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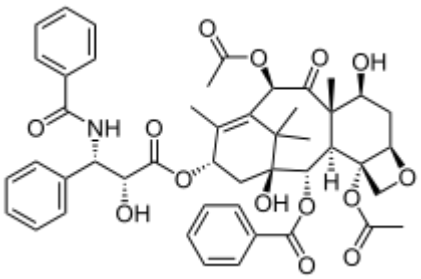
Lecturer

Classification of natural Products.



Natural products: **-**

Natural products are compounds consisting essentially of carbon derived from natural sources (flora, fauna, land, etc.). And that generally have very diverse and interesting properties. Some of the most relevant applications of the Natural Organic Products are using it as: **Fuels, plastics, fats, soaps, sugars.**

Natural product sources

1. Natural products from microorganisms

Microorganisms as a source of potential drug candidates were not explored until the discovery of penicillin in 1929. Since then, a large number of terrestrial and marine microorganisms have been screened for drug discovery. Microorganisms have a wide variety of potentially active substances and have led to the discovery of antibacterial agents like cephalosporins, antidiabetic agents like acarbose, and anticancer agents like epirubicin.

2. Natural products from marine organisms

The first active compounds to be isolated from marine species were spongouridineand spongothymidine from the Carribean sponge Cryptothecacrypta in the 1950s. These compounds are nucleotides and show great potential as anticancer and antiviral agents. Their discovery led to an extensive research to identify novel drug candidates from marine sources. About 70% of the earth's surface is covered by the oceans, providing significant biodiversity for exploration for drug sources. Many marine organisms have a sedentary lifestyle, and thereby synthesize many complex and extremely potent chemicals as their means of defence from predators. These chemicals can serve as possible remedies forvarious ailments, especially cancer. One such example is discodermolide, isolated from the marine sponge, *Discodermia dissoluta*, which has a similar mode of action to that of Paclitaxel, and possesses a strong antitumor activity. It also exhibits better water solubility as compared to paclitaxol. A combination therapy of the two drugs has led to reduced tumor growth in certain cancers.

3. Natural products from animal sources

Animals have also been a source of some interesting compounds that can be used as drugs. Epibatidine obtained from the skin of an Ecuadorian poison frog, is ten times more potent than morphine. Venoms and toxins from animals have played a significant role in designing a multitude of cures for several diseases. Teprotide for example, extracted from a Brazilian viper, has led to the development of cilazapril and captopril, which are effective against hypertension.

4. Natural products from plant sources

The use of plants as medicines has a long history in the treatment of various diseases. The earliest known records for the use of plants as drugs are from Mesopotamia in 2600 B.C., and these still are a significant part of traditional medicine and herbal remedies. To date, 35,000-70,000 plant species have been screened for their medicinal use.13 Their Several important drugs such as Taxol, camptothecin, morphine and quinine have been isolated from plant sources. The first two are widely used as anticancer drugs, while the remaining are analgesic and antimalarial agents, respectively.

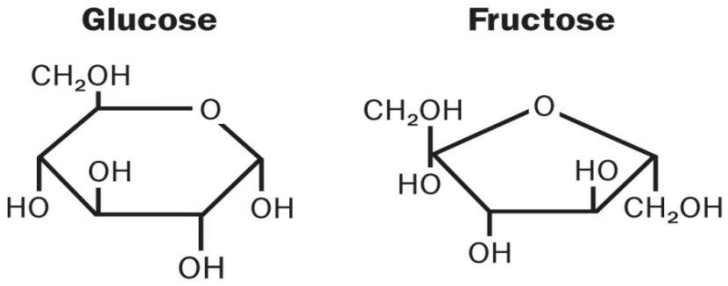
Main Classes of Natural Products:

- Carbohydrates
- Lipids
- Proteins
- Nucleic Acids

Carbohydrates

A broad category of chemical compounds, also referred as Sugars. The most abundantclass of bio-organic molecules on Earth. Although relatively low in human, it constitutesabout 75% by mass of dry plant materials.

Main functions: Energy storage, structure element, source of carbon of the biosynthesisof other substances, “Markers” on cell surface for cell-cell recognition.



Lipids

Abroad category of chemical compounds, also referred as Fat. Most of those productsare non-polar fat, oil, or wax that does not (or poorly) dissolves in water.
Main functions: Main component of cells membrane, energy storage, communicationbetween cells (hormones).

Protiens

A broad category of chemical compounds composed of amino acids. IncludinsAminoacids, polypetides, Enzymes.
Main functions: Very large variety of functions, from maintenance or repairing of existing tissues and synthesis of new ones to the catalysis of all the bio-chemical reactions that take place in a living organism (Enzyms).

Nucleic Acids

A category of complex chemical compounds involved in the transmition of geneticinformation (DNA) and its transfer as information to the cell (RNA).
Main functions: Genetic information,some simple nucleotides acts as sourceof energy for chemical reaction (ATP,GTP,...).

Soap:- is the sodium salt of a fatty acid. Have a party hydrophilic (dissolves in water) and other lipophilic (fat dissolves dirt).

Sugars:- are natural polyhydroxialdehides or polyhydroxiketones with different functions: structure, energy storage components of the nucleic acids, etc. They are formed by photosynthesis in plants and are classified into monosaccharides (glucose), disaccharides (sucrose) and polysaccharides (cellulose, starch, etc.).

Sweeteners:- are natural or synthetic substance that gives a sweet taste to food. We can find natural sweeteners such as sucrose (cane and beet), fructose (sugar simpler and sweet, honey), lactose and galactose (sugars from milk, less sweet), and synthetic as: saccharin (300 times sweeter than sucrose), aspartame (160 times sweeter), etc.

Saccharin:- is an artificial sweetener. The basic substance, benzoic sulfilimine, has effectively no food energy and is much sweeter than sucrose, but has a bitter or metallic aftertaste, especially at high concentrations.
Formula: $C_7H_5NO_3S$
Molar mass: 183.18 g/mol
Melting point: 228.8 °C
Density: 828.00 kg/m³
Soluble in: Water

Aspartame:- is an artificial, non-saccharide sweetener used as a sugar substitute in some foods and beverages. In the European Union, it is codified as E951. Aspartame is a methyl ester of the aspartic acid/phenylalanine dipeptide.
Formula: $C_{14}H_{18}N_2O_5$
Molar mass: 294.3 g/mol
Melting point: 246 °C
Density: 1.35 g/cm³

Flavours and perfumes:- Food Additives (flavours, colours, antioxidants, etc.).
An antioxidant:- is a molecule that inhibits the oxidation of other molecules.

Drugs:- Product to be administered for curative purposes. Although there are many natural source products that are used as drugs, the synthesis of drugs is well developed and provides a large amount of chemicals that are used as such. For example: sedatives, antiinflammatories, diurethics, antiviral, hepatoprotectors, etc.

Regulators:- like dopamine, used for Parkinson´s síndrome (only L-Dopa is active)Parkinson's disease is a degenerative disorder of the central nervous system. The motor symptoms of Parkinson's disease result from the death of dopamine-generating cells in the substantianigra, a region of the midbrain; the cause of this cell death is unknown.

Antibiotics:- chemical products able to inhibit the growth of microorganisms and even destroy them.

Analgesics:- drug that relieves pain without causing loss of consciousness. Painkillers are a large group that ranges from the derivatives of opium (solid product obtained drying the milky juice of the opium poppy "*Papaver sommiferum*" with a 25% alkaloids), and morphine (potent analgesic, very toxic and produces dependence), codeine (anticoughing, produces no habit), heroin (synthetic derivative obtained by acetylation of morphine, good analgesic with less depression than morphine addiction but more addiction), methadone (synthetic substitute forheroin with analgesic properties but also cause addiction) to opiates, such as aspirin, which is derived from the Silicilina (glycoside from the bark of willow formerly used as an analgesic), Paracetamol and ibuprofen. The application of topical analgesics includes all anti-inflammatories, such as hydrocortisone and derivatives, and the general and local anesthetics at low doses.

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Natural Products classification based on their chemical structure.

It is based on the type of chemical skeleton. So there are

· Aliphatic or non-aliphatic fatty compounds of open chain as: fatty acids, sugars and a great amount of amino acids.

· Acyclic and cycloaliphatic compounds as terpenoids, steroids and some alkaloids.

· Aromatic or benzoic compounds as phenols, quinones, etc.

· Heterocyclic compounds such as alkaloids, flavonoids and nucleic acid bases.

Many natural products belong to more than one of these categories. For example, geraniol, farnesol and scualene belong to class 1, and thymol to class 3, but because of the biogenetic considerations they are treated as class 2.