VNIVERSITAT DE VALÈNCIA

Course Guide
33179 Immunology: immunological methods

COURSE DATA

Data Subject	
Code	33179
Name	Immunology: immunological methods
Cycle	Grade
ECTS Credits	4.5
Academic year	2020 - 2021

Study (s)

Degree	Center	Acad. year	Period
1102 - Degree in Biotechnology	Faculty of Biological Sciences	3	First term

Subject-matter

Degree	Subject-matter	Character
1102 - Degree in Biotechnology	86 - Cellular and molecular methodology	Obligatory

Coordination

Name	Department
COSTELL ROSSELLO, M.MERCEDES	30 - Biochemistry and Molecular Biology
PEÑARRUBIA BLASCO, DOLORES	30 - Biochemistry and Molecular Biology

SUMMARY

Currently experimental sciences use multiple analytical techniques based on interactions between antigen and antibody. The theoretical part of the course consist of an introduction to the basic components of the immune system, structure and types of immunoglobulins, and cellular mechanisms leading to the generation of diversity. It also briefly describes the molecular mechanisms of immune responses and explain those failures that may have a greater biotechnological impact, such as graft rejection and bound healing. In the following chapters we will explain the techniques for producing polyclonal and monoclonal antibodies, as well as some applications to use them. The theoretical basis of immunological techniques based on the formation and precipitation of immune complexes will be explained. The main applications of both analytical and separative techniques, based on immunodiffusion and immunoprecipitation, will be studied. We will also explore in detail the immunological technics that use either direct or indirect markers, that increase the sensitivity of detection, such as radioimmunoassays, enzyme immunoassays and fluoroimmunoassays. Finally, we will analyze the location techniques in tisues and the special treatment required to preserve the antigen-antibody recognition.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

OUTCOMES

1102 - Degree in Biotechnology

- Design protocols for the separation, purification and characterisation of biological molecules.
- Properly handle the equipment and material of a biochemistry and molecular biology laboratory.
- Saber realizar análisis de expresión génica.
- Know how to use immunological techniques in qualitative and quantitative tests.
- Saber utilizar las técnicas microscópicas en sus distintas aplicaciones.

LEARNING OUTCOMES

The main objective of the course is to provide a detailed overview of the analytical methods based on antibody-antigen interaction. We will try to give students basic knowledge about:
• The molecular and cellular basis of the immune system.
• The main structural properties of antigens and antibodies and the kinetics of their interaction.
• The molecular processes that allow the generation of diversity in the repertoire of T lymphocytes and immunoglobulins.
• The description of the recent advances in biotechnology to solve health problems related to immune response, such as grafts and bound healing.
• The production of antibodies as experimental tools.
• The foundations of experimental methods with an immunologic basis including those related to immunoprecipitation, analytical techniques and the localization of antigens.

DESCRIPTION OF CONTENTS

1. Overview of the immune system.

Hematopoietic cells: phagocytes, granulocytes and lymphoid cells. Primary and secondary lymphoid organs. Lymphocyte recirculation

2. Antibodies (immunoglobulins).

Structure of immunoglobulins. Antigenic variants of immunoglobulins: isotypes, allotypes and idiotypes. Classes and subclasses of immunoglobulins. The membrane receptor of B lymphocytes (BCR). Cellular receptors for immunoglobulins. Germline organization of immunoglobulin genes: rearrangements of the gene encoding the variable regions; mechanism of rearrangements of the variable region, mechanisms responsible for antibody diversity.

3. T cell receptor

Organization and rearrangement of TCR genes. General organization and genetics of the major histocompatibility complex (MHC). Interaction ternary TCR-MHC-antigen. Influence of MHC on the immune response. Restriction of T cells by the own MHC haplotype. Role of antigen-presenting cells. Antigen processing routes.

4. Immune response in health and disease from the biotechnological point of view.

Innate or natural immunity and acquired immunity. Inflammation. Molecular mechanism of leukocyte extravasation. Bound healing. Involvement in atherogenesis and tissue regeneration. Transplants and grafts. Mechanisms of rejection.

5. Production of antibodies.

Preparation of antisera. Production of monoclonal antibodies. Some specific uses of monoclonal antibodies. Other methods of synthesis of antibodies. DNA vaccines.

6. Immunoprecipitation.

Direct immunoprecipitation: curve of formation of precipitin. Immunodiffusion. Immunoelectrophoresis. Assisted immunoprecipitation. Co-immunoprecipitation of chromatin (ChIP). Affinity chromatography.

7. Analytical techniques

Radioimmunoassay. Immunosorbent assays: ELISA. Western Blotting. Fluoroimmunoassay. Antigen localization.

8. Immunology practical classes

Immunological detection of Bur6p protein from Saccharomyces cerevisiae.
Titration of rabbit polyclonal antisera against bovine serum albumin by ELISA (Enzyme-Linked Immunosorbent Assay).

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	29,00	100
Laboratory practices	16,00	100
Development of group work	20,00	0
Study and independent work	20,00	0
Preparation of evaluation activities	17,50	0
Preparation of practical classes and problem	10,00	0
TOTAL	**112,50**	

TEACHING METHODOLOGY

The course is divided into 20 one-hour classes will be taught in the classroom, at 2 hours per week. Practical classes are taught in laboratory sessions of 4 hours for 4 consecutive days. Attendance at practical classes is mandatory. The material used will be on the Virtual Classroom.

Students may prepare and present a seminar in groups of at least 3 students, on topics chosen by them, and related to the subject. The seminars will be placed in the virtual classroom and must be exposed in class. Students who do not prepare a seminar should meet in the final exam, a question about some of the subjects treated in seminaries.

EVALUATION

The methodological approach outlined above has, among other objectives, to encourage frequent and continuing contact between students and professors, so it is possible from it to assess the level of learning. The course is evaluated through a written exam consisting of questions and problems. This will be 70% of the final note.
The practical course is also evaluated in the final exam that will include several questions on basic concepts covered in it. This will be 20% of the note.
The realization of monographs and active participation in seminars will count up to 10% of the final note. For the application of these points it will be required that the score of the written exam exceeds a punctuation of 4.

REFERENCES

Basic

- Inmunologia. Fundamentos (12ª ED). Roitt, Ivan M. y Delves, Peter J. Editorial Médica Panamericana, 2014.
- Inmunología Celular y Molecular (8ª ED). Abbas, Abul K , Lichtman, Andrew H and Pillai Shiv. Ediciones Elsevier, 2015.
- Inmunología aplicada y técnicas inmunológicas. Sanchez-Perez, Miguel. Editorial Síntesis S.A., 1998
- Inmunología. Biología y patología del sistema inmunitario (4ª ED). Regueiro Gonzalez J. R. y col. Editorial Médica Panamericana, 2011.
- Immunobiology (6ª ED). Janeway, Charles y col. Oxford, 2004
- Immunology (5ª ED). Goldsby, Richard A y col. 2003
- Inmunología de Kuby (7ª ED). Kindt T y col. Editorial McGraw-Hill Interamericana, 2013 (disponible como ebook en biblioteca).

Additional

- Annu. Rev. Immunol., Nat. Rev. Immunol., Curr. Opin. Immunol., Immunol Rev., Trends Immunol
- Open acces by PubMed: http://www.ncbi.nlm.nih.gov/sites/entrez
- Open acces to books on-line (NCBI Bookshelf): http://www.ncbi.nlm.nih.gov/sites/entrez/query.fcgi?db=Books

ADDENDUM COVID-19

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

The teaching plan distribution and the relationship between in-class and non presential activities may be modified throughout the course period if it is required because of the health emergency conditions by Covid-19.