Medicinal Plants

Introduction

Introduction

"In All things there is a poison, and there is nothing without a poison. It depends on only upon the dose whether a poison is a poison or not"---------Paracelsus (1493?-1541, Switzerland)

Chinese saying "*Shi Yao San Fei Du*" means "*Any drugs have toxic effects*".

Introduction: ***Why Study Medicinal Plants***

Medicinal plants and religions

- Medicinal plants have played an essential role in the development of human culture, for example religions and different ceremonies. (e.g. *Dutura has long been associated with the worship of Shiva, the Indian god*).

Introduction: *Why Study Medicinal Plants*

Statue of Kuan Yin on Mount Putuo near Shanghai, China

Nelumbo nucifera,
common name: blue lotus

Introduction: *Why Study Medicinal Plants*

Significances of Medicinal Plants to Human Being

- Many of the modern medicines are produced indirectly from medicinal plants, for example aspirin.
- Plants are directly used as medicines by a majority of cultures around the world, for example Chinese medicine and Indian medicine.
- Many food crops have medicinal effects, for example garlic.

Introduction: *Why Study Medicinal Plants*

4. Medicinal plants are resources of new drugs. It is estimated there are more than 250, 000 flower plant species.

5. Studying medicinal plants helps to understand plant toxicity and protect human and animals from natural poisons.

6. Cultivation and preservation of medicinal plants protect biological diversity, for example metabolic engineering of plants.

Introduction: *Why Study Medicinal Plants*

Plant resources for new medicine

Bryophytes (nonvascular plants, e.g. liverwort and moss) have about 15,350 species.

Seedless vascular plants (commonly called fern) are estimated about 12, 157 species

Gymnosperm has about 760 species.

Angiosperm is estimated to have more than 250,000 species.

Introduction: *Why Study Medicinal Plants*

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Introduction: *Why Study Medicinal Plants*

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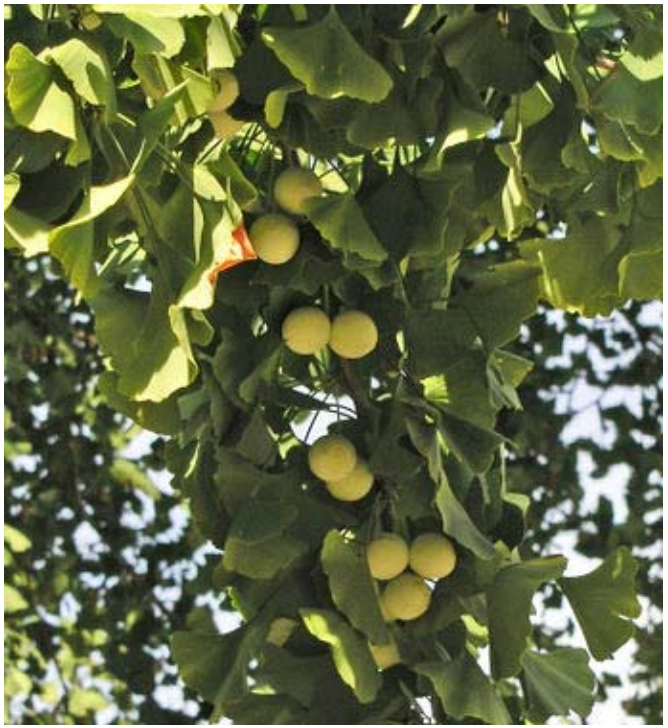
Boston fern

Christmas fern

Introduction: *Why Study Medicinal Plants*

Gymnosperm has about 760 species



Ginkgo biloba

Pine leaf and cone

Introduction: *Why Study Medicinal Plants*

Gymnosperm has about 760 species

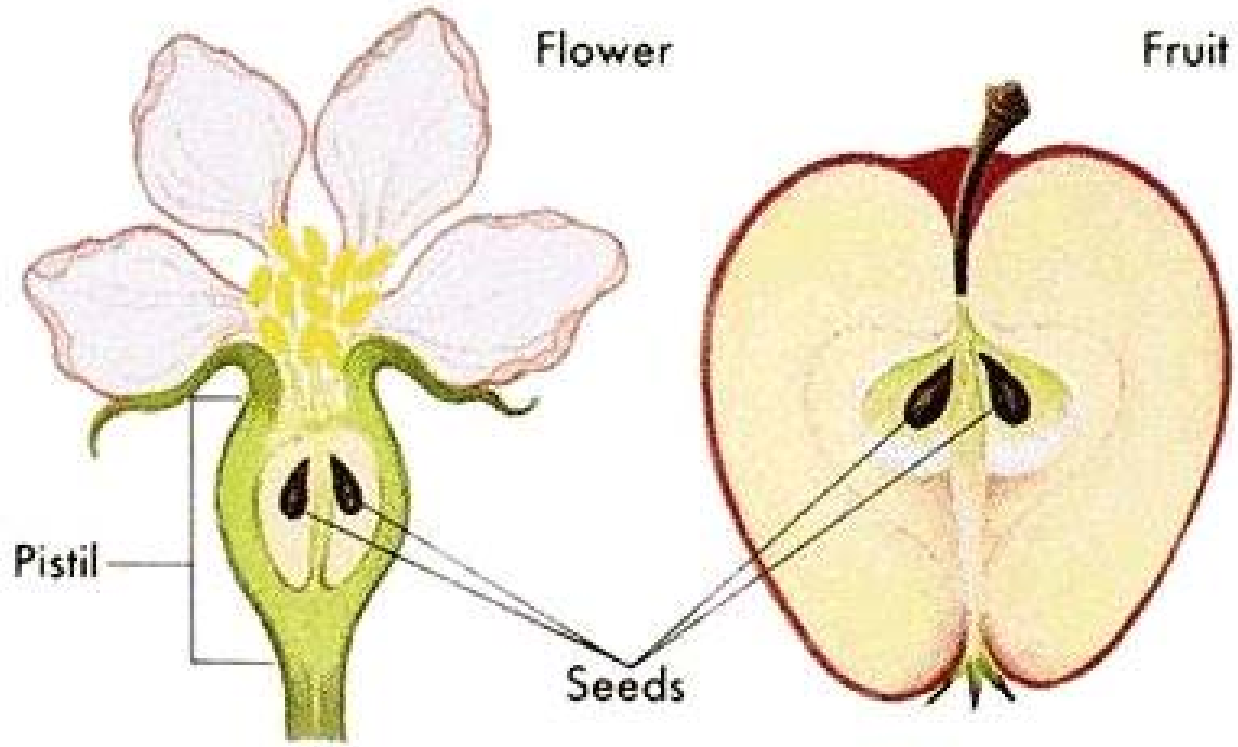
Male tree

Female tree

Ginkgo biloba (Ginkgoaceae)

Introduction: *Why Study Medicinal Plants*

Angiosperm is estimated to have more than 250,000 species.



Introduction: *Why Study Medicinal Plants*

Angiosperm is estimated to have more than 250,000 species.

Yellowroot
(*Xanthorhiza simplicissima*)
Buttercup family (*Ranunculaceae*)

Ms.Reed's dark blue
(Rosmarinus officinalis)
Lamiaceae (mint family)

Introduction:

The Principle of Phytotherapy

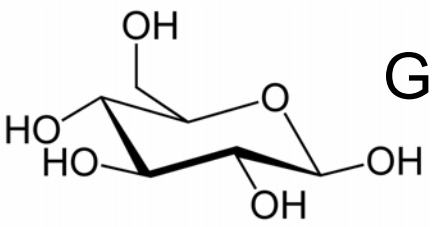
The medicinal effects of plants are due to metabolites especially secondary compounds produced by plant species.

Plant metabolites include: primary metabolites and secondary metabolites.

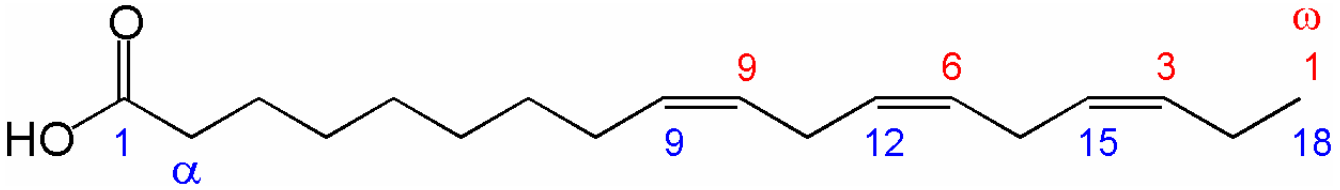
Introduction: *The Principle of Phytotherapy*

Plant primary metabolites	***Plant Secondary metabolites (Plant natural products)***
1. Organic compounds produced in the plant kingdom 2. Have metabolic functions essential for plant growth and development 3. Produced in every plant 4. Include carbohydrates, amino acids, nucleotides, fatty acids, steroids and lipids	1. Organic compounds produced in plant kingdom 2. Don't have apparent functions involved in plant growth and development 3. Produced in different plant families, in specific groups of plant families or in specific tissues, cells or developmental stages throughout plant development. 4. Include terpenoids, special nitrogen metabolite (including, non-protein amino acids, amines, cyanogenic glycosides, glucosinolates, and alkaloids), and phenolics.

Introduction: *The Principle of Phytotherapy- Plant primary metabolites*

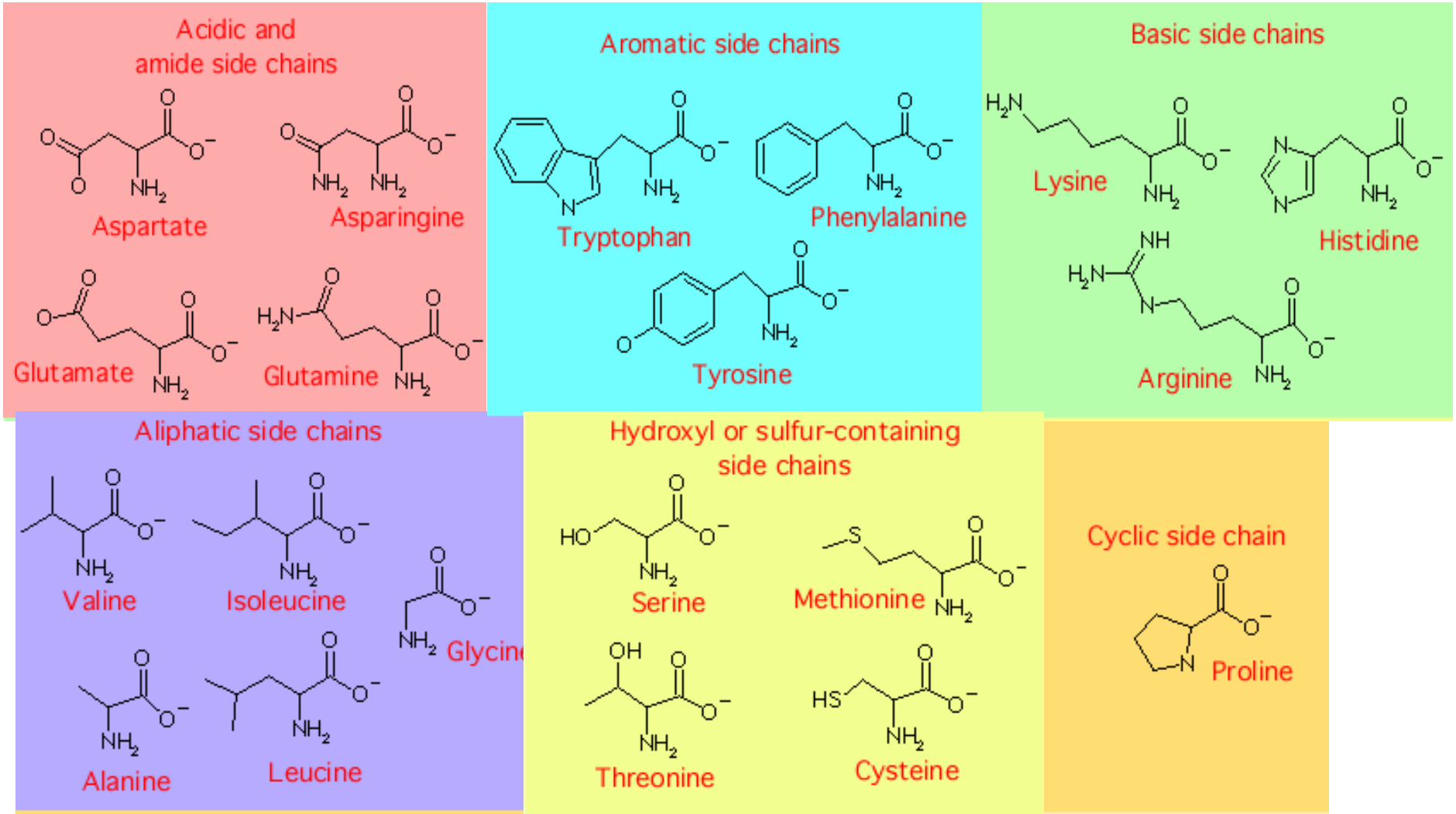


Glucose



α-Linolenic acid (polyunsaturated omega-3 fatty acid, $C_{18}H_{30}O_2$), in walnut and flaxseeds

Introduction: *The Principle of Phytotherapy- Plant primary metabolites*



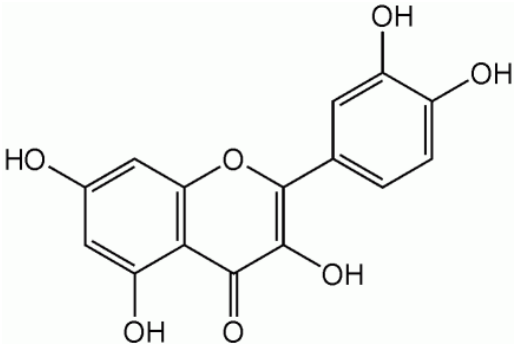
Amino acids

Introduction: *The Principle of Phytotherapy- Plant primary metabolites*

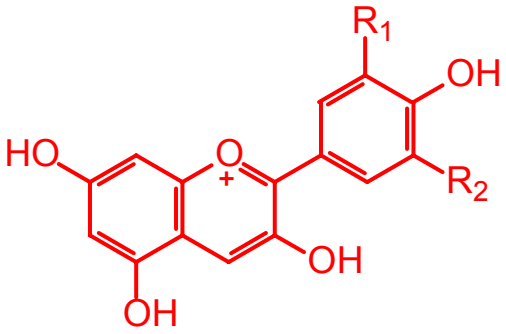
10 Amino acids are essential nutrients

Essential	Nonessential
Isoleucine	Alanine
Leucine	Asparagine
Lysine	Aspartate
Methionine	Cysteine
Phenylalanine	Glutamate
Threonine	Glutamine
Tryptophan	Glycine
Valine	Proline
Arginine*	Serine
Histidine*	Tyrosine

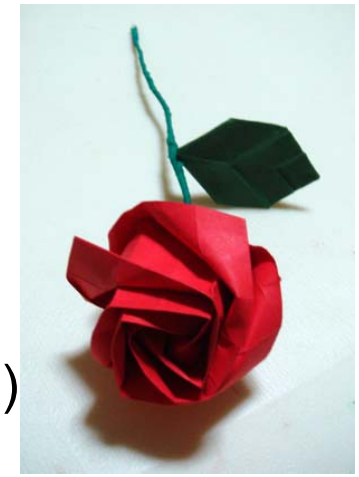
Introduction: *The Principle of Phytotherapy- Secondary metabolites*



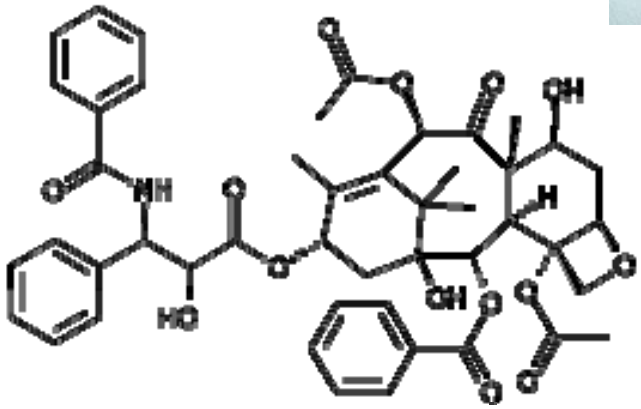
Quercetin (flavonoids)



Anthocyanidins (flavonoids)

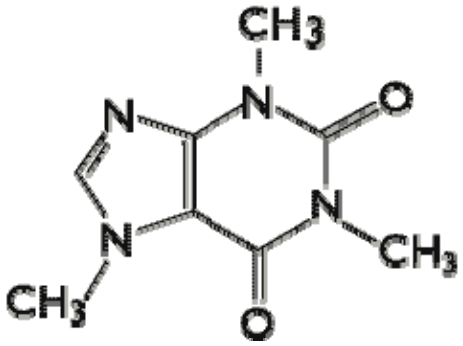


Artemisinin (terpenes)

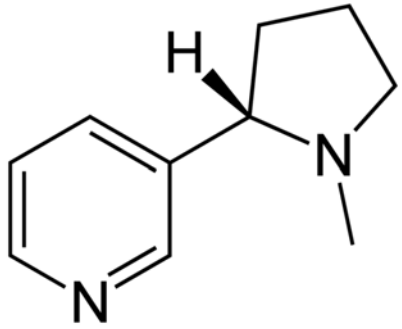


Paclitaxel (terpenes)

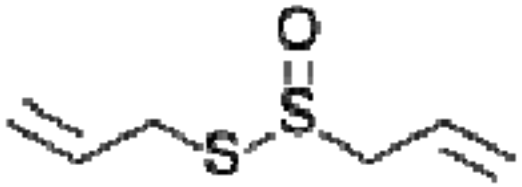
Introduction: *The Principle of Phytotherapy- Secondary metabolites*



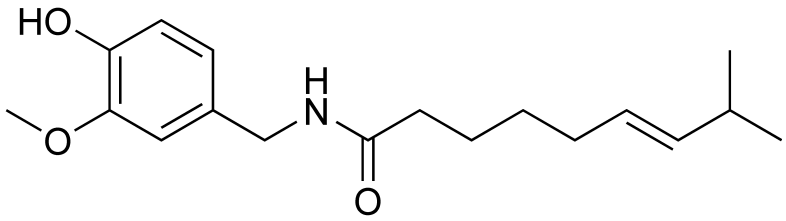
Caffeine (alkaloids)



Nicotine (alkaloids)

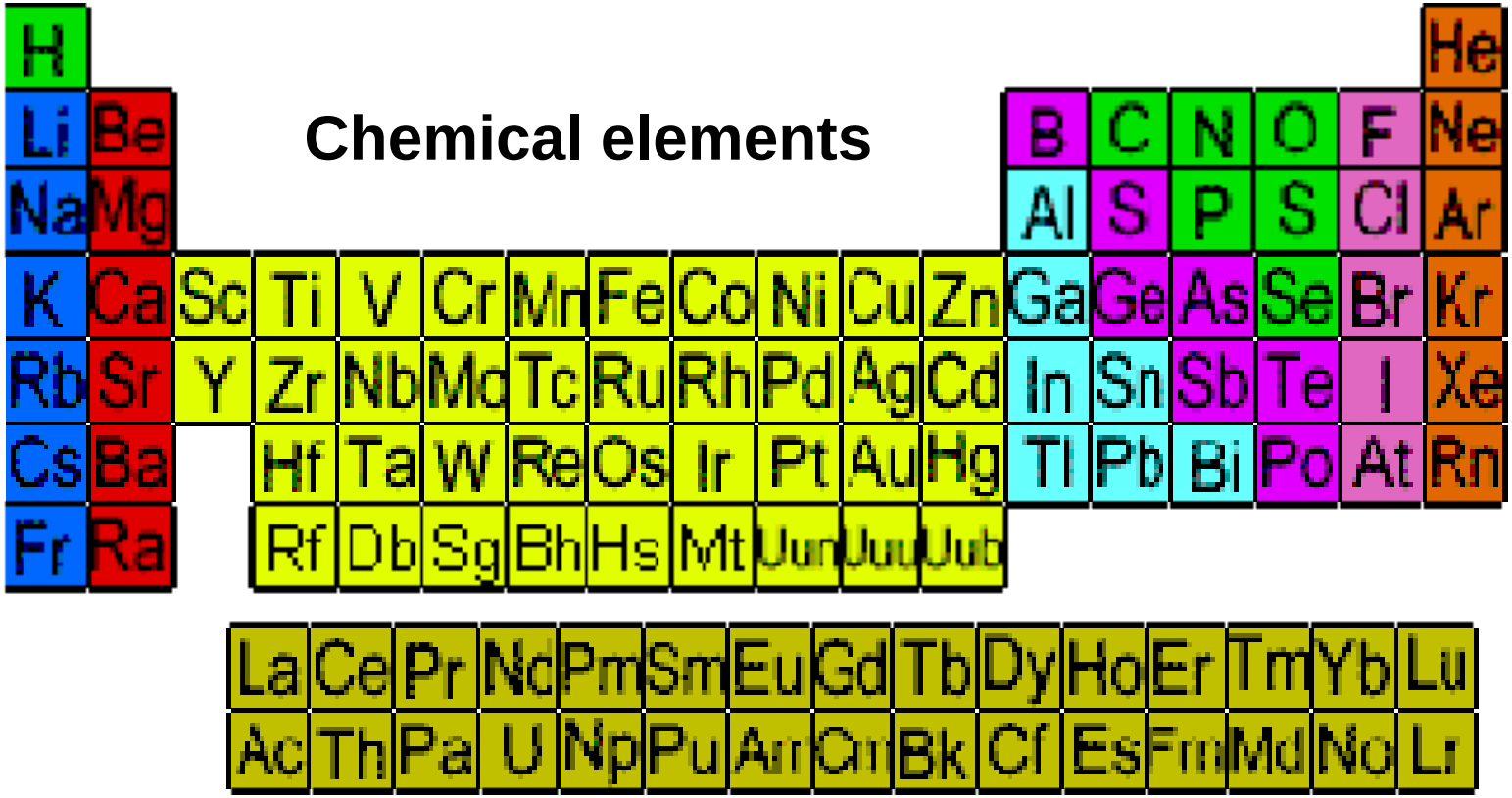


Allicin (non-protein amino acids)



Capsaicin (amines)

Introduction: *The Principle of Phytotherapy- Inorganic chemicals*



Introduction: *development of drugs*

- **Medicinal effects of plants developed in Ancient time**

1. *Direct test by physicians*: for example ancient Chinese physician, Shen Nong tested 70 plant species daily.
2. *Lessons from animals*: ancient people might gather knowledge of plants for medicinal use on the basis of animal e.g. chimpanzee's self-medication.

- **Ethnobotanists**

1. Joseph Rock (1884-1962)-kalaw tree (*Taraktogenos kurzii, Achariaceae*), chaulmoogra oil (for treatment of leprosy)

2. Richard Evans Schulte, from Harvard university

- Phytochemistry, Pharmacognosy, and Pharmacology

Introduction: *herb and medicinal herb*

A ***herb***, in botany, is a plant that does not form a woody stem, and in temperate climates usually dies, either completely (annual herb) or back to the roots (perennial herb) by the end of the growing season. Examples for perennial herbs include bulbs, Peonies, Hosta, grasses and Banana.

A ***medicinal herb*** is different from botanic term “herb”. It refers to any plants used for medicinal purposes.

For example, a medicinal herb can be a real herbal plant, a shrub, other woody plant, or a fungus. The used part may be the seeds, berries, leaves, barks, roots, fruits, or other parts of a plants, or mushroom, which may be considered "herbs" in medicinal or spiritual use.

Introduction: *fundamental concepts*

Botany is a branch of biology studying plant life, including: structure, growth, taxonomy, systematics, reproduction, metabolism, physiology, biochemistry, development, diseases, ecology, and evolution of plants.

Ethnobotany is the study of the relationship between plants and people and their culture.

William Harshberger (1895-1896), botanist in USA, termed "Ethnobotany"

Leopold Glueck, 19th century German physician, ethnobotanist

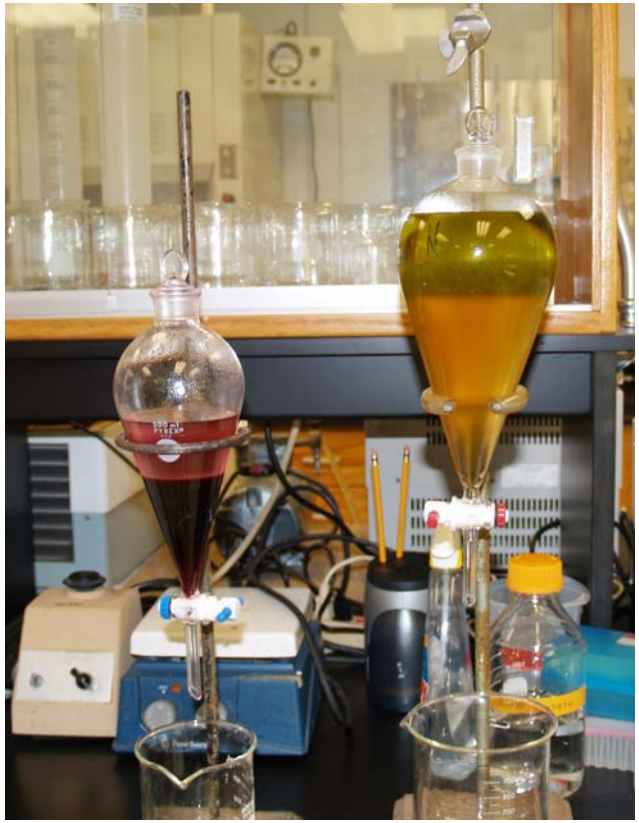
Richard Evans Schulte, called "father of modern ethnobotany"

Introduction: *fundamental concepts*

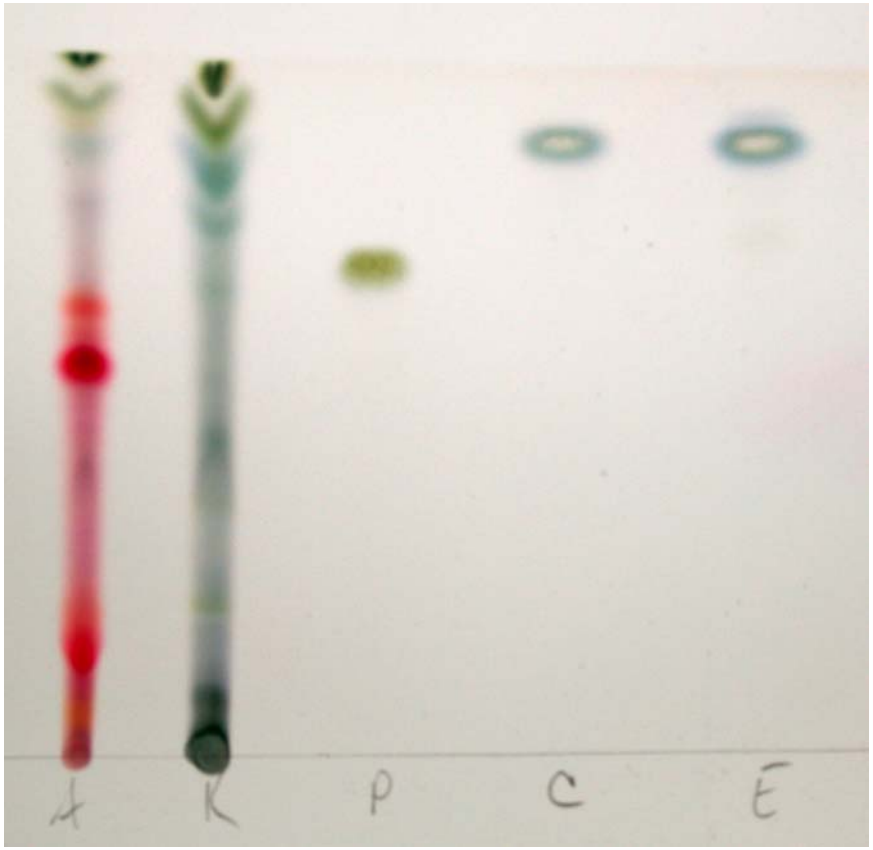
Phytochemistry is the study of phytochemicals produced in plants, describing the isolation, purification, identification, and structure of the large number of secondary metabolic compounds found in plants.

- Thin layer chromatography (TLC)
- Gel (column) chromatography)
- High performance of liquid chromatography (HPLC)
- Gas chromatography (GC)
- Mass spectrometry
- Nuclear magnetic resonance

Introduction: *fundamental concepts*



Extraction



TLC separation

Introduction: *How many doctors take care of human health?*

Allergists	allergy experts
Anesthesiologist	administer anesthesia during operations
Cardiologists	experts on the heart
Dermatologists	experts on skin disorders
Endocrinologists	experts on the endocrine glands
Epidemiologist	the occurrence of disease among large numbers of people
Gastroenterologists	experts on the stomach and digestive organs
Gynecologists	Expert on the female reproductive system
Hematologists	experts on the blood and the blood-forming organs
Internists	experts on internal organ problems
Nephrologists	experts on the kidneys
Neurologists	experts on the nervous system
Obstetricians	deliver babies and care for the mother
Oncologists	experts on cancer
Ophthalmologists	experts on eye diseases
Orthopedic Surgeons	operate on bones and on other parts of the skeletal system
Otolaryngologists	experts on ear, nose, and throat
Pediatricians	specialize in treating children
Psychiatrists	experts on mental illnesses
Urologists	treat the urinary tract and the male sex organs

Introduction: *fundamental concepts*

Phytotherapy is the use of plants or plant extracts for medicinal purposes (especially plants that are not part of the normal diet).

Homeopathy is a system of alternative medicine that strives to treat "like with like" . Treating ailment is carried out by using agents similar to but not identical to causative agents