VNIVERSITAT DE VALÈNCIA

Course Guide
43099 Biochemical basis of immunology: Principles and applications

COURSE DATA

Data Subject	
Code	43099
Name	Biochemical basis of immunology: Principles and applications
Cycle	Master's degree
ECTS Credits	3.0
Academic year	2019 - 2020

Study (s)

Degree	Center	Acad. year	Period
2142 - M.U. en Aproximaciones Moleculares CC Salud 12-V.2	Faculty of Biological Sciences	1	First term

Subject-matter

Degree	Subject-matter	Character
2142 - M.U. en Aproximaciones Moleculares CC Salud 12-V.2	1 - Molecular technologies for research in health sciences	Obligatory

Coordination

Name	Department
CASTELL RIPOLL, JOSE VICENTE	30 - Biochemistry and Molecular Biology
O'CONNOR BLASCO, JOSE ENRIQUE	30 - Biochemistry and Molecular Biology

SUMMARY

In the course of Immunology Biochemical Bases: Fundamentals and Applications, will study the molecular and cellular interactions that regulate the maturation, activation, differentiation, and apoptosis inhibition of immune cells in normal and pathological conditions.

The course also aims to highlight the fundamentals and applications in research and clinical diagnosis of new technologies based on cellular and molecular analysis in Immunology. To do this, there will be also attended by invited lecturers, renowned international experts in immunology. Through laboratory sessions and workshops, students solve experimental examples represent advanced applications of Immunology in Biomedicine.

The course also has a part laboratory equivalent of 10 hours, which will address the technical basis, the interest and the use of relevant immunological techniques. Through laboratory sessions, the student will understand its application to solving practical real situations in the context of research in Health Sciences.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

None.

OUTCOMES

2142 - M.U. en Aproximaciones Moleculares CC Salud 12-V.2

- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
- Tener capacidad de analizar y sintetizar un problema.
- Tener capacidad de comunicación oral y escrita en una segunda lengua científica.
- Tener capacidad de localizar información.
- Tener capacidad de desarrollar un trabajo interdisciplinar.
- Conocer y comprender los conceptos básicos y las aplicaciones en investigación básica y clínica de la Metodología y Técnicas Inmunológicas de Investigación.
- Conocer, comprender y aplicar en la práctica la Metodología y Técnicas Inmunológicas de Investigación en situaciones relacionadas con la investigación básica y clínica.
- Aprender a identificar, manejar y presentar adecuadamente en informes y exposiciones públicas, conocimientos existentes sobre la Metodología y Técnicas Inmunológicas de Investigación, usando como vehículo la lengua inglesa.

- Aprender a identificar, manejar y presentar adecuadamente en informes y exposiciones públicas, conocimientos existentes sobre Citómica, usando como vehículo la lengua inglesa.
- Aprender a identificar, manejar y presentar adecuadamente en informes y exposiciones públicas, conocimientos existentes sobre células madre, usando como vehículo la lengua inglesa.

LEARNING OUTCOMES

1. To know and to understand the basic concepts and applications of Immunology in basic and clinical research.

2. To know,to understand and to apply in practice instruments of Immunology in situations related to basic and clinical research.

3. To learn to identify, to manage and to present properly in reports or public exhibitions, existing knowledge on Immunology, using the English language as a vehicle.

DESCRIPTION OF CONTENTS

1. Introduction to immunology and the immune system

Concept of immunity and immunology. Objectives of the immune system. Types of immune responses. Classification and integration of immune responses. Phases and characteristics of the specific immune response. Generation of the diversity and specificity of the immune responses. Alterations of the immune response. Future of immunology.

2. Components of the immune system: Evolution, development and maturation

Cells of the immune system: Myeloid and lymphoid lineages and related cells. Primary and secondary lymphoid organs and tissues. Signalling and effector molecules of the immune System. Phylogenetic evolution of the immune system. Ontogenetic development of the Immune System. Maturation and differentiation of immune cells.

3. The challenges to the immune system: pathogens, antigens, allergens and immunogens

The concept of self and non-self in the immune response. Identification of self elements: The Major Histocompatibility Complex (MHC) genes and proteins. Identification and recognition of non-self structures: Danger signals and receptors of Pathogen-Associated Molecular Patterns (PAMP). Antigens, epitopes, haptens and immunogens: Requisites for immunogenicity. Characterisitics of the antigens recognized by T lymphocytes or B lymphocytes. Viral and bacterial antigens. Superantigens and mitogens.

4. World antigenic immune sensors: Cellular receptors and free molecules

Invariant receptors of pathogen-associated molecules: PAMP receptors. Polymorphic receptors: Toll-like receptors. Antigen-specific recptors: B-cell and T-cell antigen receptors. Soluble antigen-specific receptors: the antibodies and their structural and functional characteristics. Mechanisms of the generation of the diversity of the antigen-specific receptor repertoire. Antigen processing and presentation.

5. Intercellular communication and cellular trafficking in the immune system.

Adhesion molecules: Definition, classification and functions in the immune response. Cytokines: Definition, classification and functions in the immune response. Mechanisms of intracellular signal transduction in the immune system.

6. Effector mechanisms of normal immune responses

Effector mechanisms of the innate immunity. The complement system. Phagocytosis and intracellular destruction of pathogens. Consequences of the activation of the specific immunity. Cell-mediated and antibody-mediated cell death. The mechanisms of cell death in the immune system.

7. Regulation of normal immune responses. Integration of immune responses to internal and external signals

Mechanisms maintaining autotolerance to self molecules and structures. General regulation of the immune response by cytokines. Mechanisms of inhibition of the immune response. Mechanisms of memory cell generation. Interactions between the immune System and the Neuroendocrine System.

8. Immunopathology: Immunodeficiencies

This part of the course is addressed to study the pathology of the immune system (Immunopathology) with an introductory overview of the most relevant dysfunctions, followed by a detailed review of the alterations resulting in the loss of immunocompetence (Immunodeficiencies). Alterations of B and T cells, as well the phagocytic system and the complement will be addressed. Finally, alterations resulting in immune cell dyscrasia will be reviewed, as well as diagnosis laboratory strategies

9. Immunopathology: Hypersensitivity responses

Hypersensitivity reactions are a set of responses that can be recognized as attribute of the immune response, but are disproportionately large in relation to the potential danger of the antigen. The Gell and Coombss classification issued in 1930 on the basis of the observed clinical response, is still valid in our days, but now supported by the existence of molecular and cellular mechanisms that distinguish them. We will explore the nature of the different types of hypersensitivity reactions and the laboratory tests to study them.

10. Immunopathology: Autoimmunity

When the immune system loses the ability to distinguish self from non-self antigens an auto-aggression response can be triggered against cells, tissues or structures of the organism resulting in a very severe chronic and disabling disease called autoimmunity. In this lesson we will review the mechanisms by which our body develops tolerance against self antigens, the key role of T reg cells and the mechanisms that can lead to a loss of tolerance against self antigens. It will also be reviewed the laboratory diagnostic tools methods for this pathology.

11. Seminar 1: Molecular Immunology Techniques

Antibodies are proteins which is able to recognize and bind to a great variety of antigens in a very specific way. Produced by the inoculation of antigens in laboratory animals by various strategies, poly- or monoclonal antibodies can be artificially generated for many different uses in biomedical and clinical research. The main applications and use of antibodies in biochemistry, molecular biology and clinical diagnosis will be reviewed.

12. Seminar 2: Cell Immunology Techniques

The study of the biology of the cells of the immune system requires unique experimental strategies. In this topic we will examine the production of monoclonal antibodies in vitro, the strategies for the study of the response and lymphocyte activation and mechanisms for the stimulation ex-vivo of antigen-presenting cells

13. Practice 1: Analysis by flow cytometry of leukocyte immunophenotype

By using different combinations of fluorescent monoclonal antibodies and flow cytometric systems, the functional main circulating leukocyte populations in human peripheral blood will be characterized. Applications of this technique in the diagnosis and prognosis of various immunological and hematological disorders will be discussed.

14. Practice 2: flow cytometry analysis of leukocyte activation

By using different combinations of fluorogenic substrates and flow cytometry systems, the students will experience the activation responses to physiological and pathological stimuli in inflammatory leukocytes and lymphocytes in peripheral blood of humans. The applications discussed in this technique diagnosis and prognosis of various inmunopathologies.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	20,00	100
Group work	5,00	100
Seminars	5,00	100
Attendance at events and external activities	5,00	0
Development of individual work	20,00	0
Study and independent work	20,00	0
TOTAL	**75,00**	

TEACHING METHODOLOGY

The subject is devised to be developed in the form of face and non-face work.

Actual teaching of this subject will be made by the following methodological approaches: lectures, labs, workshops and tutoring assistance. 25% of the course will be taught in English.

In the lectures, professor will present an overview of the topic, with special emphasis on the key concepts. At the same session, professor will indicate the most appropriate resources for a deepening of the subject so that students complete their education in the same. In the laboratory practicals and workshops, students will solve technical and experimental examples representing major applications of Immunology in Biomedicine.

EVALUATION

Assessment of student learning will be made by assessing the following sections:

1) Theoretical and practical exam, including long questions (theoretical part) and quizz-test type (practicals) to be held in the classroom. This test will be worth 50% of the final grade and will be held at the end of the first quarter.

2) Practical work written on a basic or clinical application of Immunology, which will be worth up to 40% of the final grade.

3) Student involvement in the subject, expressed as participation in organized discussions, the answers to the questions ask by teacher during the sessions, tutoring assistance and / or any other type of activity carried out by the student in relation to the subject. These concepts will sum up to 10% of the final grade for the course.

REFERENCES

Basic

- K. Abbas, A. H. Lichtman y S. Pillai. Inmunologia celular y molecular, Editorial Elsevier.
- C.A. Janeway, P. Travers, M- Walport y J.D. Capra. Inmunobiología. El sistema inmunitario en condiciones de salud y enfermedad, Editorial Masson.
- T. J. Kindt, R.A. Goldsby y B. A. Osborne. Inmunología de Kuby, Editorial McGraw-Hill.
- D. Male, J. Brostoff, D. B. Roth e I. Roitt. Inmunología, Editorial Elsevier-Masson.

Additional

- Immunology. Wikibooks. http://en.wikibooks.org/wiki/Immunology
- Frank, SA (2007) Immunology and Evolution of Infectious Disease. Princeton University. Press. https://stevefrank.org/antiVar/antiVarCut.pdf
- Immunology. Wikibooks. http://en.wikibooks.org/wiki/Immunology
- Essential Clinical Immunology, Edited by Zabriskie, JB. Cambridge University Press http://sacema.org/uploads/Essential-Clinical-Immunology.pdf

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

English version is not available