

# *Pharmacognosy*

## *lab exercise 1*



**What is Pharmacognosy?**

**What is a drug?**

**How can we identify drugs?**

**How to prepare microscopic preparations?**

# Important Lab Safety Rules



Know the location of safety equipment

Follow the instructions

Don't play mad scientist

Leave experiments at home

Dress appropriately

Know what to do in case of an accident

Don't taste or sniff chemicals

Don't eat or drink in lab

Don't experiment on yourself

Dispose of waste properly



# How to obtain course credits

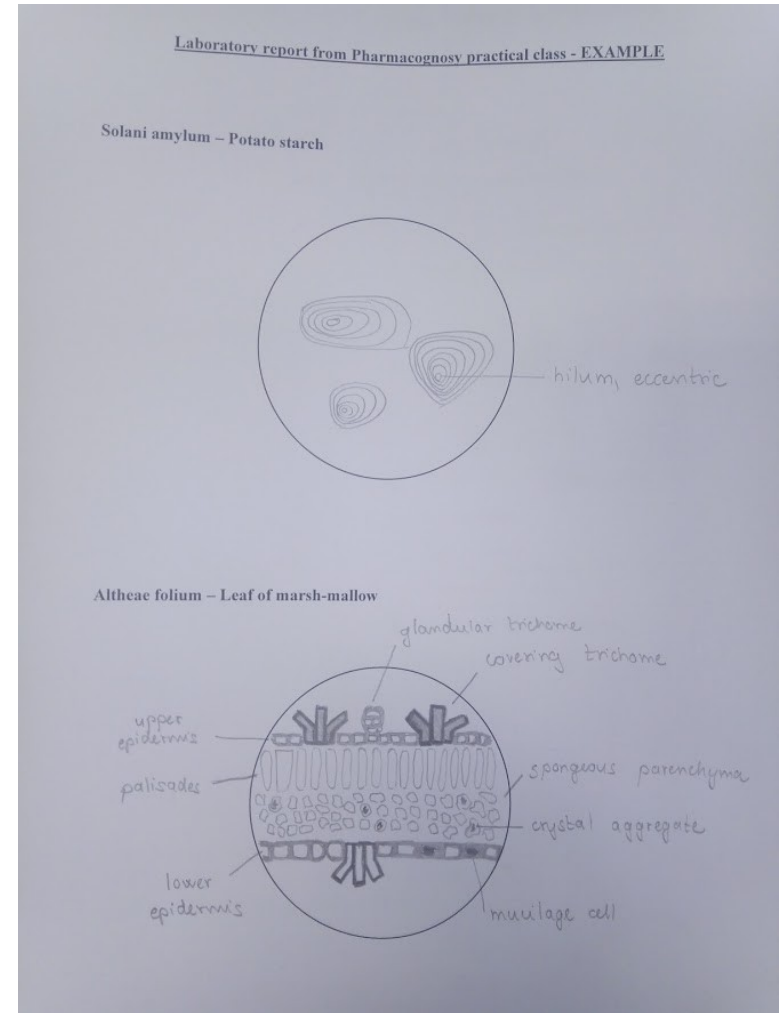
100% participation in practical lessons – in case of one-time absence you will write a short paper on a given topic (2-3 standard pages)

At least 60% of **two** tests (12 points of 20 max.)

Test 1 – 6th week of semester

Test 2 – 10th week of semester

Reports from lab exercises – sketches of microscopic preparations, with designations of typical structures, possibly denote the magnification used for observation, sketches are made during the practical class and are handed in at the end of the that class



# *Pharmacognosy*

Science about drugs of natural origin – plant, animal, microbial, which are used for treatment, prevention of diseases, and diagnostics and affection of physiological functions

Pharmacognosy relates to other pharmaceutical disciplines (pharmacology, medicinal chemistry, galenic pharmacy)

Starting material for isolation of natural medicinal products are drugs

# Drug

Word origin: *droog waere* (flemish word for dry spices and herbs)

Modified or non-modified preserved **plants** or their parts; **animals** or their parts; or **products of metabolism** of plants, animals, or microbials (starch, mucilage, honey)

## Drugs according to structure:

with organized body structure (cellular structure, *Malvae flos*)

amorphous (products of metabolism, *Balsamum peruvianum*)

## Drugs according to origin: plant-derived

animal-derived (whole animal – *Cantharis*, animal organs – glands, products – waxes, hormones, enzymes)

**Conservation** stops the decomposition of plant material after it has been removed from the mother plant

- freezing, freeze-drying
- preferred way of conservation – **drying**

# Drying

- direct sunlight is unsuitable
- in shade and well-ventilated rooms
- properly dried plant material contains most of its original constituents in the same amounts as before drying
- drying temperature, duration and method of drying depend on the constituents of the dried plant – plants containing volatile essential oils up to 40°C,
  - easily hydrolysed constituents (glycosides) – fast drying with a higher temp. (enzyme inactivation) and then drying with usual drying temp. 60-70°C

## Change of colour during the drying process:

- Plants with **neutral** cellular fluid – almost no colour change
- Plants with **acidic** cellular fluid get dark
- Flowers with **anthocyanins** content change colour from pinkish or red to purple or blue

## We need to know:

Drying temperature

Way of drying

Length of drying

Storage parameters (no direct sunlight, 5-15°C)

Right labelling

# ***Systematic classification of drugs***

Pharmaco-botanical – according to the phylogenetic development of mother plants

Pharmaco-chemical – according to the chemical structure of content compounds

Pharmacological – according to the therapeutic effect of content compounds

Biogenetic – according to the biosynthetic origin of content compounds

# ***Nomenclature of Drugs***

Binomic – first part of name expresses mother plant (genus or species), second part expresses name of corresponding plant organ

*Lini semen, Belladonnae radix, Conii fructus*

One name - *Lycopodium, Mel*

Exceptions - *Liquiritiae radix, Cynosbati fructus*

It is necessary to state the mother plant and family each time



# *Drugs from aerial plant parts*

**Folium** (*leaf*) – plant leaves



**Herba** (*herb*) – whole aerial plant part



**Flos** (*flower*) - whole flowers or their parts (floral leaf petals), or whole inflorescence

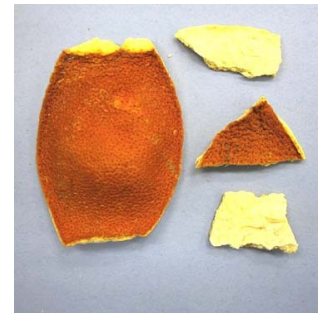


# *Drugs from aerial plant parts*

**Fructus** (*fruit*) – whole fruit or infructescence, or fruit imitations



**Pericarpium** – pericarps of Rutaceae family



**Semen** (*seed*) – seed or its part (germ)



# *Drugs from aerial plant parts*

**Cortex** (*bark*) – all kinds of plant tissues upon the cambium



**Lignum** (*wood*) – woody parts of plant only (xylem)



# *Drugs from aerial plant parts*

***Stipes*** – drug contains peduncle only

***Gemma*** - drug contains eye only

***Sporae*** – drug contains spores only

***Glandulae*** - drug contains glands only

***Caulis*** - drug contains footstalk (stem) only

***Strobilus*** - drug contains strobiles only



# *Drugs derived from underground plant organs*

**Radix** – used for drug made of rhizomes, roots, bulbs and tubers



# ***Nomenclature of plant products and most often used adjectives***

*Amylum* - starch

*Balsamum* - balm

*Resina* – resin/oleoresin

*Gummi* - mucilage

*Gummi-resina* – gum resin  
(bdellium)

*Cera* - wax

*Oleum* - oil, volatile oil

*naturalis* - natural

*pulvis* - powdered

*mundata* - peeled

*maturus* - ripened

*imaturus* - unripened

*amari* - bitter

*dulcis* - sweet

# ***Review of traditional pharmacological effects of drugs***

- astringent (adstringent)
- amarum
- anabolic
- analgesic
- anthelmintic
- antianemic
- antiarrhythmic
- antiasthmatic
- antidiabetic
- antidiarrhoic
- antidysmenoreic
- antiphlogistic
- antihemoroidal
- antihydrotic
- antirheumatic
- antisclerotic
- aromatic
- balneologic

# ***Review of traditional pharmacological effects of drugs***

- cardioactive
- cardiotonic
- carminative
- cholagogue
- cholekinetic
- choloretic
- corrigens
- cytostatic
- derivans
- dermatic
- desinfiens
- diaphoretic
- diuretic
- emenagogue
- emetic
- expectorant
- gargarism
- gynecologic
- hypotensive



# ***Review of traditional pharmacological effects of drugs***

- lactagogue
- laxative
- metabolic
- nervine
- roborans
- sedative
- spasmolytic
- stimulans
- stomachic
- urologic
- venotonic

# *Drug analysis*

- Using the demands of **pharmacopaeia** or other mandatory rules
- Identification
- Purity checking
- Content determination

**Important** – sample collection and preparation

# *Identification*

- **Sensoric (organoleptic) assays** – using our natural sensors
  - Smell
  - Taste
  - Vision
  - Touch
- **Microscopic identification** – directed on characteristic signs (shape of skin cells, presence of typical structures/organelles containing essential oils, mucilages, starch grains, vascular bundles)
- **Physico-chemical methods** – microsublimation, fluorescence, simple chemical reaction or thin layer chromatography

# *Purity checking*

- Foreign matter, impurities
- Loss on drying
- Determination of total ash
- Determination of HCl-insoluble ash
- Optical rotatory power
- Index of refraction

# ***Content determination***

- Direct / indirect determination of compounds
- Colorimetric methods
- Gravimetric methods
- Titration methods
- Biological methods
- HPLC, GC

# *Division of plant metabolites*

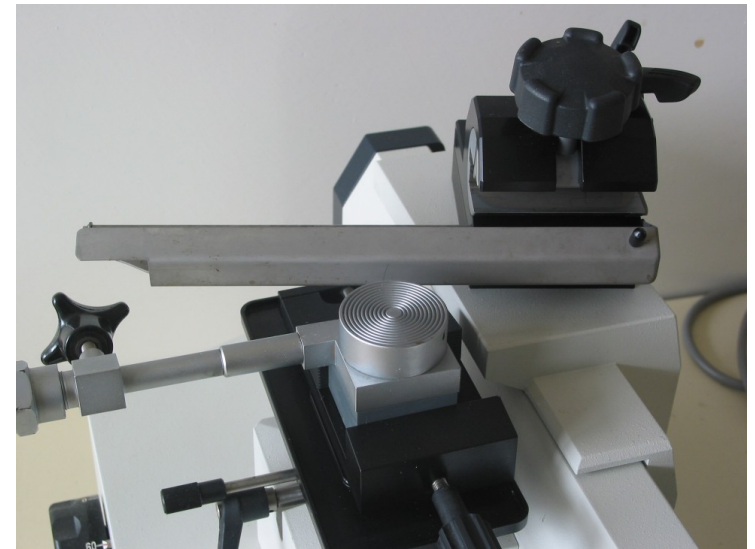
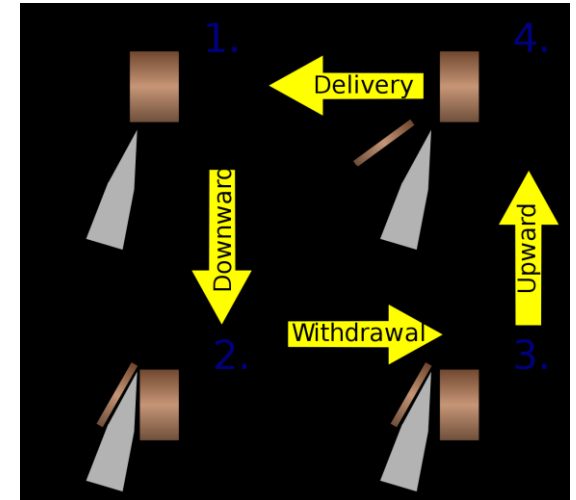
- **primary metabolites** - saccharides, amino acids, low-molecular carboxylic acids – mevalonate, pyruvic acid, shikimic acid
- **secondary metabolites** - polysaccharides, alkaloids, terpenoids, phenolic glycosides, flavonoids, coumarines, anthocyanins, tannins, anthraglycosides...

# *Preparation of microscopic slides*

- Temporary microscopic slides
- Permanent microscopic slides
- Surface specimens - leaves, flowers
- Cuts - barks, wood, root
  - transversal
  - tangential
  - radial

# • Ways of cutting

- manual
- microtome cut thickness: 50 nm- 100  $\mu$ m
  - Sledge-type microtome
  - Rotary microtome
  - Cryomicrotome
  - Laser microtome contact free slicing





# *Procedure of permanent slide preparation*

- **Softening and conservation**
  - Alcohol-glycerol mixture, chlorine dioxide in acetic acid, formaldehyde
- **Fixation**
  - Immediate termination of biochemical reactions
  - Fixation mixtures – FAA (formaldehyde/acetic acid/alcohol), chromic acid
- **Clearing**
  - Chloral hydrate, hydrogen peroxide, glycerol

- **Fastening of object**

- Encapsulation into paraffin

- it is necessary to remove water by treatment with ethanol (ethanol series)

- Encapsulation into gelatin

- Freezing

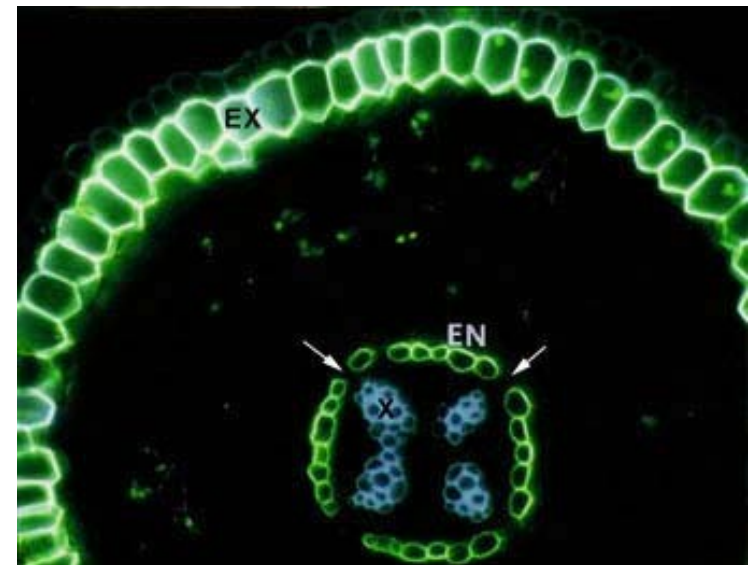
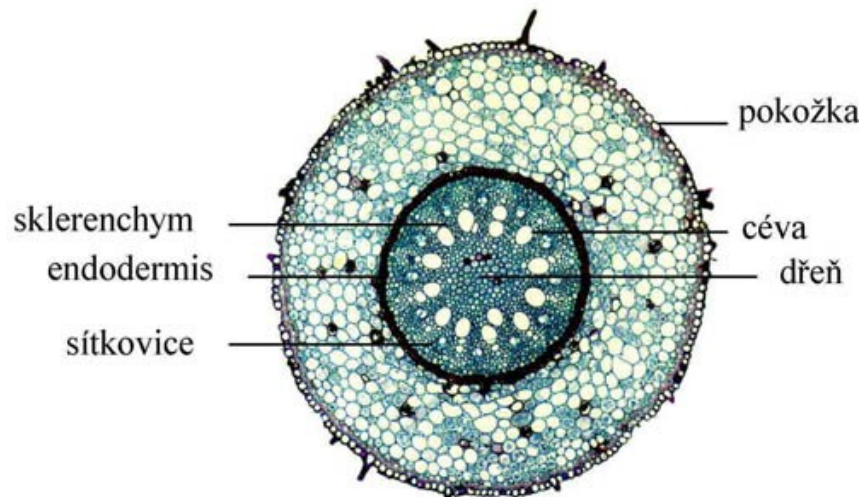
- **Cutting and adhesion**

- Mixture of albumin and glycerol 1:1

- **Staining**

- Before using stains paraffin must be removed by hydration with alcohol series

- Staining according to the procedure
  - progressive, regressive, succedaneous, simultaneous
- Staining according to the result
  - diffusive, differentiative
- phloroglucine, picric acid, iodine solution, saphranine, fuchsine, ferric chloride, congo red



- **Mounting**
  - Necessary to dehydrate
  - Canada balsam, resins, liquid paraffin
- **Enframement**
  - lanoline-colophony glue, albumin, colorless nail polish

# *The most important information sources about natural products*

- **Text books for Pharmacognosy**
  - Bruneton J.: Pharmacognosy, phytochemistry
  - Evans W.C.: Pharmacognosy
  - Dewick: Natural products
  - Wichtl M.: Herbal drugs and phytopharmaceuticals
  - European Pharmacopoeia

- internet

- Web of Science
- Science Direct
- Belstein Crossfire
- American Chemical Society
- SciFinder