**MINISTRY OF HEALTH OF THE REPUBLIC OF BELARUS**
EDUCATIONAL INSTITUTION
BELARUSIAN STATE MEDICAL UNIVERSITY



**APPROVED**
by First Vice-Rector, Professor
_____S.V. Gubkin
_____19.06.2018
Reg. # UD-_____/edu.

# PHARMACOGNOSY

**Curriculum of higher educational institution in the educational discipline for the specialty:**

**1-79 01 08 «Pharmacy»**

Minsk, BSMU 2018

Curriculum is based on the standard educational program "Pharmacognosy", approved on September 15, 2015, registration # ТД-L.518/тип.

**COMPILERS:**

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N.S. Gurina, dean of the Faculty of Pharmacy of the Educational Institution "Belarusian State Medical University", PhDs in Biology., professor;

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**RECOMMENDED FOR APPROVAL:**

by the Department of Organization of Pharmacy of the Educational Institution "Belarusian State Medical University"
(protocol №10 of 14.05.2018);

by the Methodological Commission of biomedical disciplines of the Educational Institution "Belarusian State Medical University"
(protocol № 9 of 23.05.2018)

# EXPLANATORY NOTE

Pharmacognosy is an educational discipline that contains systematic scientific knowledge about medicinal plants, medicinal raw materials of vegetable, less often animal, origin and some products of primary processing of plants and animals.

The training program includes the latest scientific data on harvesting, pharmacological analysis and application of medicinal plant material.

The purpose of teaching and studying the discipline "Pharmacognosy" is to form and acquire by students scientific knowledge about the rational use, standardization, quality control, storage and processing of medicinal plant raw materials, as well as the use of medicines based on it.

The tasks of studying the academic discipline "Pharmacognosy" are to develop academic students` competences, the basis of which is the ability to independently search for educational and information resources, master the methods of acquiring and comprehending the knowledge of:

– the basic concepts of pharmacognosy, methods of pharmacognostic analysis, the tasks of pharmacognosy at the present stage;

– the general principles of rational harvesting of medicinal plant raw materials and measures to protect natural exploited thickets of medicinal plants;

– nomenclature of medicinal plant raw materials and medicinal products of plant and animal origin, permitted for use in medicine and for use in industrial production;

– methods of pharmacognostic analysis of whole and crushed medicinal plant raw materials and collections from it;

– basic information about the chemical composition and application in medicine of medicinal products of vegetable and animal origin.

The tasks of teaching the discipline "Pharmacognosy" consist in the formation of social, personal and professional competence in teaching students the ability to determine the authenticity and good quality of medicinal plant raw materials using methods prescribed by regulatory documents.

Teaching and successful study of the academic discipline "Pharmacognosy" is carried out on the basis of the knowledge and skills acquired by the student in the sections of the following academic disciplines:

*Organic chemistry.* The main classes of natural organic substances, the importance of compounds of certain classes in biochemical processes, in medicine and pharmacy; the fundamentals of the technique of chemical experiment, the methods of purification and isolation of compounds from mixtures, the application of physical constants of organic substances as a criterion of their purity and identification.

*Pharmaceutical latin.* Latin names of medicinal plants and their parts.

*Analytical chemistry.* Quantitative methods of chemical analysis (titrimetric, photocolorimetric, chromatographic, spectrometric).

*Physical and colloid chemistry.* The concept of high-molecular compounds, solutions of surfactants.

*Pharmaceutical botany.* Anatomy and morphology of plants, phytocenology, botanical geography, plant ecology.

As a result of studying the academic discipline "Pharmacognosy" the student must

**know:**

– nomenclature and system of classification of herbal raw materials;

– general principles of rational harvesting of medicinal plant raw materials and measures for the protection of thickets of medicinal plants;

– the main groups of biologically active compounds, their physicochemical properties, methods of isolation, purification, qualitative and quantitative determination, biological standardization;

– the main ways and forms of using medicinal plant raw materials and medicinal products of plant and animal origin in pharmacy;

**be able to:**

– determine reserves and possible harvesting volumes of medicinal plant raw materials;

– carry out the acceptance of medicinal plants, to take samples for its analysis;

**master:**

– skills of identification of medicinal plants by external signs in a live and herbarium form;

– the technique of preparation of micropreparations, conducting qualitative and microchemical reactions to the main biologically active substances contained in medicinal plants and raw materials;

– technique of using titrimetric, gravimetric, spectrometric and chromatographic methods for analysis of herbal medicinal raw materials.

The structure of the curriculum for the academic discipline "Pharmacognosy" includes two sections.

**A total** of 344 academic hours are devoted to the study of the academic discipline. Distribution of classroom hours: 42 hours of lectures, 138 hours of laboratory work, 164 hours of student self-study.

The current attastation is conducted in accordance with the curriculum in the specialty in the form of pass (5 semester) and the exam (6 semester).

Final attestation - state examination.

Form of higher education – full-time

## ALLOCATION OF ACADEMIC TIME ACCORDING TO SEMESTERS OF STUDY

| Code, name of the specialty | Semester | The number of hours of training sessions | | | | | Form of the current certification |
|---|---|---|---|---|---|---|---|
| | | total | classroom | of them | | self-study | |
| | | | | lectures | laboratory exercises | | |
| **1-79 01 08 «Pharmacy»** | 5 | 144 | 92 | 26 | 66 | 52 | credit |
| | 6 | 200 | 88 | 16 | 72 | 112 | examination |
| | | 344 | 180 | 42 | 138 | 164 | |

## THEMATIC PLAN

| Number of section (topic) | Number of classroom hours | |
|---|---|---|
| | lectures | laboratory |
| **1. General pharmacognosia** | **6** | **16** |
| 1.1. Introduction to the academic discipline "Pharmacognosia". A short historical essay of the development of pharmacognosia. Chemical composition of medical plants. Classification of MPRM | 2 | – |
| 1.2. Methods of pharmacognostical analysis of MPRM | 2 | 16 |
| 1.3. The main directions of scientific research in the field of the study of medicinal plants | 2 | – |
| **2. Individual pharmacognosia** | **34** | **106** |
| 2.1. Polysaccharides. Medicinal plants and medicinal plant raw material containing polysaccharides | 2 | 4 |
| 2.2. Vitamins. Medicinal plants and medicinal plant raw material containing vitamins | 2 | 4 |
| 2.3. Terpenoids. Essential oils. Medicinal plants and medicinal plant raw material containing essential oils | 4 | 12 |
| 2.4. Iridoids and glycosides of monoterpenoids. Medicinal plants and medicinal plant raw material containing iridoids and glycosides of monoterpenoids | 2 | 8 |
| 2.5. Cardiac glycosides. Medicinal plants and medicinal | 2 | 4 |

| Number of section (topic) | Number of classroom hours | |
|---|---|---|
| | lectures | laboratory |
| plant raw material containing cardiac glycosides | | |
| 2.6. Saponins and phytoecdysones. Medicinal plants and medicinal plant raw material containing saponins and phytoecdysones | 2 | 8 |
| 2.7. Phenol glycosides and lignans. Medicinal plants and medicinal plant raw material containing phenol glycosides and lignans | 2 | 4 |
| 2.8. Antracene derivatives. Medicinal plants and medicinal plant raw material containing antracene derivatives | 2 | 6 |
| 2.9. Coumarins and chromones. Medicinal plants and medicinal plant raw material containing coumarins and chromones | 2 | 4 |
| 2.10. Flavonoids. Medicinal plants and herbal raw materials containing flavonoids | 4 | 12 |
| 2.11. Tannins. Medicinal plants and medicinal plant raw materials containing tannins | 2 | 8 |
| 2.12. Alkaloids. Medicinal plants and medicinal plant raw materials containing alkaloids | 4 | 16 |
| 2.13. Medicinal plants and medicinal plant raw materials containing various groups of biologically active substances. | 2 | 8 |
| 2.14. Medicinal raw materials of animal origin and natural products | 2 | 8 |
| **1. General pharmacognosia** | **2** | **16** |
| 1.4. Analysis of crushed, powdered raw materials and their mixtures | - | 4 |
| 1.5. Raw material base of medicinal plants. Fundamentals of procuring the medicinal plant material | 2 | - |
| 1.6. Teas, biologically active food additives | - | 12 |
| **Total hours** | **42** | **138** |

# CONTENT OF EDUCATIONAL MATERIAL

## 1. GENERAL PHARMACOGNOSIA

### 1.1. Introduction to the academic discipline "Pharmacognosia". A short historical essay of the development of pharmacognosia. Chemical composition of medical plants. Classification of MPRM

Definition of pharmacognosy as a science and discipline. The role of pharmacognosy in the professional activities of the pharmacist. Integrative relations of pharmacognosy with the academic disciplines of natural-science and general professional, special cycles.

Chemical composition of medicinal plants. Minerals. Primary and secondary metabolism. Biologically active substances. Operating, concomitant and ballast substances. Classification of medicinal plant raw material (MPRM).

A short historical outline of the development of pharmacognosy. The main historical stages of the use and study of medicinal plants in the world medicine, the origin and development of pharmacognosy as a science in the Republic of Belarus. The influence of Arab (Avicenna, etc.), European (Galen, Hippocrates, Dioscorides, etc.) and other medical systems on the development of pharmacognosy. The importance of foreign scientists for the development of pharmacognosy (A. Chirkh, G. Dragendorf, A.F. Gammerman, A.P. Orekhov, V.S. Sokolov, D.A. Muravieva, etc.).

### 1.2. Methods of pharmacognostical analysis of MPRM

The purpose and objectives of pharmacological analysis. Methods for determining the authenticity of MPRM. Macroscopic analysis. Microscopic analysis. Qualitative chemical analysis. Chromatographic analysis. Analysis of plant raw materials of various morphological groups: leaves, herbs, flowers, fruits, seeds, bark, roots, rhizomes, bulbs, tubers, corms.

Quality control of MPRM. Rules of acceptance MPRM. Sample size of the MPRM. Methods of sampling MPRM. Indicators of quality and safety of the MPRM. Determination of authenticity, crushing, permissible impurities, degree of infection with pest barns, loss in weight during drying, ash content, extractive and active substances of MPRM.

### 1.3. Analysis of crushed, powdered raw materials and their mixtures

Classification of medicinal plant raw materials by the method of grinding, methods and features of its analysis.

### 1.4. Raw material base of medicinal plants. Fundamentals of procuring the medicinal plant material

Cultivated and wild-growing medicinal plants of the Republic of Belarus. Methodology for determining the yield and stocks of MPRM. Rational use of natural resources of medicinal plants and their protection (identification of thickets, stock accounting, mapping, reproduction of wild medicinal plants).

Fundamentals of procurement process of MPRM. Rational methods of collecting MPRM of various morphological groups. Primary processing, drying, packaging, marking, storage, transportation of MPRM. Good practices of cultivation,

collection, storage of MPRM. The main producers of MPRM in the Republic of Belarus.

### 1.5. Medicinal harvests, teas and dietary supplements

Classification, preparation, pharmacological analysis and administration of harvests, teas and dietary supplements.

### 1.6. The main directions of scientific research in the field of the study of medicinal plants

Studying the chemicals that make up plants. Resource studying the medicinal plants. Rationing and standardization of MPRM. Cultivation of medicinal plants. Biotechnological research of medicinal plants. Identification of new medicinal plants. Studying and using the experience of traditional medicine.

## 2. INDIVIDUAL PHARMACOGNOSIA

### 2.1. Polysaccharides. Medicinal plants and medicinal plant raw material containing polysaccharides

General characteristics and classification of polysaccharides. Starch, inulin, pectin substances, mucus, gums, polysaccharides of algae. Physico-chemical properties of mucus, their detection and quantification. The use of polysaccharides in medicine.

Medicinal plants and MPRM containing mucus (the name of MPRM, which produces plants and families in Russian and Latin languages, the appearance of the producing plant and its difference from morphologically similar species, the range and habitat, rational methods of collecting raw materials, reproduction and protection of wild medicinal plants; primary processing, drying, bringing the raw material into the standard state and storing the MPRM, the chemical composition of the MPRM, the ways of using and using it in medicine): Linum usitatissimum, types of Althaea, types of Plantago, Tussilago farfara, Laminaria, Fucus vesiculosus, types of Tilia, Cetraria islandica.

### 2.2. Vitamins. Medicinal plants and medicinal plant raw material containing vitamins

General characteristics, classification, physicochemical properties, methods of isolation and analysis of vitamins.

Plants and MPRM containing vitamins: types of Rosae, Ribes nigrum, Calendula officinalis, Sorbus aucuparia, Hippophaë rhamnoides, types of Urtica, Capsella bursa-pastoris, Zea mays.

### 2.3. Terpenoids. Essential oils. Medicinal plants and medicinal plant raw material containing essential oils

General characteristics, classification and distribution in plants of terpenoids. Classification of essential oils. Essential oils containing monoterpenoids, sesquiterpenoids and aromatic compounds. Distribution and localization in plants,

physical and chemical properties, methods of preparation, methods of analysis, application of essential oils in medicine.

Medicinal plants and MPRM containing acyclic monoterpenoids: Coriandrum sativum, Lavandula angustifolia, Melissa officinalis.

Medicinal plants and MPRM containing monocyclic monoterpenoids: Mentha piperita, Salvia officinalis, types of Eucalyptus, Carum carvi, Anethum graveolens.

Medicinal plants and MPRM containing bicyclic monoterpenoids: Juniperus communis, Valeriana officinalis, Pinus silvestris, Abies sibirica.

Medicinal plants and MPRM containing sesquiterpenoids: types of Betula, Inula helenium, Matricaria chamomilla, Achillea millefolium, Humulus lupulus, Ledum palustre, types of Arnica, Acorus calamus, Artemisia absinthium, Angelica archangelica, Zingiber officinalis, Taraxacum officinale.

Medicinal plants and MPRM containing aromatic compounds: Anisum vulgare, Foeniculum vulgare, types of Thymus, Thymus vulgaris, Origanum vulgare, Levisticum officinale.

**2.4. Iridoids and glycosides of monoterpenoids. Medicinal plants and medicinal plant raw material containing iridoids and glycosides of monoterpenoids**

Physicochemical properties of iridoids, propagation in plants. Analysis of iridoids in plant raw materials.

Medicinal plants and MPRM containing iridoids: types of Leonurus, Viburnum opulus, Menyanthes trifoliata, Valeriana officinalis, types of Centaurium, Gentiana lutea.

Medicinal plants and MPRM containing glycosides of monoterpenoids: Paeonia anomala.

**2.5. Cardiac glycosides. Medicinal plants and medicinal plant raw material containing cardiac glycosides**

General characteristics, classification of cardiac glycosides. Preparation, drying and storage of MPRM containing cardiac glycosides. Physicochemical properties, isolation methods, qualitative and quantitative analysis, application of cardiac glycosides in medicine.

Medicinal plants and MPRM containing cardiac glycosides: Digitalis purpurea, D. grandiflora, D. lanata, Strophantus Kombe, Adonis vernalis, Convallaria majalis, Erysimum diffusum.

**2.7. Saponins and phytoecdysones. Medicinal plants and medicinal plant raw material containing saponins and phytoecdysones**

The concept of saponins, classification. Physicochemical properties, isolation methods, qualitative and quantitative analysis, application in medicine of saponins.

Medicinal plants and MPRM containing saponins: Echinopanax elatum, types of Glycyrrhiza, Polemonium coeruleum, Aralia mandshurica, Aesculus hippocastanum, Panax ginseng, Tribulus terrestris, Primula veris, Hedera helix.

General characteristics of phytoecdisones, classification. Physicochemical properties, isolation methods, qualitative and quantitative analysis of phytoecdisones.

Medicinal plants and MPRM containing phytoecdisones: Rhaponticum carthamoides.

**2.8. Phenol glycosides and lignans. Medicinal plants and medicinal plant raw material containing phenol glycosides and lignans**

General characteristics of phenol glycosides and lignans, classification, physico-chemical properties, isolation methods, qualitative and quantitative analysis.

Medicinal plants and MPRM containing phenol glycosides: Arctostaphylos uva-ursi, Vaccinium vitis-idaea, Rhodiola rosea, types of Salix.

Medicinal plants and MPRM containing lignans: Schizandra chinensis, Eleutherococcus senticosus, Podophyllum peltatum, Silybum marianum.

**2.9. Antracene derivatives. Medicinal plants and medicinal plant raw material containing antracene derivatives**

General characteristics, classification, physicochemical properties, isolation methods, qualitative and quantitative analysis, application of anthracene derivatives in medicine.

Medicinal plants and MPRM containing anthracene derivatives: Rhamnus cathartica, Rheum tanguticum, Rumex confertus, Cassia acutifolia, Aloë arborescens, Rubia tinctorium, types of Hypericum, Frangula alnus.

**2.10. Coumarins and chromones. Medicinal plants and medicinal plant raw material containing coumarins and chromones**

General characteristics, classification of coumarins and chromones. Physicochemical characteristics, methods of extraction, qualitative, quantitative and chromatographic analysis of coumarins and chromones.

Medicinal plants and MPRM, which contain coumarins: Melilotus officinalis, Ammi majus, Pastinaca sativa, Phlojodicarpus sibiricus.

Medicinal plants and MPRM, which contain chromones: Ammi visnaga.

**2.11. Flavonoids. Medicinal plants and medicinal plant raw material containing flavonoids**

General characteristics, classification and distribution of flavonoids in medicinal plants. Physicochemical characteristics, methods of extraction, qualitative and quantitative analysis of flavonoids, the use in medicine.

Medicinal plants and MPRM which contain flavonoids: types of Crataegus, Helichrysum arenarium, Tanacetum vulgare, Gnaphalium uliginosum, types of Polygonum, Ginkgo biloba, types of Bidens, types of Viola, Equisetum arvense, Ononis arvensis, Fragaria vesca, Sophora japonica, Aronia melanocarpa, centaurea cyanus, Begonia erythrophylla, Filipendula ulmaria, Cynara cardunculus.

**2.12. Tannins. Medicinal plants and medicinal plant raw material containing tannins**

Distribution of tannins in plants. Physicochemical characteristics, methods of extraction, qualitative, quantitative and chromatographic analysis of tannins, use in medicine.

Medicinal plants and MPRM which contain tannins: rhus coriaria, Cotinus coggygria, Polygonum bistorta, Sanguisorba officinalis, Bergenia crassifolia, types of Alnus, Quercus robur, Potentilla erecta, Vaccinium myrtillus, Padus racemosa, Thea sinensis, Comarum palustre, Agrimonia eupatoria.

**2.13. Alcaloids. Medicinal plants and medicinal plant raw material containing alcaloids**

Classification of alcaloids. Distribution and accumulation of alcaloids in plants. Physicochemical characteristics, methods of extraction, methods of separation, qualitative and quantitative analysis of alcaloids, use in medicine.

Medicinal plants and MPRM which contain protoalkaloids: Ephedra equisetina, Capsicum annuum, Colchicum speciosum.

Medicinal plants and MPRM which contain pyrrolizidine and tropane alkaloids: Senecio platyphylloides, Atropa belladonna, Hyoscyamus niger, Datura stramonium, Datura inoxia.

Medicinal plants and MPRM which contain quinolizidine alkaloids: types of thermopsidis.

Medicinal plants and MPRM which contain steroidal alkaloids (glycoalkaloids): Solanum laciniatum, Veratrum lobelianum.

Medicinal plants and MPRM which contain isoquinoline alkaloids: Glaúcium flávum, Berberis vulgaris, Chelidonium majus, types of Macleaya.

Medicinal plants and MPRM which contain purine alkaloids: Thea sinensis, Coffea arabica.

Medicinal plants and MPRM which contain indole alkaloids: Rauwolfia serpentina, Passiflora incarnata, Vinca minor, Catharanthus roseus, Strychnos nux-vomica, Claviceps purpurea.

**2.14. Medicinal plants and medicinal plant raw material containing various groups of biologically active substances**

Medicinal plants and MPRM which contain **various groups of BAS**: Kalanchoë pinnata, types of Cucurbita, Echinacea purpurea, Inonotus obliquus, Orthosiphon stamineus, Sambucus nigra, Phaseolus vulgaris, Rubus idaeus.

Medicinal plant raw material of animal origin and natural products: poisons of snakes, honey bee products. Medical leeches. Pants. Shilajit. Spongilla.

# EDUCATIONAL DISCIPLINE CURRICULAR CHART

| Section number, topics, classes | Section (topic) name | Number of hours | | Independent work of the student | Equipment | Form of control |
|---|---|---|---|---|---|---|
| | | lectures | laboratory classes | | | |
| | **5 semester** | **26** | **66** | **52** | | |
| | **1. General pharmacognosy** | | | | | |
| 1.1 | Introduction to the academic discipline "Pharmacognosy". A short historical outline of the pharmacognosy development. Chemical composition of medicinal plants. Classification of medicinal plant raw material | 2 | - | 4 | | Interviews<br>evaluation based on a modular rating system |
| 1.2 | Methods of pharmacognostic analysis of medicinal plant raw material | 2 | 12 | 6 | microscopes | Interviews<br>tests;<br>control questions,<br>evaluation based on a modular rating system |
| | Final lesson | | 4 | | | tests<br>colloquium |
| 1.3 | Main directions of scientific research in the field of the study of medicinal plants | 2 | | 4 | | Interviews |
| | **2. Private pharmacognosy** | | | | | |
| 2.1 | Polysaccharides. Medicinal plants and medicinal plant raw materials containing polysaccharides | 2 | 4 | 4 | microscopes | Interviews<br>tests; |

| Section number, topics, classes | Section (topic) name | Number of hours | | Independent work of the student | Equipment | Form of control |
|---|---|---|---|---|---|---|
| | | lectures | laboratory classes | | | |
| | | | | | | control questions, evaluation based on a modular rating system, reports on home, practical exercises with their oral protection; reports on laboratory work with their oral protection; |
| 2.2 | Vitamins. Medicinal plants and medicinal plant raw materials containing vitamins | 2 | 4 | 4 | Microscopes, chromatographic chamber | Interviews tests; control questions |
| 2.3 | Terpenoids. Essential oils. Medicinal plants and medicinal plant raw materials containing essential oils | 4 | 12 | 6 | Microscopes, Ginsberg apparatus | Interviews control questions reports on home practical exercises with their oral protection; reports on laboratory work with their oral protection; |
| 2.4 | Iridoids. Medicinal plants and medicinal plant raw materials containing iridoids | 2 | 4 | 4 | Microscopes,chromatographic chamber | oral tests; evaluation based on a modular rating system |

| Section number, topics, classes | Section (topic) name | Number of hours | | Independent work of the student | Equipmen: | Form of control |
|---|---|---|---|---|---|---|
| | | lectures | laboratory classes | | | |
| | Final lesson on topics "Polysaccharides. Vitamins. Terpeno'ds. Iridoids" | | 4 | | | Colloquium<br>Interviews |
| 2.5 | Car'iac glycosides. Medicinal plar.ts and medicinal plant raw materials containing car.iac glycosides | 2 | 4 | 4 | Microscopes,chromatographic chamber, photoelectrocolorimeter | Interviews<br>control questions<br>reports on home practical exercises with their oral protection;<br>reports on laboratory work with their oral protection; |
| 2.6 | Saponins and phytoecdizones. Medicinal plants and medicinal plan: raw materials containing saponins and phytoecdysones | 2 | 8 | 6 | Microscopes,chromatographic chamber, spectrophotometer | Interviewing<br>control questions<br>reports on home practical exercises with their oral protection<br>visual laboratory work |
| 2.7 | Simple phenols, phenol glycosides and lignans. Medicinal plants and medicinal plant raw materials containing phenol glycosides and lignans | 2 | 4 | 6 | Microscopes,chromatographic chamber | Interviewing<br>control questions<br>reports on home practical exercises with their oral protection |
| 2.8 | Anthracene derivatives. Medicinal plants and medicinal | 2 | 4 | 4 | Microscopes,chr | Interviewing |

| Section number, topics, classes | Section (topic) name | Number of hours | | Independent work of the student | Equipment | Form of control |
|---|---|---|---|---|---|---|
| | | lectures | laboratory classes | | | |
| | plant raw materials containing anthracene derivatives | | | | omatographic chamber, photoelectrocolo rimeter | control questions reports on home practical exercises with their oral protection col oquium evaluation based on a modular rating system |
| | Final lesson on topics "Cardiac glycosides. Saponins. Simple phenols. Anthracene derivatives" | | 2 | | | Colloquium |
| 2.9 | Coumarins and chromones. Medicinal plants and medicinal plant raw materials containing coumarins and chromones | 2 | | | | |
| | **6 semester** | **16** | **72** | **112** | | |
| 2.9 | Coumarins and chromones. Medicinal plants and medicinal plant raw materials containing coumarins and chromones | | 4 | 4 | Microscopes,chr omatographic chamber | Interviewing control questions reports on home practical exercises with their oral protection |
| 2.10. | Flavonoids. Medicinal plants and medicinal plant raw materials containing flavonoids | 4 | 12 | 4 | Microscopes,chr omatographic chamber, photoelectrocolo rimeter | Interviewing control questions reports on home practical exercises with their oral protection |

| Section number, topics, classes | Section (topic) name | Number of hours | | Independent work of the student | Equipment | Form of control |
|---|---|---|---|---|---|---|
| | | lectures | laboratory classes | | | |
| | | | | | | visual laboratory work |
| 2.11. | Tannins. Medicinal plants and medicinal plant raw materials containing tannins | 2 | 4 | 4 | Microscopes, spectrophotometer | Interviewing<br>control questions<br>reports on home practical exercises with their oral protection<br>visual laboratory work;<br>tests |
| | Final lesson on topics "Coumarins. Flavonoids. Tannins" | | 4 | 8 | | Colloquium<br>oral test<br>tests |
| 2.12. | Alkaloids. Medicinal plants and medicinal plant raw materials containing alkaloids | 4 | 16 | 8 | Microscopes chromatographic chamber | Interviewing<br>control questions<br>reports on home practical exercises with their oral protection<br>visual laboratory work |
| 2.13. | Medicinal plants and medicinal plant raw materials containing various groups of biologically active substances | 2 | 8 | 8 | Microscopes chromatographic chamber | Interviewing<br>control questions |
| 2.14. | Medicinal raw materials of animal origin and natural products | 2 | 4 | 4 | | Interviewing<br>control questions |
| | Final lesson on topics "Alkaloids. Different groups of | | 4 | 8 | | Colloquium |

| Section number, topics, classes | Section (topic) name | Number of hours | | Independent work of the student | Equipment | Form of control |
|---|---|---|---|---|---|---|
| | | lectures | laboratory classes | | | |
| | BAS. Medicinal raw materials of animal origin" | | | | | oral test; |
| | **General pharmacognosy** | | | | | |
| 1.4 | Analysis of crushed, powdered raw materials and their mixtures | | 4 | 4 | Microscopes | Interviews<br>case-based assessment; |
| 1.5 | Raw material base of medicinal plants Fundamentals of procuring the medicinal plant material | 2 | - | 4 | Microscopes | Interviews |
| 1.6 | Teas, biologically active food additives | | 4 | 4 | | Interviews<br>case-based assessment;<br>reports on laboratory work with their oral protection; |
| | Final lesson on all sections | | 4 | 12 | | Interviews |
| | Protection of course project | - | 4 | 40 | | publication of articles, reports;<br>research reports<br>term papers (projects); |
| | **Totai hours** | **42** | **138** | **164** | | |

# INFORMATION AND INSTRUCTIONAL UNIT

## LITERATURE

**Basic :**

1. Antonyuk V.O., Lysyuk R.M., Antonyuk L. Ya. Practical course of pharmacognosy/ Антонюк В.О., Лисюк Р.М., Антонюк Л.Я. Практичний курс фармакогнозии – Львов, 2011. – 499с

**Additional:**

2. Коноплева, М.М. Фармакогнозия: природные биологически активные вещества / М.М. Коноплева. – Витебск, ВГМУ, 2013. – 407 с.

**Normative regulatory acts:**

3. EUROPEAN PHARMACOPOEIA - 8th EDITION published 15 July 2013

## LIST OF AVAILABLE DIAGNOSTICS TOOLS

To diagnose competencies, the following forms are used for assessment:

1. Oral form:

- interviews;
- colloquiums;
- oral credits;

2. Written form:

- tests;
- projects;
- research reports;
- publication of articles, reports;
- evaluation based on a modular rating system;
- case-based assessment;

3. Oral-written form:

- reports on home practical exercises with their oral presentation;
- reports on laboratory work with their oral presentation;
- course work (projects) with their oral presentation;
- credits;
- exams;

4. Technical form:

- visual laboratory work;

## LIST OF PRACTICAL SKILLS

- Identify and distinguish plants by macro and microscopic features.
- Possession of the technique of preparation of micropreparations of various morphological groups of MPR.
- Possession of the technique of conducting qualitative and microchemical reactions to the main BASs contained in the MPR
- Possession of the technique of using physical-chemical, titrimetric, gravimetric and chromatographic methods for analyzing LRS.
- Ability to interpret the results of the analysis of medicines to assess their quality.

# LIST OF LECTURES

*Semester 5*

1. Introduction to the educational discipline "Pharmacognosia". A short historical outline of the pharmacognosia development. Chemical composition of medicinal plants. Classification of medicinal plant raw material.
2. Methods of pharmacological analysis of medicinal plant raw materials
3. Polysaccharides. Medicinal plants and medicinal plant raw materials containing polysaccharides
4. Vitamins. Medicinal plants and medicinal plant raw materials containing vitamins
5. Terpenoids. Essential oils. Medicinal plants and medicinal plant raw materials containing essential oils
6. Terpenoids. Essential oils. Medicinal plants and medicinal plant raw materials containing essential oils
7. Iridoids and glycosides of monoterpenoids. Medicinal plants and medicinal plant raw materials containing iridoids and glycosides of monoterpenoids
8. Cardiac glycosides. Medicinal plants and medicinal plant raw materials containing cardiac glycosides
9. Saponins and phytoecdisones. Medicinal plants and medicinal plant raw materials containing saponins and phytoecdisones
10. Phenolic glycosides and lignans. Medicinal plants and medicinal plant raw materials containing phenolic glycosides and lignans
11. Antracene derivatives. Medicinal plants and medicinal plant raw materials containing antracene derivatives
12. Coumarins and chromones. Medicinal plants and medicinal plant raw materials containing coumarins and chromones
13. Teas and biologically active food additives

*Semester 6*

1. Flavonoids. Medicinal plants and medicinal plant raw materials containing flavonoids
2. Flavonoids. Medicinal plants and medicinal plant raw materials containing flavonoids
3. Tannins. Medicinal plants and medicinal plant raw materials containing tannins
4. Alkaloids. Medicinal plants and medicinal plant raw materials containing alkaloids
5. Alkaloids. Medicinal plants and medicinal plant raw materials containing alkaloids
6. Medicinal plants and medicinal plant raw materials containing various groups of biologically active substances.
7. Medicinal raw materials of animal origin and natural products
8. The main directions of scientific research in the field of medicinal plants study
9. Raw material base of medicinal plants. Fundamentals of procuring the medicinal plant material

## LIST OF LABORATORY (PRACTICAL) CLASSES

*Semester 5*

1. Methods of pharmacological analysis of medicinal plant raw materials.
2. Methods of pharmacological analysis of medicinal plant raw materials.
3. Methods of pharmacological analysis of medicinal plant raw materials.
4. Methods of pharmacological analysis of medicinal plant raw materials.
5. Polysaccharides. Medicinal plants and medicinal plant raw materials containing polysaccharides
6. Vitamins. Medicinal plants and medicinal plant raw materials containing vitamins
7. Terpenoids. Essential oils. Medicinal plants and medicinal plant raw materials containing essential oils
8. Terpenoids. Essential oils. Medicinal plants and medicinal plant raw materials containing essential oils
9. Terpenoids. Essential oils. Medicinal plants and medicinal plant raw materials containing essential oils
10. Iridoids and glycosides of monoterpenoids. Medicinal plants and medicinal plant raw materials containing iridoids and glycosides of monoterpenoids
11. Iridoids and glycosides of monoterpenoids. Medicinal plants and medicinal plant raw materials containing iridoids and glycosides of monoterpenoids
12. Cardiac glycosides. Medicinal plants and medicinal plant raw materials containing cardiac glycosides
13. Saponins and phytoecdisones. Medicinal plants and medicinal plant raw materials containing saponins and phytoecdisones
14. Saponins and phytoecdisones. Medicinal plants and medicinal plant raw materials containing saponins and phytoecdisones
15. Phenolic glycosides and lignans. Medicinal plants and medicinal plant raw materials containing phenolic glycosides and lignans
16. Antracene derivatives. Medicinal plants and medicinal plant raw materials containing antracene derivatives
17. Antracene derivatives. Medicinal plants and medicinal plant raw materials containing antracene derivatives

*Semester 6*

1. Coumarins and chromones. Medicinal plants and medicinal plant raw materials containing coumarins and chromones
2. Flavonoids. Medicinal plants and medicinal plant raw materials containing flavonoids
3. Flavonoids. Medicinal plants and medicinal plant raw materials containing flavonoids
4. Flavonoids. Medicinal plants and medicinal plant raw materials containing flavonoids

5. Tannins. Medicinal plants and medicinal plant raw materials containing tannins
6. Tannins. Medicinal plants and medicinal plant raw materials containing tannins
7. Alkaloids. Medicinal plants and medicinal plant raw materials containing alkaloids
8. Alkaloids. Medicinal plants and medicinal plant raw materials containing alkaloids with nitrogen in the side chain, derivatives of pyrrolizidine and tropane
9. Alkaloids. Medicinal plants and medicinal plant raw materials containing quinolizidine and steroidal alkaloids
10. Alkaloids. Medicinal plants and medicinal plant raw materials containing alkaloids, isoquinoline and indole derivatives
11. Medicinal plants and medicinal plant raw materials containing various groups of biologically active substances.
12. Medicinal plants and medicinal plant raw materials containing various groups of biologically active substances.
13. Medicinal raw materials of animal origin and natural products
14. Medicinal raw materials of animal origin and natural products
15. Analysis of crushed, powdered raw materials and their mixtures
16. Analysis of crushed, powdered raw materials and their mixtures
17. Teas and biologically active food additives
18. Presentation of the course projects

## PROTOCOL OF THE CURRICULUM APPROVAL BY OTHER DEPARTMENTS

| Title of the discipline requiring approval | Department | Amendments to the curriculum of the academic discipline | Decision of the department, which designed the curriculum (date, protocol № ) |
|---|---|---|---|
| 1. Pharmaceutical chemistry | Pharmaceutical chemistry | Physicochemical properties of biologically active substances of plant origin and the use of quality control techniques in the analysis of medicines containing these substances | Protocol №10 of 14.05.2018 |
| 2. Pharmacy technology | Pharmaceutical technology | Features of physicochemical properties of biologically active substances of plant origin, used in the study of the topic of making infusions and decoctions. | Protocol №10 of 14.05.2018 |

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signature O.V. Mushkina

Dean of the faculty of Pharmacy of the Educational Institution "Belarusian State Medical University", PhD in Biology., Professor.

signature N.S. Gurina

Assistant of the department of Pharmacy Organization of the Educational Institution "Belarusian State Medical University"

signature N.I. Grischenko

Curriculum content, composition and accompanying documents comply with established requirements.

Dean of the Medical Faculty for International Students
12. 06. 2018 A.V.Haiduk

Methodologist of Educational Institution "Belarusian State Medical University"
18. 06. 2018 S.V.Zaturanova

Head of the Foreign Languages Department M.N.Petrova

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