PHARMACOGNOSY Lecture 1
2010/2011

PHARMACOGNOSY

Naming „Pharmacognosy“ is derived from two Greek words, „*pharmakon*“ that is drug and „*gnosis*“ that is knowledge.

Today it is highly interdisciplinary science, which is one of the five basic sciences of pharmaceutical education.

Pharmacognosy includes study of physical, chemical biochemical and biological properties of drugs, their content compounds, potential drugs and their content compounds, and search for new therapeutics from natural sources.

Research topics of pharmacognosy include studies in area of phytochemistry, microbial chemistry, biosynthesis, biotransformation and chemotaxonomy.

PHARMACOGNOSY

Science about drugs of natural origin

Explicates natural relations touching drugs and adjuvans of natural (biogenic) origin, which are produced by plants, animals and microorganisms,
used in human and veterinary medicine for therapy or prophylaxis or to affect physiological functions

Teaches:

- To recognose mechanisms of biologically active compounds biosynthesis
- To evaluate their role in drug preparations
- To predict their possible changes
- To understand the inter-relations of effective compounds, adjuvans and balast compounds from the utilization for the therapeutics preparation point of view

BENEFITS OF PHARMACOGNOSY TO DEVELOPMENT OF SOCIETY

- Production of new knowledge through the results of scientific research
- Employment of this knowledge in educational and training processes of pharmaceutical faculty
- Distribution of knowledge through further informational and communication channels
- Employment of knowledge and innovations in large scale in cooperation with industry and other economical players

BASIC TERMINOLOGY

79. Law about drugs and about changes of and additions to chosen corresponding laws

- Medicinal compound is usually compound of natural or synthetic origin, usually with pharmacologic or immunologic effect or affecting metabolism, compound which usually serves to prevent, cure or control disease, for diagnostic purposes and for affecting physiological functions.
- Medicinal preparation (medicament) is a preparation obtained by technologic processing of medicinal compounds and adjuvants, as well as plants used for pharmaceutical or therapeutic purposes, individually or in mixtures, into specific drug formulation packed in suitable cover and well descripted. Medicinal preparations are designated for application to human (human medicinal preparation) or for application to animals (veterinary medicinal preparations). Medicinal preparations are also: …diagnostics, immunologic preparations, preparations for blood transfer and blood derivatives, radio-therapeutics, medicinal teas, and medicinal dietetics.
- Medicines are medicinal compounds or their mixtures, or medicinal preparations, which are destined for application to human or animals, if not additional compounds or premixes.

Inter-relations between pharmacognosy and other sciences

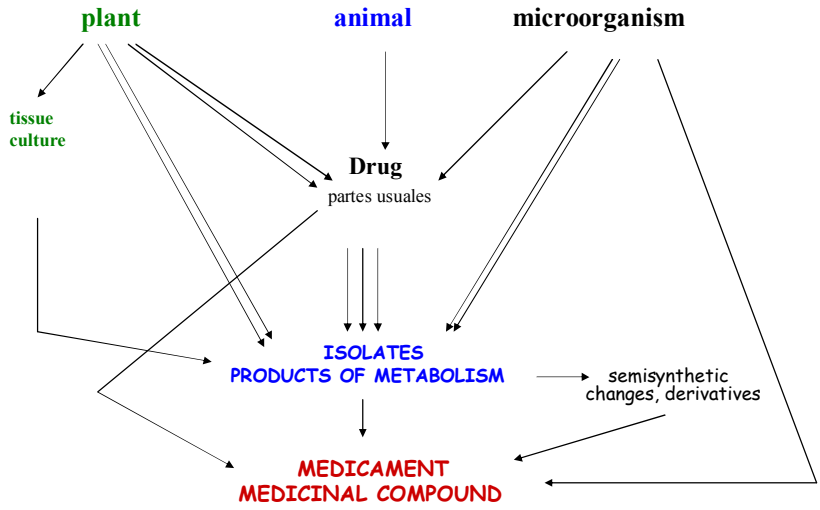
FGN belongs to life sciences; follows basic professional disciplines:

- General biology
- Botany
- Pharmacologic propedeutics
- General chemistry
- Analytic chemistry
- Organic chemistry
- Biochemistry
- Phytochemistry

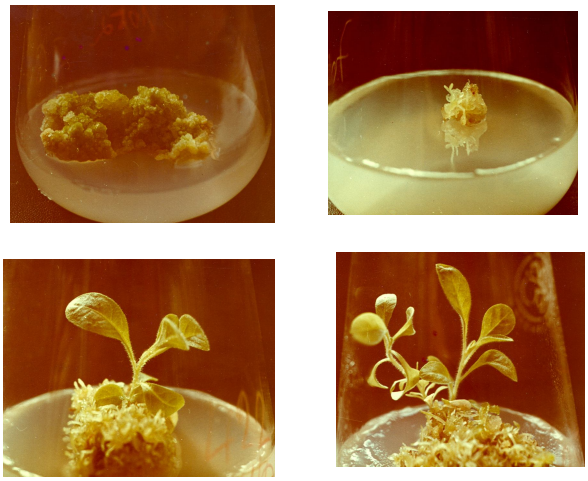
CONTINUITY ON PHARMACOGNOSY

- Pharmaceutical Chemistry
- Pharmacology and Toxicology
- Pharmaceutical Technology – Galenic Pharmacy
- Pharmacy

SOUCES OF NATURAL MEDICINES



Tissue cultures – differentiation



TISSUE CULTURES

- Shikonin (naphtoquinone), *Lithospermum erythrorhizon*
- Nicotine (alkaloid), *Nicotiana sp.*
- Ubiquinone (benzoquinone), *Nicotiana sp.*
- Taxol, *Taxus brevifolia*
- Berberine, *Coptis japonica*

ANIMALS

- Cera flava, Mel, Propolis, Royal Jelly (*Apis mellifica*)
- Cetaceum (*Physeter catodon* – sperm-whale*),* ointment base
- Adeps lanae (*Ovis aries* - sheep), ointment base
- Cantharis (derivant, aphrodisiac), Coccionella (coregent of color)
- Animal organs, glands (enzymes, hormones, proteins)

MICROORGANISMS

- *Penicillium sp.* – antibiotics, antimycotics (penicillin, griseofulvine)
- *Streptomyces sp.* - antibiotics (streptomycin = aminoglycoside, erythromycin = makrolide, nystatine = polyene, neomycin = oligosaccharide)
- *Lactobacillus sp.* - probiotics – Actimel (*L. cassei imunitas)*
- *Bacillus subtillis* IP 5832 (Bactisubtil – non-infective enteritides)
  spores --- vegetative forms; dungman
- *Leuconostoc mesenteroides* (Dextran – blood plasma substitution)
- *Aspergillus flavus, A. fumigatus* – toxicologically important

Natural medicines – preparations used for treatment or prevention of diseases. Bearers of effect are metabolites of plants, fungi and animals. Natural medicines can be divided:

with complex character with defined structure

Medicines with complex character:

- More beneficial effect than pure compounds (co-effectors, synergism) – for example anthraquinone laxatives, carminatives, Rauwolfiae extr. - reserpine
- Preparation of pure compounds non-economic, technologically complicated – for example expectorants, amara, saponine diuretics
- Slowly emerging and prolonged effect – for example Belladonnae extr. – atropin
- Content compounds responsible for effect not known

Compounds with defined structure (isolates):

- Fast effect
- Precise dosage
- Standardness

direct use
derivatives with targeted effect
model for synthesis
study of effect mechanism

For isolation of 1 kg taxol / bark of 2500 adult trees. Terapy of CA ovaries in USA – consumption 20-25 kg / year, represents 50-70 000 trees *Taxus brevifolia*

Human civilisation experimented with plants and used them and their extracts for centuries based on *empiria*.

Last 100 years the reseach and development on plants and their compounds is systematic.

HISTORY/1

Primitive communism

Sumer, Babylonia, Assyria; Ebers papyrus 1500 BC, prescriptions with medicinal plants)

Plants separated based on empiric knowledge:

- food
- poisonous, harmful
- medicinal

Slavery and feudalism (Old Greece, Roman Empire): Démokritos (-5), Hippokrates (-5) Theofrastos (-4), Plínius (+1), Dioskuridés (+1) - De materia medica, Galénos (+2)

- primitive processing
- selection of plant organs
- effect veiled in mysteries
- gift of supernatural being

Yellow residue visible on a piece of a wine vessel from about 3150 BC
Image: German Archaeological Institute, Cairo
BioMedNet 2009 04 15.

Chemical traces of medicinal herbs identified in ancient Egyptian wine jugs demonstrate that the culture employed herbal remedies 1500 years earlier than previously thought, reports a study in april 2009 in PNAS.

The analysis identified a group of relatively rare compounds that are known to be present in a number of herbs and plants, including tree resins–pryskyřice (possibly used as a preservative), juniper berries, rosemary, mint, camphora, savory, artemisia, coriander, sage and thyme. This suggests that one or more of them were likely additives to the wine, the researchers wrote.

HISTORY/2

Medieval Ages

- stagnation affected by problems of religion (development of theology, life sciences suppressed)
- some monasterial botanical gardens with medicinal plants (early feudalism, shelters for diseased and poor people)
- development in Islamic part of world (Avicena, Mesue, Avenzoar, Ibn Beithar-1400 AD)
- Universities - 1148 Bologna, (Salamanca), 1348 Charles University in Prague
- book printing + herbals = spreading of knowledge (Guttenberg 1436,. Herbal of Brunfels – illustrated by Albrecht Dürrer, Herbal of Mathioli, Herbal of Jan Černý)

Renaissance

- an effort to follow consequences between the effect and content compounds
- Paracelsus (15./16. century „ the effect does not possess whole plant, but active principles which contains – Quinta essentia")
- Alchemy (an effort to transmutate elements, preparation of gold, search for philosopher's stone (lapis philosophorum, El Iksir) and elixir of youth, methodological benefit for recognition of nature)
- Discovery of microscope, first scientific journals (17th century)
- W. Withering – 1785 firstly described therapeutic potential of digitalis for treatment of heart diseases

HISTORY/3

- Jiří Josef Kamel, born in Brno (1661 – 1706), „coadjutor" and religious brother of Jesuits. In Manila (Philippines) founded a pharmacy and botanical garden. He collected local plants and built up herbals, studied animals, made detailed pictures and descriptions. He tried to start systematic classification of plants (before Carl Linné). According to him: plants were devided into three classes (according to habitus): *Plantae humiles* – herbs; *Arbores et Frutices* – trees; *Plantae Scandentes* – lianes. He enhanced knowledge of botany, zoology and pharmacy, has was builder of modern life sciences in 17th century.etí. Carl Linné as a credit of his scientific merits named in Theaceae family genus Camellia; *Thea japonica* seu *chinensis* was named *Camellia Thea.*

- Carl Linné (23.5.1707-10.1.1778), Swedish naturalist, founder of botanical and zoological systematics. His work *Systema naturae* (System of Nature, 1735) described all at that time known organisms with short latin characteristic and described them with double word name, tribal and generic (binomic nomenclature), majority of them valid today. He created a genus as a basic term for natural systematics of organism.

MEDAL of J.J. KAMEL

(acad. painter Karel Zeman)

HISTORY/4

Capitalism
- Recognition of therapeutic effect of drugs
- Isolation of effective compounds – model for synthesis

Pharmacists: Karl W. Scheele 1742-1786, Stockholm;
Fridrich W. Sertürner r. 1806 - Mo, Peletier and Caventou – quinine

(dramatics: Norwegian Henrik Ibsen (1828-1906) „Peer Gynt“;
German Herman Sudermann (1857-1928) „Body And Devil“; „Prohibition of Sodoma“;
Swedish August Strinberg (1849-1912), fight against institution of marriage manželství and against feminism; „Fools Defense“ = pathologic intensity of live expirience;
German painter Carl Spitzweg (1808-1885) period of biedermeier
„Hypochondr“