

**COURSE DATA****Data Subject**

Code	34086
Name	Immunology
Cycle	Grade
ECTS Credits	4.5
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1201 - Degree in Pharmacy	Faculty of Pharmacy and Food Sciences	2	Second term
1211 - D.D. in Pharmacy-Human Nutrition and Dietetics	Faculty of Pharmacy and Food Sciences	2	Second term

Subject-matter

Degree	Subject-matter	Character
1201 - Degree in Pharmacy	20 - Immunology	Obligatory
1211 - D.D. in Pharmacy-Human Nutrition and Dietetics	1 - Asignaturas obligatorias del PDG Farmacia-Nutrición Humana y Dietética	Obligatory

Coordination

Name	Department
TOLEDO NAVARRO, RAFAEL	21 - Cellular Biology and Parasitology

SUMMARY

Currently, immunology is one of the areas of greatest interest in the field of biology in general and more specifically in the Health Sciences. In this context, the study of immunology is necessary for the student of pharmacy today. This need is determined by several factors: (i) the immune response is a physiological process central to understanding the functioning of organisms, (ii) the immune response is a process is a key issue in the context of diseases of infectious nature for understanding aspects such as pathology, treatment, etc., (III) immunodiagnostic methods are essential in the current diagnostic laboratory (IV) the



immune system abnormalities are a group of diseases of great importance, and (V) the use of pharmacological agents related to the immune system to the treatment and / or prevention of human disease is increasingly prevalent in our environment. Therefore the course aims Immunology give students the necessary knowledge for understanding the immune response as a physiological process and its implication in various diseases, their importance in the relations of the organism to pathogens and their application in the diagnosis, therapy and prophylaxis of diseases.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

Basic knowledge of physiology, anatomy, biochemistry and molecular biology and genetics.

OUTCOMES

1201 - Degree in Pharmacy

- To possess and to understand the knowledge in the different areas of study included in the formation of the pharmacist.
- To apply this knowledge to the professional world, contributing to the development of Human Rights, democratic principles, principles of equality between women and men, solidarity, protection of the environment and promotion of a culture of peace with Gender perspective.
- 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.
- Skills for oral and written presentations.
- Acquire ability to obtain adequate, diverse and up-to-date information.
- The student must acquire basic knowledge on basic and applied immunology.
- The student must acquire basic knowledge on the immune system.
- The student must acquire knowledge of the application of immunological reactions to the laboratory.
- The student must acquire knowledge of immunopathology and pharmacology of the immune system.



- The student must acquire comprehension of the nature of the biological associations.

LEARNING OUTCOMES

The course of Immunology aims to provide the student with the knowledge necessary for understanding the immune response as a physiological process and its implication in various diseases, their importance in the relations of the organism with pathogens, as well as its application in the diagnosis, therapy and prophylaxis of diseases.

DESCRIPTION OF CONTENTS

1. Module 1: Introduction to Immunology

Introduction to Immunology: Concept of the immune system.- Primary and secondary lymphoid organs: functional anatomy.- Main cells of the immune system: ontogeny, characteristics and functions.- Innate immune response.- Specific immune response.- Humoral response. and cell phone.

2.

Antigens: Concepts of antigen, hapten, epitope and antigenic mosaic.- Immunogenicity: requirements and immunogenic characteristics of different molecules.- T-dependent and T-independent antigens.

B lymphocytes: Cell development and differentiation.- B lymphocyte receptors.- Antigenic recognition.- Functions of B lymphocytes in the immune response: introduction to the concept of antibody.

Antibodies: Structure and properties of immunoglobulins.- Isotypes, idiotypes and allotypes.- Properties of the different isotypes.- Antigen-antibody union.- Avidity, affinity, specificity and cross-reaction.- Concepts of polyclonal and monoclonal antibodies. - Homologous and heterologous immunity. - Mechanism of generation of the antibody repertoire.

T lymphocytes: Cell development and differentiation.- T lymphocyte receptors.- Subpopulations of T lymphocytes.- Antigenic presentation processes: concept of antigen-presenting cells.- Concept of restriction: introduction to the main histocompatibility complex.- Functions of T lymphocytes.

The main histocompatibility complex: Concept and properties.- Class I molecules: processing of intracellular antigens and presentation.- Class II molecules: processing of extracellular antigens and presentation.

Cytokines: General characteristics and properties.- Main cytokines.- Role of cytokines in the innate response and in the specific response.- Cytokines that stimulate hematopoiesis.

Antigenic recognition and activation of T lymphocytes: types of recognized antigens.- Differentiation of CD8+ T lymphocytes.- Cytotoxic T lymphocytes (Tc).- Differentiation of CD4+ T lymphocytes.- T helper lymphocytes (Th): Th1 subpopulations and Th2.- Functions of each subpopulation of T lymphocytes in the immune response.- Polarization of the immune response: Th1 vs Th2.



Antigenic recognition and activation of B lymphocytes: General characterization of the humoral response.- Activation by T-dependent and T-independent antigens.- Cooperation processes of Th lympho

3. Module 3: Mechanisms of the immune response effectors

Cytotoxicity processes: Tc lymphocytes: antigenic recognition and mechanisms of action.- NK cells: recognition of target cells and mechanisms of action.- Cellular cytotoxicity mediated by antibodies. The complement system: characteristics and properties.- Activation pathways.- The complement cascade.- The membrane attack complex.- Main biological functions of complement proteins. Phagocytosis: General description of the process.- Opsonization.- Macrophages: characteristics and mechanisms of action.- Neutrophils: characteristics and mechanisms of action.- Antigen destruction mechanisms.

4. Module 4: Regulation of the immune response

Functional anatomy of the immune response: Induction of the response.- Lymphocytic recirculation.- Response in the spleen and lymph nodes.- The cutaneous immune system.- Mucosal immunity. Inflammatory response: General dynamics of the process.- Cell populations involved.- Mediators of inflammation.- Cell migration, intercellular adhesion and extravasation.- Chronic inflammation and granuloma formation.- Transcendence of the inflammatory response in the immune response. Homeostasis of the immune system: Mechanisms dependent on antigen elimination.- Mechanisms mediated by CTLA-4 (CD152).- Treg lymphocytes.- Idiopathic regulation.- Feedback by antibodies.- Inhibitory cytokines.

5. Module 5: Applications of the immune response

Application of antibodies in the laboratory: antigen-antibody interactions and their usefulness.- Characterization of antigens and antibodies.- Obtaining polyclonal antigens and antibodies.- Monoclonal antibodies: obtaining and applications. Introduction to immunological diagnosis: Fundamentals.- Advantages and limitations of immunodiagnosis.- Detection of antigens.- Analysis of different biological samples.- Main non-specific markers of disease. Exploration of the humoral immune response: General foundations.- Precipitation reactions: foundation and main techniques.- Agglutination reactions: foundation.- Active and passive agglutination.- Hemagglutination.- Reactions that use complement. Immunoenzymatic techniques: Foundation.- Enzymes and substrates.- ELISA: foundation.- Types of ELISA: direct, indirect, sandwich and competitive.- Advantages and limitations of ELISA techniques. Immunoblotting techniques: General foundation.- Western-blot: foundation, applications and advantages.- Dot-blot: foundation, applications, advantages and limitations.- Immunochromatography. Immunofluorescence (IF) reactions: General foundation.- Fluorochromes.- Types of IF: direct, indirect and sandwich.- Fluorimetric techniques.- Advantages and disadvantages of IF. Radioimmunoassays (RIA): General foundation.- Liquid phase methods.- Solid phase methods.- Advantages and disadvantages of RIA. Lesson 23: Exploration of the cellular response: isolation of lymphocytes.- Lymphocyte proliferation



tests.- Immunohistochemistry.- Evaluation of cellular immunity.- Flow cytometry.
Immunization: concept.- Passive immunization: serotherapy.- Active immunization: vaccine concept.-
Strategies for vaccine development.- Types of vaccines: attenuated organisms, purified or recombinant
molecules and DNA vaccines.- Adjuvants and immunomodulators .- Advantages and limitations of
vaccination.

6. Module 6: The immune system and disease

Hypersensitivity: Concept.- Type I hypersensitivity: allergies.- Type II hypersensitivity.- Type III
hypersensitivity: immune complexes.- Type IV hypersensitivity.

Tolerance and autoimmunity: Immune tolerance: Concept and significance.- Mechanisms of tolerance.-
Central thymic tolerance.- Post-thymic or peripheral tolerance. Concept and types of autoimmune
diseases.- Mechanisms of autoimmunity: general principles.- Etiology of the autoimmunity

Immunity against infectious agents: Immunity against extracellular bacteria.- Immunity against
intracellular bacteria.- Immunity against fungi.- Immunity against viruses.- Immunity against parasites.-
Agent evasion mechanisms infectious.- Immune response caused by arthropods. .

Immunodeficiencies: Concept.- Primary immunodeficiencies: lymphocyte, complement and phagocyte
anomalies.- Acquired immunodeficiencies: acquired immunodeficiency syndrome.- Life cycle of the virus
and mechanisms of immunosuppression.- Immune response to the HIV virus.- Other acquired
immunodeficiencies.

Antitumor immunity: tumor antigens.- Effector mechanisms in antitumor immunity.- Tumor mechanisms
of immunoevasion.- Antitumor immunotherapy.

Immune response to transplants: histocompatibility antigens.- Allogeneic and xenogeneic transplants.-
Time course of rejection.- Prevention of rejection.

Pharmacology of the immune system: Immunostimulating medications: Concept and applications.- Main
immunostimulating medications.- Immunosuppressive medications: Concept and applications.- Main
immunosuppressive medications.- Therapeutic application of monoclonal antibodies.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	43,00	100
Tutorials	1,00	100
Seminars	1,00	100
Development of group work	20,00	0
Study and independent work	30,00	0
Preparing lectures	17,50	0
TOTAL	112,50	



TEACHING METHODOLOGY

1.- Group learning with the teacher:

Lectures in theoretical classes, enabling the teacher to organize how to cover and raise the subject, study and influence the most important aspects of each lesson. Each lecture is accompanied by the appropriate graphic material to help consolidate knowledge. The delivery will be theoretical, although it has active student participation through problem solving and practical assumptions raised throughout the course. In this sense, the teacher will explain the points of greatest interest or importance of each topic, while the student should seek information and / or deduced from what is explained of the most accessories. The student will have a script for each of the issues. For all that the course be raised in two stages. Initially, we address basic aspects of immunology that students can reach a proper understanding of the molecular basis of immune response. Subsequently analyzed in a particular immune response as a physiological process to then study different aspects of experimental and diagnostic immunology. Finally, addressing other aspects of interest the various pathologies associated with the immune system. This will be addressed so that students can engage in teaching and to acquire capacity for analysis and resolution of problems and issues of an experimental nature.

2.- Tutorial:

This encounter or meeting between a teacher and small groups of students in order to exchange information, analyze, guide or assess a problem or project, discuss a topic, discuss an issue, and so on., Useful for academic and personal student. The appropriate mentoring, the student will receive the proposed theme of the seminar to be prepared in groups and present the day set.

3.- Group work with colleagues (seminar):

In order to foster personal relationships, enhance speaking, share problems and solutions by working with other people during the seminar should be submitted necessarily assigned work in a team (group of 4 persons), which will be evaluated and exposed orally to the other classmates.

EVALUATION

1.- Evaluation of theory: drawing up a compulsory written examination which includes issues like small issues, concepts, reasoning problems or questions, tests, drawings and diagrams etc issues. The content of the theoretical examination of the lessons that include theoretical and practical lessons that. The written exam grade will be a 80% of the final grade, but will be required to obtain a 5 on the exam in order to pass the course.

2.- Evaluation of team work: 10% of the grade will be the final grade in the development, composition and presentation of compulsory work (seminar).

3.- Continuous Assessment: 10% of what will constitute the final grade for attendance, class participation, motivation and concerns about the course, and so on.



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>

REFERENCES

Basic

- ABBAS (A.K.), LICHTMAN (A.H.) & POBER (J.S.), 2004.- Inmunología Celular y Molecular (5ª Ed.). Elsevier Science, Barcelona. 560 pp.
- JANEWAY (C.A), TRAVERS (P.), WALPORT (M.) & CAPRA (J.J.), 2000.- Inmunobiología: El sistema inmunitario en condiciones de salud y enfermedad (1ª Ed.). Masson, Barcelona. 656 pp.
- MARGNI (R.A.), 1996.- Inmunología e Inmunoquímica. Fundamentos (5ª Ed.). Editorial Médica Panamericana, Madrid. 976 pp.
- PARHAM (P.), 2006.- Inmunología (2ª Ed.). Editorial Médica Panamericana, Madrid. 469 pp.
- REEVES (G.) & TODD (I.). 2000.- Lecture Notes on Immunology (4th Ed.). Blackwell Science, Oxford. 267 pp.
- REGUEIRO (J.R.) & LOPEZ-LARREA (C.), 2004.- Inmunología. Biología y patología del sistema inmune (3ª Ed.). Editorial Médica Panamericana, Madrid. 218 pp.
- ROITT (I.) & DELVES (P.J.), 2003.- Inmunología: Fundamentos (10ª Ed.). Editorial Médica Panamericana, Madrid. 559 pp.
- ROITT (I.), BROSTOFF (J.) & MALE (D.), 2000.- Inmunología (5ª Ed.). Ediciones Harcourt S.A., Madrid. 423 pp.
- SANCHEZ-PEREZ (M.) (Edit.), 1997.- Introducción a la inmunología humana. Editorial Síntesis, Madrid. 383 pp.