COURSE DATA

Data Subject	
Code	34079
Name	Pharmacognosy
Cycle	Grade
ECTS Credits	9.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1201 - Degree in Pharmacy	Faculty of Pharmacy and Food Sciences	3	Annual
1211 - D.D. in Pharmacy-Human Nutrition and Dietetics	Faculty of Pharmacy and Food Sciences	3	Annual

Subject-matter

Degree	Subject-matter	Character
1201 - Degree in Pharmacy	13 - Pharmacognosy	Obligatory
1211 - D.D. in Pharmacy-Human Nutrition and Dietetics	1 - Asignaturas obligatorias del PDG Farmacia-Nutrición Humana y Dietética	Obligatory

Coordination

Name	Department
BLAZQUEZ FERRER, MARIA AMPARO	135 - Pharmacology

SUMMARY

Pharmacognosy with 9 ECTS (6 credits in the first semester and 3 credits in the second), is given annually in the third year of degree in pharmacy. This subject is a branch of Pharmacological Sciences that has a long tradition in the Pharmacy studies, and brings to the student the knowledge on the **materials of biological origin** (crude drugs) obtained from **plants, animals or microorganisms**, both terrestrial and marine, useful for obtain medicines. Its development, like other sciences has experienced periods of great splendor with other ones slow progress. Currently there is a great interest in such natural sources, because they furnish from the secondary metabolism a large number of compounds that are difficult and/or commercially less profitable and sustainable to produce by synthesis. In this sense, it is worth highlighting the importance of innovations in sustainable agronomy, highlighting the possibility of using biopesticides obtained from the geographical environment itself. Furthermore, certain secondary

metabolites are subject to semisynthetic change to become more effective or less toxic drugs. It is also possible to obtain molecules useful as a lead compounds for synthetic drugs with similar activity to that of the original.

The theoretical contents of this subject are aligned with the Sustainable Development Goals (SDG) 3 (Health and Well-Being), 4 (Quality Education) and 15 (Life on Land) of the United Nations 2030 Agenda and have been organized following a **biogenetic-chemical criterion** for the classification of the most common chemical groups of drugs. At the beginning, some basic general topics are proposed for the understanding of the contents, which facilitate the achievement of the objectives (SDG) and skills to be achieved with the learning of this subject. In these units the multidisciplinary nature of this subject will be evident through the connections with more or less closely related, previously studied, matters (Plant Physiology, Botany, Physiology, Organic Chemistry, Analytical Chemistry, Biochemistry, Microbiology ....) and with other disciplines that will be simultaneously studied along the same academic year (Pharmaceutical Chemistry, Pathophysiology, Pharmacology I, etc.)

The theoretical aspects are supplemented by laboratory practice, in them the students implement certain SDGs (SDG 5, 11, 12 and 13) acquiring skills in the basic techniques in a Pharmacognosy's laboratory by carrying out experimental studies on some of the concepts developed in the lectures.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

It is suggested to have knowledge of Botany, Organic Chemistry, Analytical Techniques, Instrumental Techniques and Physiology.

OUTCOMES

1201 - Degree in Pharmacy

- To know how interpret, value and communicate relevant data in the different aspects of pharmaceutical activity, making use of information and communication technologies.
- Skill to communicate ideas, analyze problems and solve them with a critical mind, achieving team-working abilities and assuming leadership whenever required.
- Development of skills to update their knowledge and undertake further studies, including pharmaceutical specialization, scientific research and technological development, and teaching.
- Ability to collect and transmit information in English with a level of competence similar to the B1 of the Council of Europe.
- To recognize personal limitations and the need to keep up to date professional competence, paying particular attention to the self-learning of new knowledge based on available scientific evidences.

- Handle with precision and safety products, equipment and laboratory equipment.
- Identify, obtain, analyze and produce drugs and other products and raw materials of health interest for human or veterinary use.
- Know and identify the raw materials of biological origin (crude drugs) that are used to obtain drugs and medicines based on medicinal plants.
- To know the bases and stages of the analytical control of vegetal drugs.
- Know the use, efficacy and safety of medicinal plants.
- To know the main structural types of secondary metabolites used to obtain drugs and their relationship with biosynthetic pathways.
- Acquire the ability to design the extraction and purification method more suitable for the isolation of the active principles of a crude drug, as well as know how to apply the spectroscopic techniques to the structural elucidation of the same.
- To know the pharmacological activity of the active principles of those crude drugs which, for their therapeutic interest, are considered the more important vegetal drugs.
- Understand the use of natural products as "lead compounds" for the development of new drugs.
- Open new perspectives for the development of biotechnology in the investigation of living organisms as sources of new active principles.

LEARNING OUTCOMES

The main objective in learning the subject of Pharmacognosy is to achieve through lectures, practical sessions, tutorials, seminars, that students acquire general theoretical-practical knowledge in the field of natural crude drugs as source of medicines, taking into account the principles of sustainability and their application.

* Using adequately the basic scientific terminology related to the subject of Pharmacognosy.

* Knowing the basic skeleton of the different types of active secondary metabolites present in crude drugs and relate them to their biogenesis.

* From the chemical structure of the active principle, deduce their physico-chemical properties and implement extraction, purification and isolation procedures that are, to the greastest extent possible, neutral for the environment (SDG 13) and for humans (SDG 11).

* Knowing and understanding the indications of the Pharmacopoeia for quality control of officinal crude drugs, paying attention to some of the main morphological elements.

* Knowing the origin of the most representative drugs, their active principles, pharmacological activity and therapeutic use.

* Distinguishing between the pharmacological action of the isolated active principle and the action of the whole crude drug.

* Knowing and understanding the use of natural products as "lead compounds" for the development of new medicines (SDG 12).

* Understanding the use, efficacy and safety of medicinal plants.

* Understanding the interactions of herbs with conventional medicines.

* Knowing and understanding scientific papers related to the subject.

DESCRIPTION OF CONTENTS

1. Block I. Generalities

UNIT 1. Basic concepts: crude drug, active principle, natural product. Pharmacognosy objectives and its future. Bibliography.
UNIT 2. Source of drug: biodiversity. Obtention. Quality criteria for herbal drugs.
UNIT 3. Biosynthesis of natural products. Primary and secondary metabolism. Main biosynthetic pathways: Precursors. Secondary metabolites biosynthetic classification.
UNIT 4. Isolation and identification of active principles. Extraction. Methods of purification and isolation. Strategies for structural elucidation of natural products.

2. Block II. Study of the active principles of drugs, according to their biosynthetic origin

Derivatives of MONOSACCHARIDES
UNIT 5. Oligosaccharides. Homogeneous and heterogeneous polysaccharides.
ACETATE and SHIKIMATE derivatives, lipids and polyphenols
UNIT 6. Lipids and related compounds. Statins.
UNIT 7. Biosynthesis of the aromatic ring. Coumarins. Lignans: podophyllotoxin and derivatives.
UNIT 8. Flavonoids: rutin, citrus and derivatives. Anthocyanins. Proanthocyanidols. Tannins. Drugs containing these principles.
UNIT 9. Anthracene glycosides. Senna, buckthorn, sacred bark, aloes.
MEVALONIC ACID derivatives: terpenoids
UNIT 10. Biosynthesis of terpenoids. Essential Oils. Iridoids.
UNIT 11. Monoterpene-phenols: cannabinoids.
UNIT 12. Sesquiterpenoids: artemisinin. Diterpenoid: paclitaxel.
UNIT 13. Triterpenes and steroids. Saponins. Saponin-containing drugs. Industrial production of steroidal hormones.
UNIT 14. Cardioactive glycosides. Foxgloves. Digitoxin and digoxin. Other drugs containing cardioactive glycosides: squill, strophanthus.
AMINO ACID derivatives: alkaloids
UNIT 15. Generalities of alkaloids.
UNIT 16. Ornithine derivatives. Tropane alkaloids. Drugs containing tropane alkaloids: deadly nightshade, henbane and thornapple. Atropine, scopolamine and related compounds. Drugs containing pseudotropane alkaloids: coca. Cocaine. Pyrrolidine alkaloid drugs: tobacco.
UNIT 17. Phenylalanine and/or tyrosine derivatives. Phenethylamine alkaloids: ephedrine. Morphinan

alkaloids. Opium. Morphine and its derivatives. Aporphinoid alkaloids: boldine. Bisbenzylisoquinoline alkaloids. Menispermaceous curares. Monoterpenoid isoquinoline alkaloids: emetine. Benzoazepine ring alkaloids: galanthamine. Tropolone ring alkaloids: colchicine.
UNIT 18. Tryptophan derivatives. Lysergic acid alkaloids. Ergot. Ergopeptines and related compounds. Monoterpenoid indole alkaloids. Vinca. Quinoline alkaloids: quinine, quinidine, camptothecin and derivatives.
UNIT 19. Imidazole alkaloids. Xanthines. Other nitrogenous substances.

3. Laboratory Practices. Analysis and control of herbal drugs

SESSION 1. Basis of analytical control of herbal drugs. Polyphenols containing-drugs: flavonoids of Citrus sp. fruits. Tannins of Thea sinensis leaves.
SESSIONS 2 and 3. Terpenoids containing-drugs: saponins of Glycyrrhiza glabra roots. Cardiactive glycosides of Nerium oleander leaves. Essential oils of Matricaria recutita flowers.
SESSION 4. Anthracene glycosides containing-drugs: Cassia sp. leaves.
SESSION 5. Alkaloids containing-drugs: (qualitative analysis). Tropane alkaloids of Atropa belladonna leaves.
SESSION 6. Alkaloids containing-drugs (quantitative analysis). Tropane alkaloids of Atropa belladonna leaves.
SESSION 7. Determination of active compounds in a problem drug: extraction, qualitative or quantitative determination. Written report as a scientific paper including introduction, methods, results and discussion, conclusions and bibliography.
SESSION 8. Oral presentation of written report. Conclusions of laboratory sessions.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	40,00	100
Laboratory practices	28,00	100
Seminars	4,00	100
Tutorials	4,00	100
Attendance at events and external activities	3,00	0
Development of group work	20,00	0
Development of individual work	10,00	0
Study and independent work	70,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	2,00	0
Preparing lectures	12,00	0
Preparation of practical classes and problem	10,00	0
Resolution of case studies	2,00	0
Resolution of online questionnaires	1,00	0

TOTAL	**211,00**

TEACHING METHODOLOGY

The matter is structured in order to the student will be the protagonist of their own learning.

***Theoretical classes.** Students must reinforce the basic knowledge included on the program through self-study and class assistance. Before the end of class the teacher will consider a number of questions that can be answered by students and, with them, focus the most important concepts of the unit and other aspects of particular complexity.

After each block of units, a summary will provide to the students the ability to relate the contents of different units. To encourage active student participation, the teacher will alternate the above methodology with case studies, problem solving, analysis of readings, press notes etc.

In the individual study, and in the preparation of the units in depth, the teacher will show students the adequate literature and provide the necessary support material.

***Laboratory practice.** Labs are structured in 8 sessions of 3.5 hours each, four in the first semester and four in the second one. The student has to complete a pre-laboratory assistance consisting in the understanding of the script of practice, the review of the theoretical concepts involved and the preparation of a scheme of the working process. At the beginning of each session, the teacher will report the most important aspects of experimental work, promoting knowledge and attitudes in favor of the prudent and sustainable use of solvents (SDG 12 and 13) and other chromatographic elements and will assist to the student during the session. Once the corresponding practice was made, the student will analyze the observed facts and solve some questions proposed by the teacher at the beginning of the session or during the course of practice. In the seventh session, a drug problem will be give on which the teacher raise a number of questions. Each student will plan using the practice outlines, his lab notebook and appropriate manuals. After the implementation of the proposed plan, a report, in a scientific paper format, will be delivered and exposed to the other students in the last session, for a maximum period of 15 minutes. Then a time of debate about reasoning, methodological aspects, interpretation given to the results and conclusions reached, will be open. The teacher may assess the realization by pairs.

***Tutorials.** The tutorials are organized in small groups of students, according to the timetable established by the Faculty (two sessions in each semester). In them, the teacher will evaluate the process of student learning in a globalized manner. Similarly, in the tutorial students will be advised about the strategies to follow in order to avoid the difficulties that they may have. The teacher may propose an individual or collective specific questions according to the needs of students that will be analyzed and discussed on the date by mutual agreement.

***Seminars.** They consist of the preparation and exposure to other students of a work carried out by subgroups of four or five students about a subject of Pharmacognosy or about a multidisciplinary subject (SDG 17) proposed by several teachers. In these seminars, students will exercise the search of information, the ability to outline and summarize as well as oral and written expression, promoting teamwork and provide the knowledge and attitudes to implement the SDGs in their professional future. The theme and date of exposure will be established at the beginning of course in coordination with the other matter.

***Other activities.** These classroom activities are aimed at the search and projection of videos, films and/or documentaries related to the subject, as well as the realization by subgroup of three or four students of different games with questions of increasing difficulty, in order to obtain information about their teaching-learning process.

EVALUATION

In the evaluation of student learning, all aspects described in the methodology section of this guide will be considered and evaluated continuously by the teacher.

10% of the qualification (**1.0 point)**: the result of the preparation and presentation of work in the seminars.

20% of the qualification (2.0 points): the qualification of the practical sessions, which will be of compulsory assistance. The score will take into account the participation (10%), performance in the laboratory (30%) and the mark of the practical exam (60%). In case a student fails the subject the year that they were taken, the score obtained will be applicable to only the consecutive year.

65% of the qualification (6.5 points): the results obtained in the exams.The two exams will be performed in the periods established by the Faculty: January 2024 (First Part), May and June 2024 (Second Part and Final Exam). Except units 1-4, the rest of theoretical contents corresponding to the first part will drop off for the second one. Both exams will consist in a series of questions that require students to relate aspects discussed in various units or even complementary aspects studied in other matter. It may also include a theme to develop, which can demonstrate the ability to synthesize and written expression acquired by the student.

5% of the qualification: (0.5 points): will be from the direct evaluation of the teacher with the student, in the various forms of programmed learning. It will take into account different aspects such as **participatory** assistance, progress in the use of language characteristic of matter, critical thinking, ability to work in groups, etc.

Evidence of copying or plagiarism in any of the assessable tasks will result in failure to pass the subject and in appropriate disciplinary action being taken. Please note that, in accordance with article 13. d) of the Statute of the University Student (RD 1791/2010, of 30 December), it is the duty of students to refrain from using or participating in dishonest means in assessment tests, assignments or university official documents.

In the event of fraudulent practices, the "**Action Protocol for fraudulent practices at the University of Valencia**" will be applied (ACGUV 123/2020): https://www.uv.es/sgeneral/Protocols/C83sp.pdf

In any case, to pass the course is necessary to obtain a positive evaluation (5 out of 10 points) in each of the semesters and laboratory practices.

REFERENCES

Basic

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Additional

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- American Botanical Council: https://www.herbalgram.org/resources/commission-e-monographs/approved-herbs/