiol and testosterone and the anti-inflammatory drug dexamethasone. Steroids have two principal biological functions: certain steroids (such as cholesterol) are important components of cell membranes which alter membrane fluidity, and many steroids are signaling molecules which activate steroid hormone receptors.

### Structure

1. Steroids basic structure consists of 3 6-membered rings (e.g. Containing 6 carbon atoms each) and a fourth rings that contain 5 carbons.
2. Different steroids exist based on added chemical substituents at the molecule.
3. For example, the structure of a common and important steroid, cholesterol, is shown.
4. Cholesterol is produced only by animals.



4 Steroid ring system



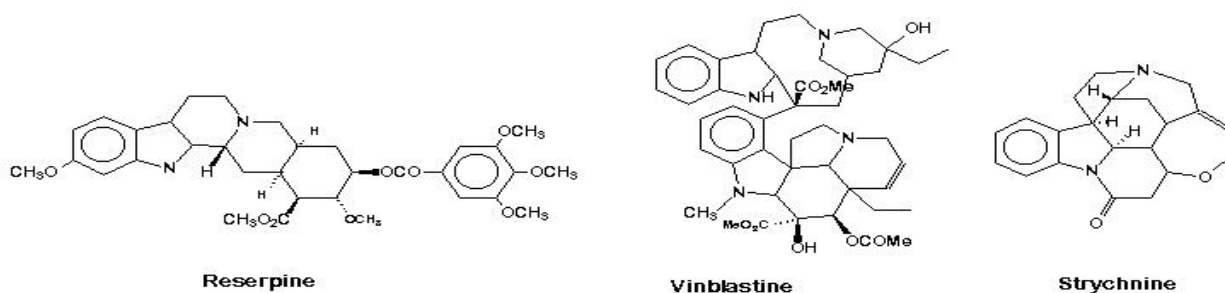
5 (Cholesterol)

## Alkaloids

Alkaloids are a group of naturally occurring chemical compounds that contain mostly basic nitrogen atoms. This group also includes some related compounds with neutral and even weakly acidic properties. Some synthetic compounds of similar structure are also termed alkaloids.

### Structure

1. Plants produce a large number of alkaloids, many of which have important applications.
2. Coniine and strychnine (upper left and lower right) are two highly poisonous compounds.
3. Reserpine and vinblastine are two alkaloids that are poisonous in large quantities
4. They have been determined to be highly effective medicines when used at the proper concentrations and conditions



## Examples of Plant Medicines

- 1 Anesthetics
- 2 Analgesics
- 3 Heart medicines
- 4 Laxatives
- 5 Muscle relaxants

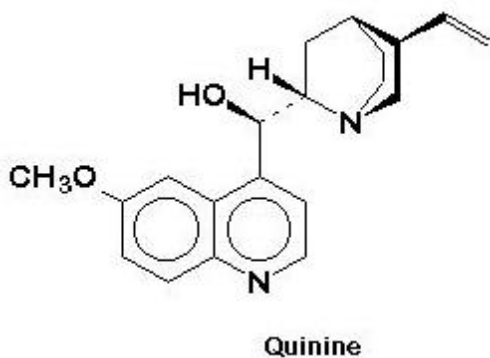
## Chaulmoogra Oil - Hydnocarpus

Chaulmoogra is a tree in the Achariaceae family. The oil from its seeds has been widely used in Indian medicine and Chinese traditional medicine for the treatment of leprosy. It entered early Western medicine in the nineteenth century before the era of sulfones and antibiotics for the treatment of several skin diseases and leprosy.



### Malaria Cure from *Cinchona*

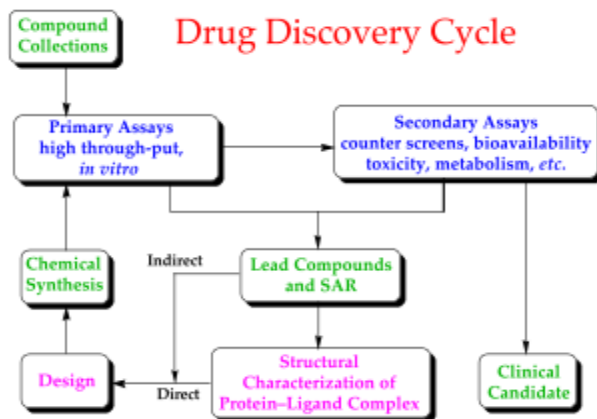
*Cinchona* is a genus of flowering plants in the family Rubiaceae containing at least 23 species of trees and shrubs. They are native to the tropical Andean forests of western South America. The disease is caused by a protozoan. The medicine quinine was the first effective treatment. Quinine is a medication used to prevent and treat malaria and to treat babesiosis. It was obtained from extracting the bark of a shrub. This includes the treatment of malaria due to *Plasmodium falciparum* that is resistant to chloroquine when artesunate is not available.



### New Drug Development

Drug development is the process of bringing a new pharmaceutical drug to the market once a lead compound has been identified through the process of drug discovery. It includes pre-clinical

research on microorganisms and animals, filing for regulatory status, such as via the United States Food and Drug Administration for an investigational new drug to initiate clinical trials on humans, and may include the step of obtaining regulatory approval with a new drug application to market the drug.



### Regenerative Medicine from stem cells

Regenerative medicine is an interdisciplinary approach that seeks to repair or replace damaged or diseased human cells or tissues to restore normal function, which holds the promise of revolutionizing patient care in the 21st century. It may involve the transplantation of stem cells, progenitor cells or tissue, stimulation of the body's own repair processes, or the use of cells as delivery-vehicles for therapeutic agents such as genes and cytokines. Develop methods to prepare patients for transplants with minimal toxic agents.

### Cure of Neural Diseases

Neurology is a medical specialty dealing with disorders of the nervous system. Specifically, it deals with the diagnosis and treatment of all categories of disease involving the central, peripheral, and autonomic nervous systems, including their coverings, blood vessels, and all effected tissue, such as muscles.

There are over 600 known neurological disorders and conditions that affect the human nervous system and for many of them treatment options are extremely limited.

### Neurological disorders are health conditions involving the nervous system.

A neurological disorder is a disease or injury of the central nervous system that causes paralysis of any part of the body.

1. Sometimes physical injury to the brain, spinal cord, or nerves can be the cause of neurological disorders.
2. Sometimes they can result from biochemical causes.
3. Other times, the cause may be unknown and only the effects are seen.

These disorders include

1. Lysosomal storage diseases (Battens, Gauchers, etc)
2. Brain cancers
3. Spinal cord contusion with demyelination
4. Strokes

5. ALS
6. Parkinsons
7. Alzheimers
8. Huntington's
9. Cerebral palsy

The product is CNS stem cells that regenerate for life; not a drug.

**References.**

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