

2024/2025. ACADEMIC YEAR

PROGRAM OF STUDY

Full (Hungarian) name of the subject: GYÓGYNÖVÉNY- ÉS DROGISMET II.							
Program: Undivided program (pharmaceutical)							
Schedule: full time							
Short name of the subject: Pharmacognosy II.							
English name of the subject: Pharmacognosy II.							
German name of the subject: Pharmakognosie II.							
Type of registration: <u>obligatory</u> /obligatory elective/elective/criteria requirement							
Neptun code of the subject: GYKFMG130E2A (theory)							
Responsible Department: Department of Pharmacognosy							
Responsible tutor Dr. Ágnes Alberti				Title, academic degree: associate professor, Ph.D.			
Contact information: - phone: +3620/825-8389 - email: alberti.agnes@semmelweis.hu							
Name of the persons responsible for the teaching of the subject: Ágnes Alberti Orsolya Csernák Ida Fejős Nóra Gampe Eszter Riethmüller Attila Ványolós				Title, academic degree: associate professor, Ph.D. assistant professor, Ph.D. assistant professor, Ph.D. assistant professor, Ph.D. assistant professor, Ph.D. associate professor, Ph.D.			
Class per week: 2 lectures				Credit point(s): 3 credits lecture			
Professional content, intent of acquirement and its function in order to implement the goals of the program: The aim of the course is to acquaint pharmacy students with medicinal plants, herbal drugs and the analytical methods applied in their quality assurance. By doing so, it contributes to the education of pharmacy students to become key experts in herbal medicines. It contributes to the training of students with modern knowledge of pharmacognosy at a time when the knowledge about natural substances and herbs has come to the fore and has expanded with new aspects due to European harmonization.							
Short description of the subject: The topics of the classes follow the biogenetic system of plant materials. It represents a shift in proportion and, in part, selection in the curriculum, that sufficiently emphasizes the importance of knowledge of herbal drugs and their active ingredients that are important in therapeutic practice. At the same time, it provides knowledge in the context of structure-activity relationships for the sufficient processing of newly emerging herbal drugs, possibly of foreign origin, based on their chemical groups. It also introduces the requirements of the European Pharmacopoeia (Ph. Eur.) regarding herbal drugs and preparations. Thus, it provides knowledge of all herbal drugs and active substances that serve as raw materials for phytopharmaceuticals (including those that will soon become traditional OTC medicines) and preventive products (dietary supplements).							
Course data							
Recommended term	Contact hours (lecture)	Contact hours (practice)	Contact hours (seminar)	Individual lectures	Total number of contact hours/semester	Normal course offer	Consultations

7th semester	28	-	-	-	28	<u>Autumn semester*</u> Spring semester Both semesters (<i>Please underline</i>)	--
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Program of semester**

Topics of theoretical classes (pro week):

Week 1: Biosynthesis and grouping of terpenoids. Essential oils in the plant kingdom, their medicinal significance. Essential oils containing monoterpene components.

Acyclic monoterpenes: *Lavandulae flos*, *Coriandri fructus*, *Melissae folium*, *Rosae flos*

Monocyclic monoterpenes: *Aurantii amari flos*, *Aurantii amari epicarpium et mesocarpium*, *Menthae crispae folium*, *Menthae piperitae folium*, *Carvi fructus*, *Melaleuca folium*

Bicyclic monoterpenes: *Eucalypti folium*, *Lignum cinnamomi amphorae*, *Rosmarini folium*, *Juniperi galbulus*, *Salviae officinalis folium*

Aromatic monoterpenes: *Thymi herba*

Week 2: Volatile phenylpropane and sesquiterpene-containing essential oils. Balms, resins.

Phenylpropane derivatives: *Caryophylli flos*, *Anisi fructus*, *Foeniculum drugs*, *Cinnamomi cortex*, *Myristicae semen*, *Levistici radix*

Volatile sesquiterpenes: *Matricariae flos*, *Chamomillae romanae flos*, *Millefolii herba*, *Absinthii herba*, *Zingiberis rhizoma*, *Curcuma drugs*

Balms, resins: *Terebinthina drugs*, *Balsamum peruvianum*, *Benzoe drugs*, *Myrrha*, *Olibanum indicum*

Week 3: Iridoids, sesquiterpene lactones, diterpenes: valepotriate iridoid esters, bitter substances and other types of plant metabolites.

Monoterpene derivatives

Valepotriate iridoid esters: *Valerianae radix*

Iridoids and secoiridoids: *Gentianae radix*, *Menyanthidis trifoliatae folium*,

Centaurii herba, *Harpagophyti radix*, *Plantaginis lanceolatae folium*, *Agni casti fructus*, *Oleae folium*

Sesquiterpene derivatives

Sesquiterpene lactones: *Cardui benedicti herba*, *Taraxaci officinalis radix*, *Cynarae folium*, *Arnicae flos*

Diterpenes: *Marrubii herba*, *Ginkgonis folium*, *Stevia rotundifolia*

Week 4: Triterpenes, sterane saponins, tetraterpenes, polyterpenes

Triterpene saponins: *Hederae folium*, *Liquiritiae radix*, *Primulae radix*, *Saponariae albae radix*, *Hippocastani semen*, *Centellae asiaticae herba*, *Quillajae cortex*

Triterpene acids and alcohols: *Olibanum indicum*, *Calendulae flos*, *Taraxaci officinalis herba cum radice*

Drugs with adaptogenic action: *Ginseng radix*, *Poria*

Steroidal saponins: *Rusci rhizoma*, *Sarsaparillae radix*

Tetraterpenes: *Croci stigma*, *Lycii fructus*

Polyterpenes: *Resina elastica*

Week 5: Cardiac sterane glycosides, special steroids

Cardiac sterane glycosides: *Digitalis purpureae folium*, *Digitalis lanatae folium*, *Convallariae folium*, *Strophanthi semen*, *Scillae bulbus*

Specific triterpenes, phytosterols: *Pruni africanae cortex*, *Sabalis serrulatae fructus*, *Cucurbitae semen*, *Urticae radix*, *Epilobii herba*, *Cimicifugae rhizoma*

Ecdisteroids: *Leuzeae radix*

Week 6: Azotoids, nitrogen metabolism in plants. Biosynthesis and grouping of alkaloids.

Alkaloids of ornithine origin.

Amino acids, peptides, biogenic amines

Alkamides: *Echinacea drugs*

Lectins: *Visci albae herba*

Herbal enzymes: *Carica papaya*, *Ananas comosus*, *Ficus spp.*

Alkaloids

Alkaloids of ornithine origin

Tropane alkaloids: *Belladonnae folium*, *Stramonii folium*, *Cocae folium*

Week 7: Alkaloids of ornithine, lysine and tryptophan origin

Alkaloids of ornithine origin

Pyrrolidine and pyrrolizidine alkaloids: *Nicotianae folium*, *Boraginis herba*,

Symphyti radix, *Farfarae folium*

Alkaloids of lysine origin

Piperidine alkaloids: *Lobeliae herba*

Alkaloids of tryptophan origin

Simple indol alkaloids: Physostigmae semen
 Hemiterpenoid indol alkaloids: Secale cornutum
 Monoterpenoid indol alkaloids: Rauwolfiae radix, Vincae minoris herba, Uncaria-
 drugs, Catharanthi rosei herba, Strychni semen, Loganiaceae-Curare
 Monoterpenoid quinoline alkaloids: Cinchonae cortex

Week 8: Phenylalanine alkaloids

Benzyl isoquinoline alkaloids
 Aporphine alkaloids: Boldi folium
 Morphinane alkaloids: Papaveris maturi fructus, Opium crudum
 Protoberberine, benzophenanthridine, phthalidizoquinoline alkaloids: Chelidonii herba,
 Fumariae herba, Hydrastis rhizoma
 Bisbenzylisoquinoline alkaloids: Menispermaceae-Curare
 Monoterpenoid isoquinoline scaffolds: Ipecacuanhae radix
 Amaryllidaceae-alkaloids: Galanthi bulbus

Week 9: Histidine alkaloids. Protoalkaloids of phenylalanine origin. Pseudoalkaloids: alkaloids of phenylalanine and nucleotide origin.

Histidine alkaloids
 Imidazole alkaloids: Jaborandi folium
 Protoalkaloids
 Protoalkaloids of phenylalanine origin
 Tropon alkaloids: Colchici semen
 Pseudoalkaloids
 Pseudoalkaloids containing exocyclic nitrogen of phenylalanine origin
 β-amino-phenyl-propane alkaloids: Ephedrae herba, Cathae edulis folium
 Benzyl amine alkaloids: Capsici fructus
 Piperidine alkaloids: Conii fructus

Week 10: Pseudoalkaloids of nucleotide origin

Purin alkaloids: Camelliae sinensis non fermentata folia, Mate folium, Cacao semen,
 Coffeae semen, Colae semen, Guaranæ semen

Week 11: Pseudoalkaloids of terpene origin. Cyanogenic and mustard oil glycosides

Pseudoalkaloids of terpene origin
 Diterpene alkaloids: Aconiti tuber, Taxi cortex
 Steroid alkaloids: Dulcamarae stipes, Solani nigri herba, Veratri rhizoma et radix
 Cyanogenic and mustard oil glycosides: Amygdalae semen, Pruni armeniacaee semen,
 Sinapis nigrae semen, Sinapis albae semen
 Other drugs containing sulfur-containing compounds: Allii sativi bulbus, Allii cepae
 bulbus

Week 12: Plant Biotechnology

Week 13: Summary presentation: preparation for the exam

Week 14: Midterm

Topics of practical classes (pro week): -

Schedule of consultations: on demand

Course requirements

Prerequisites: Pharmacognosy I.

Conditions of attending the classes, amount of acceptable absents, way of presentation of leave, opportunity for makeup: Based on the current Study and Exam regulations

The grading method; the conditions for getting the signature; the number, topic(s) and date(s) of the mid-term assessments, (reports, term tests), and the process in which they contribute to the final grade; and the possibility of their retake or their upgrading retake (as provided in §§ 25-28 of the STUDY AND EXAMINATION REGULATIONS): -

Number, topics and dates of tests during the semester, opportunities of makeup and improvement of results*: -**

Requirements of signature (as provided for in STUDY AND EXAMINATION REGULATIONS § 29):

Participation at the practices based on the current Study and Examination regulation. Submission and acceptance of reports. The average of the grades of the midterm examinations is at least 2.0. Successful completion of the obligatory midterm test.

Number and type of projects students have to perform independently during the semester and their deadlines: -

Type of the semester-end examination: signature*/practical grade*/semi-final*/final* (Please underline)

Examination requirements:

Exam

During the exam, the students draw a package of two theoretical topics and a herbal drug as the third topic. The theoretical topics should be described, and the herbal drug should be characterized after identification (morphological and chemical properties, related analytical test methods, effects, side effects, use).

Students have 30 minutes to prepare. Students receive separate grades for each topic, the average of which gives the exam mark. Each sub-topic shall be completed separately with at least satisfactory results. Students who have achieved at least 80% of the points writing the quizzes on the lectures will receive an excellent grade, students who reach 70% will receive a good grade, for the third sub-topic (drug recognition).

Topic list:

1. The concept of pharmacognosy. Collection, cultivation, processing of medicinal plants. Factors affecting the quality of medicinal plants, herbal breeding.
2. The concept, classification, and nomenclature of drugs. The importance of drug control and qualification. The monographs and their requirements of the Pharmacopoeia and EMA.
3. The concept of universal and special metabolism, classification of plant metabolites.
4. Biosynthesis of carbohydrates, their groups. Monosaccharides, oligosaccharides, and their drugs. Honey and various beekeeping products.
5. Grouping of homo- and heteropolysaccharides, homopolysaccharide drugs. Polysaccharides of algae and fungi, pectins, gums and their drugs.
6. Structure, biological action, and drugs of mucilage polysaccharides.
7. Plant acid metabolism, organic and inorganic plant acids, their drugs.
8. Grouping of polyketides, fatty acids, production of fatty oils, their analytics.
9. Fatty oils, waxes, and their drugs.
10. Grouping of phenolics.
11. Phenol glycosides, salicylic glycosides, caffeic acid derivatives: their chemical structure, biological effects, and their drugs.
12. Chemical structure, biological effects, and drugs of lignans.
13. Diarylheptanoids, arylalcanones, stilbenes and flavonolignans: chemical structure, action, and drugs
14. Classification of coumarins based on chemical characteristics, their biological effects, and drugs.
15. Classification of flavonoids by structure, biological effects. Qualitative and quantitative analytical tests of flavonoid-containing drugs.
16. Flavonoids and their drugs.
17. The chemistry, action, and drugs of isoflavones, rotenoids, chalcone derivatives and anthocyanins.
18. Classification of tannins by structure and their biological effect. Qualitative and quantitative analytical tests of tannin-containing drugs.
19. Drugs containing tannins.
20. Chemical structure and biological effect of quinones. Drugs containing naphthoquinone. Drugs containing naphthodianthrone derivatives. Cannabinoids and phloroglucinol derivatives: chemical structure and their drugs.
21. Chemical structure, biological effect, and analytics of anthraglycosides.
22. Drugs containing anthraglycosides.
23. Poisonous mushrooms and lower order fungi, fungal toxins.
24. Fungi with medicinal potential, pharmaceutical active substances of fungal origin.
25. Biosynthesis and classification of terpenoids.
26. Essential oils in the plant world. Production of essential oils, analytics, effects, side effects.
27. Essential oils containing acyclic and monocyclic monoterpenes and their drugs.
28. Essential oils containing bicyclic, and aromatic monoterpenes and their drugs.
29. Essential oil drugs containing phenylpropane derivatives. Balms, resins, and their drugs.
30. Drugs containing sesquiterpene-lactones and volatile sesquiterpenes

31. Classification of bitter substances, chemical structure and biological effect, drugs containing bitter substances.
32. Valepotriates, iridoids, secoiridoids and their drugs. Diterpenes and their drugs.
33. Grouping of saponins by structure. Steroidal saponins and their drugs.
34. Triterpene saponins and their drugs.
35. Plant drugs with adaptogen effect. Triterpene acids and alcohols, tetraterpenes, polyterpenes and their drugs.
36. Classification of cardiac glycosides, chemical structure, analytics, and biological effect.
37. Drugs containing cardiac glycosides.
38. Phytosterols, ecdisteroids and their drugs.
39. Biogenic amines, alkaloids, plant enzymes, lectins. Classification and biosynthesis of alkaloids.
40. Tropane alkaloids and their drugs.
41. Pyrrolidine, pyrrolizidine and piperidine alkaloids and their drugs.
42. Simple, hemiterpenoid and monoterpenoid indol alkaloids and their drugs. Monoterpenoid quinoline-framed alkaloids and their drugs.
43. Aporphine- and morphine-framed alkaloids and their drugs.
44. Protoberberin-, benzophenanthrene-, phthalidisoquinoline-, bisbenzylisoquinoline- and monoterpenoid isoquinoline skeletal alkaloids and their drugs.
45. Pseudoalkaloids containing exocyclic nitrogen of phenylalanine origin and other pseudoalkaloids with their drugs
46. Pseudoalkaloids of nucleotide origin and their drugs.
47. Pseudoalkaloids of terpene origin and their drugs. Cyanogenic glycosides, glucosinolates and other sulfur-containing compounds and their drugs.
48. Plant biotechnology and genetic engineering. Production of biologically active substances by plant cultures.

Drugs to recognize:

- Carbohydrates: *Acaciae gummi*, *Agar*, *Althaeae folium*, *Althaeae radix*, *Graminis rhizoma*, *Lichen islandicus*, *Lini semen*, *Malvae folium*, *Malvae sylvestris flos*, *Plantaginis lanceolatae folium*, *Psyllii semen*, *Salviae hispanicae semen*, *Taraxaci officinalis radix*, *Tiliae flos*, *Tragacantha*, *Trigonellae foenugraeci semen*, *Verbasci flos*
- Plant lipids: *Cucurbitae semen*, *Helianthi annui semen*, *Lini semen*, *Papaveris semen*, *Ricini semen*, *Sesami semen*, *Glycine semen*
- Plant acids: *Echinaceae purpureae herba*, *Equiseti herba*, *Hibisci sabdariffae flos*, *Hippophaeae fructus*, *Pulmonariae folium*, *Rosae pseudo-fructus*, *Rosmarini folium*
- Phenolic glycosides, coumarins, lignans, diarylheptanoids: *Curcumae longae rhizoma*, *Meliloti herba*, *Rutae herba*, *Schisandrae chinensis fructus*, *Uvae ursi folium*
- Flavonoids: *Aurantii amari epicarpium et mesocarpium*, *Betulae folium*, *Crataegi folium cum flore*, *Ginkgonis folium*, *Hyperici herba*, *Sambuci flos*, *Silybi mariani fructus*, *Solidaginis herba*, *Tiliae flos*, *Verbasci flos*
- Tannins: *Alchemillae herba*, *Camelliae sinensis non fermentata folia*, *Cotini folium*, *Crataegi folium cum flore*, *Quercus cortex*, *Ratanhiae radix*
- Anthraglycosides, naphthodianthrones: *Aloe capensis*, *Frangulae cortex*, *Hyperici herba*, *Sennae foliolum*, *Sennae fructus*
- Terpenophenolics: *Cannabis herba*, *Lupuli flos*
- Essential oils: *Absinthii herba*, *Anisi fructus*, *Carvi fructus*, *Caryophylli flos*, *Cinnamomi cortex*, *Coriandri fructus*, *Foeniculi dulcis fructus*, *Juniperi galbulus*, *Lavandulae flos*, *Matricariae flos*, *Menthae crispae folium*, *Menthae piperitae folium*, *Millefolii herba*, *Rosmarini folium*, *Salviae officinalis folium*, *Thymi herba*
- Bitter substances, iridois: *Absinthii herba*, *Cardui benedicti herba*, *Centaurii herba*, *Gentianae radix*, *Valerianae radix*
- Triterpene derivatives: *Calendulae flos*, *Convallariae folium*, *Digitalis lanatae folium*, *Ginseng radix*, *Hederae folium*, *Hippocastani semen*, *Liquiritiae radix*, *Strophanthi semen*
- Tropane alkaloids: *Belladonnae folium*, *Stramonii folium*
- Benzylisoquinoline, quinoline and indole alkaloids: *Chelidonii herba*, *Cinchonae cortex*, *Ipecacuanhae radix*, *Papaveris maturi fructus*, *Secale cornutum*, *Strychni semen*, *Vincae minoris herba*
- Other alkaloids: *Camelliae sinensis non fermentata folia*, *Capsici fructus*, *Coffeae seme*, *Colae semen*, *Colchici semen*

Form of the semester-end examination: written*/oral*/combined examination/**practical examination/the assessment of completing project work (according to STUDY AND EXAMINATION REGULATIONS 30.§)*** (*Please underline*)

The possibility and conditions for offering grades: -

A list of the basic notes, textbooks, resources and literature that can be used to acquire the knowledge necessary to master the curriculum and to complete the assessments, with exact description about which of them is required to acquire which part of the syllabus (e.g. description based on topics)), as well as the main technical and other aids and study aids that can be used:

Topics:

1. semester I, lecture : Introductory lecture, the concept and history of pharmacognosy. Cultivation and processing of medicinal plants.
2. semester I, lecture : Introductory lecture, the concept and history of pharmacognosy. Cultivation and processing of medicinal plants.
3. semester I, lecture : biogenetic system of herbal metabolites
4. semester I, lecture : Saccharides, carbohydrates
5. semester I, lecture : Saccharides, carbohydrates
6. semester I, lecture : Saccharides, carbohydrates
7. semester I, lecture : Plant acids, polyketides
8. semester I, lecture : Plant acids, polyketides
9. semester I, lecture : Plant acids, polyketides
10. semester I, lecture : Classification of phenolics, cinnamic acid derivatives
11. semester I, lecture : Classification of phenolics, cinnamic acid derivatives
12. semester I, lecture : Lignans, styrylpyrrolones, diarylheptanoids, arylalkanonones, stilbenoids
13. semester I, lecture : Lignans, styrylpyrrolones, diarylheptanoids, arylalkanonones, stilbenoids
14. semester I, lecture : Coumarins
15. semester I, lecture : Flavonoids I
16. semester I, lecture : Flavonoids I
17. semester I, lecture : Flavonoids II
18. semester I, lecture : Tannins
19. semester I, lecture : Tannins
20. semester I, lecture : Naphthoquinones, anthraglycosides, naphthodianthrones, terpenophenolics
21. semester I, lecture : Naphthoquinones, anthraglycosides, naphthodianthrones, terpenophenolics
22. semester I, lecture : Naphthoquinones, anthraglycosides, naphthodianthrones, terpenophenolics
23. semester I, lecture : Medicinal potential and toxicological significance of fungi
24. semester I, lecture : Medicinal potential and toxicological significance of fungi
25. semester II, lecture : Biosynthesis and grouping of terpenoids. Essential oils in the plant world, their medicinal significance.
26. semester II, lecture : Essential oils in the plant world, their medicinal significance.
27. semester II, lecture : Essential oils containing monoterpene components
28. semester II, lecture: Essential oils containing monoterpene components
29. semester II, lecture: Volatile phenylpropane and sesquiterpene-containing essential oils, balms, resins
30. semester II, lecture: Volatile phenylpropane and sesquiterpene-containing essential oils, balms, resins. Iridoids, sesquiterpene lactones, diterpenes and triterpene derivatives, bitter substances
31. semester II, lecture: Iridoids, sesquiterpene lactones, diterpenes and triterpene derivatives, bitter substances
32. semester II, lecture: Iridoids, sesquiterpene lactones, diterpenes and triterpene derivatives, bitter substances
33. semester II, lecture: Triterpenes, sterane saponins, tetraterpenes, politerpenes
34. semester II, lecture: Triterpenes, sterane saponins, tetraterpenes, politerpenes
35. semester II, lecture: Triterpenes, sterane saponins, tetraterpenes, politerpenes
36. semester II, lecture : Cardiac glycosides, special steroids
37. semester II, lecture: Cardiac glycosides, special steroids
38. semester II, lecture: Cardiac glycosides, special steroids
39. semester II, lecture: Plant nitrogen metabolism. Biosynthesis of alkaloids
40. semester II, lecture: Alkaloids of ornithine origin
41. semester II, lecture: Ornithine, lysine and tryptophan alkaloids
42. semester II, lecture: Ornithine, lysine and tryptophan alkaloids

- 43. semester II, lecture: Alkaloids of phenylalanine origin
- 44. semester II, lecture: Alkaloids of phenylalanine origin
- 45. semester II, lecture: Alkaloids of histidine origin. Protoalkaloids of phenylalanine origin.
- 46. semester II, lecture: Pseudoalkaloids of nucleotide origin
- 47. semester II, lecture: Pseudoalkaloids of terpene origin, cyanogenic glycosides, glucosinolates
- 48. semester II, lecture: Plant biotechnology

In the case of a subject lasting more than one semester, the position of the teaching/research department on the possibility of parallel enrolment and the conditions for admission**:**

yes*/no*/on and individual assessment basis* (* Please underline)

The course description was prepared by:

Dr. Nóra Gampe

**** A tantárgy tematikáját oly módon kell meghatározni, hogy az lehetővé tegye más intézményben a kreditismerési döntéshozatalt, tartalmazza a megszerzendő ismeretek, elsajátítandó alkalmazási (rész)kézségek, (rész)kompetenciák és attitűdök leírását, reflektálva a szak képzési és kimeneti követelményeire.**