Introduction to pharmacognosy

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Pharmacognosy

Pharmacognosy is the study of those natural substances principally plants that find use in medicine. or define as an applied science that deals with the biologic , biochemical and economic features of natural drugs and their constituents. It is a study of drugs that originate in the plant and animal kingdoms. Modern aspects of the science include not only the crude drugs but also their natural derivatives.

The term pharmacognosy is formed from two Greek wards, pharmakon(drug) & gnosis(knowledge) ,It has developed from ancient civilizations that used parts of plants or animals to eliminate pain, control suffering and counter act disease.

- Pharmacognosy is closely related to both botany & plant chemistry & indeed both originated from earlier scientific studies on medicinal plants.
- Pharmacognosy played an important role in the development of other sciences ex: descriptive botany, plant taxonomy, & phytochemistry, chemical plant taxonomy, tissue culture etc
- Today pharmacognosy is a highly specialized science that represent one of the major disciplines of pharmaceutical education .
- pharmacognosy forms an important link between **pharmacology and medicinal chemistry on one hand and between pharmaceutics and clinical pharmacy on the other hand.**

- The use of modern isolation technique & pharmacological testing procedures means that new plant drugs find their way into medicine as purified substances rather than in the form of galenical preparation.

Plant nomenclature & taxonomy

Botanical nomenclature:

- In the past the plants were known by a double Latin tittle but Linnaeus (1707-1778) who is a Swedish biologist was the first to describe the present binomial system in which the first name denotes the genus, while the second (specific) name denotes the species.

- All species names may be written with small initial letters while the genus name starts with a capital letters . Examples:
- Mentha piperita Labiatae
- Digitalis purpurea Scrophulaiaceae.
- Nerium oleander Apocyanaceae

- Botanical names are followed by the names of a person or their accepted abbreviations
- Ex: Mentha piperita Linnaeus or L.
- This name (Linnaeus) refers to the botanist who first described the species or variety. This name is useful where there is different names for the same plant.

The scope and practice of pharmacognosy

- Until relatively recently pharmacognosy was regarded, almost exclusively, as a subject in the pharmaceutical curriculum focused on those natural products employed in the allopathic system of medicine.
- Coincident with the increasing attractiveness of alternative (complementary) therapies and the tremendous range of herbal products now generally available to the public, regulatory requirements covering medicinal herbs have been put in place by many countries in order to control the quality of these products.
- Monographs are now available on a large number of such drugs giving descriptions, tests for identity and purity and assays of active constituents.

- Some of These monographs are **WHO monographs, USP monographs, German Commission E monograph**
- Chromatographic, chemical and physical tests, together with assay procedures, are given for many drugs for which previously there was no quantitative evaluation of the chemical constituents available. The importance of quality control is paramount, as the demand and the possibility of substitution has increased.
- The aim has been to set standards for quality, efficacy and safety in order that the many traditional herbs meet legal requirements.

Approaches to the study of medicinal plants:

drugs can be arranged for study under the following headings:

Alphabetical: Either latin or vernacular names may be used. This arrangement is employed for dictionaries, pharmacopoeias etc…

Taxonomic: The drugs are arranged according to the plants from which they are obtained , in classes, orders, families, genera, & species.

Morphological: The drugs are divided into groups such as leaves, flowers, fruits, seeds, herbs etc… These groupings have some advantages for practical study of crude drugs & identification of powdered drugs.

4. Pharmacological or therapeutic: This classification involves the grouping of drugs according to the pharmacological action of their most important constituents or their therapeutic use.

5. Chemical or biogenetic: The important constituents ex: alkaloids, glycosides, volatile oils etc… or their biosynthetic pathways, form the basis of classification of the drugs.

- ***Biological sources of drugs***

An examination of the list of drugs derived from natural sources , reveals the followings:

- **Plant** : The majority of plants are derived from Spermatophyta (the dominant seed bearing plants). Within the Spermatophyta the number of species & the number of useful medicinal plants are divided unevenly between the phyla Gymnospermae , which yields some useful oils, resins & the alkaloid ephidrine , & the Angiospermae , which is divided into monocotyledons & dicotyledons (both of these provide many useful drugs but especially the dicotyledons).

- **Fungi** : The fungi provide a number of useful drugs especially antibiotics, & are important in pharmacy in a number of other drugs.
- **Algae** : These are source of limited number of drugs ex: agar & alginic acid.
- **Lichens & mosses** : This group contribute little to medicine.
- **Ferns & lycopodium**
- **Land animals** : It provides traditional pharmaceutical materials ex: gelatin , wool fat , beeswax & are a source of hormones, vitamins & sera.
- **Bacteria** : Bacteriophyta is a source for the production of antibiotics , substrates & their employments in genetic engineering ex: in the production of human insulin.

Methods of using plants:

- Plants may be used as **isolated parts** e.g. dried leaves of plant as digitalis which contain glycosides as digoxin which is used for the treatment of heart diseases & congestive heart failure.
- **Whole plant** e.g. Catharanthus roseus & its active constituents vincristine & vinblastine which are used as anticancer.

Extract of active constituents e.g. extract of unripe fruit of plant as Papaver somniferum which contains morphine which is used as narcotic. The resultant extract is called **extractive** which refers to the principle constituents found in natural substances & are separated or isolated from the natural substances by different means of extraction , these principles are responsible for the medicinal activities of the natural substances & these are found either single or mixtures.

Importance or value of natural products drugs:

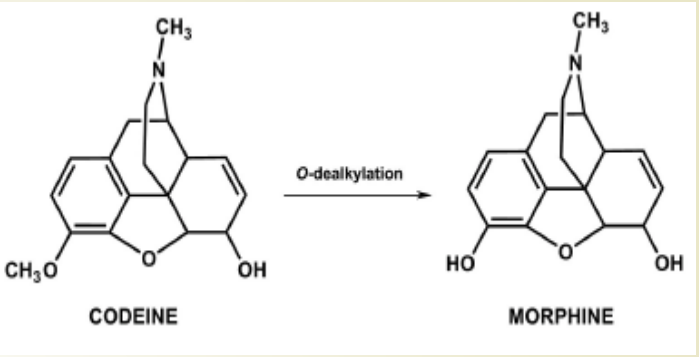
Natural drugs & their active constituents play many significant roles in modern medicine , as the followings:

1.Some medicinal plants & their drugs have a **high healing power** for some diseases specially cancer & heart diseases ,& till now these drugs are still in use in medicine e.g. digitalis & catharanthus (Vinca rosea).

2.Natural products provide a **good source for a number of useful drugs that are difficult or not possible to be produced commercially by chemical or micro biological mean** ; therefore , the only mean to produce these drugs is the plant e.g. digoxin ,vincristine , vinblastine, morphine etc….

3.Natural products supply **basic compounds that can be modified structurally** to render them more active , less toxic , or change their activity e.g. production of codeine(cough suppresant) from morphine (narcotic & causes addiction).

4.Natural compounds can be used **as models for the synthesis** of some drugs that have the similar pharmacological activities e.g. salicin which is a glycoside having antirheumatic activity was used as a model for the synthesis of salicylic acid.



5.Some natural compounds which demonstrate little or no activity themselves can be **modified structurally by chemical or biological methods to produce potent drugs** not easily obtained by other methods e.g. using saponin glycosides as a source for the production of cortisones & its derivatives & other hormones.

Medical terms in pharmacognosy

Taxonomy:(from greek taxis meaning arrangement or division &nomos meaning law)is the science of classification according to a predetermined system i.e classification of organisms or others into groups based on similarities of structure or origin.

Chemotaxonomy:is the attempt to classify& identify organism according to differences &similarities in their biochemicals composition.

Crude drug: Natural products which are not pure compounds i.e. plants or parts of plants , extract or exudes. Crude drugs are vegetable or animal drugs that consist of natural substances that have undergone only the processes of collection and drying

Wild plants:plants that are just that,they have grown in wild with very little help from humans.it grows on its own without human interference.

Primary metabolites:A metabolite excreted during the growth phase .they mainly contain carbon,nitrogen& phosphorus ex.sugars,amino acids,and nucleotides.they give rise to secondary metabolites.

Carbohydrates & related compounds: compounds composed of carbon , hydrogen , & oxygen as polyhydroxy aldehydes or ketone alcohols e.g. sucrose , lactose , starch , acacia , tragacanth , agar , pectin.

Steroids : derivatives of cyclopenta phenanthrene e.g. estrogens , androgens, adrenal cortex hormones , cardioactive aglycones , bile acids , cholesterol , ergosterol

Resins & resin combinations: compounds comprising resins , oleoresin , oleo-gum resins , & balsams.

Resins : solid or semisolid amorphous producte of complex chemical nature: e.g. rosin , podophyllum resin , jalap resin.

Oleoresin : resins & volatile oils in homogeneous mixtures e.g. turpentine , copaiba .

Oleo-gum resins : oleoresins & gums in homogeneous mixtures e.g. asafetida, myrrh.

Balsam : resins with mixtures of aromatic substances such as benzoic acid , cinnamic acid or both e.g. benzoin , tolu balsam , Peru balsam , styrax.

Secondary metabolites: Are compoundes belonging to extremely varied chemical groups , such as organic acids aromatic compounds,terpenoides,alkaloids etc..their function in plants for growth regulation , lignification,coloring of plant parts, protection.

Alkaloids: Any of various compounds normally with basic chemical properties & usually containing at least one nitrogen atom in a heterocyclic ring , occurring chiefly in many vascular plants & fungi.

Glycoside:Are compound that yield upon hydrolysis, one or more sugar molecules with an organic hydroxide and non sugar part (aglycone).most glycoside are found in plants&exhibit different pharmacological activities.

Oils:An unctuous,combustible substance that is liquid ,or easily liquefied on worming .they are soluble in ether but insoluble in water ,such substances depending on their origin , are classified as animal, mineral or vegetable oils.

Indigenous plants: Are plants that are native to a specific area & which differ from plants in another area.

Volatile oils:A rapidly evaporating oil of plant derivation(volatilize at ordinary temperature) ,also called essential oil(have odor), that is capable of distillation &that does not have a stain.also called ethearal oil.

Fixed oil:A nonvolatile fatty oil of vegetable origin consisting mainly of glycerides.

Tannin: Any of various complex phenolic substances of plant origin used in tanning &in medicine. Tannins can precipitate proteins , alkaloids & convert hide into leather including tannic acid. some are present in coffee & tea.

Extraction: methods of obtaining the active constituents found in plants .extraction removes only those substances that can be dissolved in liquid or liquid mixture which is referred to as the Solvent or more specifically called menstruum

Geographic source and habitat: Are the region in which the plant or animal yielding the drug grows.

- **Natural substances:**
- Are those substances found in nature that comprise whole plants and herbs and anatomic parts, whole animals and anatomic parts and substances that have no changes in their molecular structure as found in nature.

Cultivated plants: Are plants that has been planted by human, where it gets watered, pruned, weeded and chemicals are used to keep the bugs away. The owners may use it to create new plants with different colors, or petals with different shapes.

- **Official drugs**:
- Medicines authorized by pharmacopoeias and recognized formularies.
- **Un official drugs:**
- Drugs or medicines that are not authorized by pharmacopoeias.

Marc:the undissolved portion of the substance that remains after the extraction process is completed.

Solvent, or, more specifically, the menstruum: Is the liquid or liquid mixture that can dissolved those active principles.

Thank you