COURSE DATA

DATA SUBJECT

Code: 33179
Name: Immunology: immunological methods
Cycle: Undergraduate Studies
ECTS Credits: 4.5
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1111 - Grado en Biotecnología	Facultat de Ciències Biològiques	3	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1111 - Grado en Biotecnología	Cellular and molecular methodology	COMPULSORY

COORDINATION

CASINO FERRANDO PATRICIA

ORTIZ ZAPATER ELENA

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

COMPETENCES / LEARNING OUTCOMES

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Actuar con autonomía en el aprendizaje, tomando decisiones fundamentadas en diferentes contextos, emitiendo juicios en base a la experimentación y el análisis y transfiriendo el conocimiento a nuevas situaciones

Apply analytical, synthetic and critical thinking skills in the application of the scientific method.

Colaborar eficazmente en equipos de trabajo, asumiendo responsabilidades y funciones de liderazgo y contribuyendo a la mejora y desarrollo colectivo

Conocer las bases químicas y moleculares del funcionamiento celular

Conocer y comprender, desde el propio ámbito de la titulación, las desigualdades por razón de sexo y género en la sociedad; integrar las diferentes necesidades y preferencias por razón de sexo y de género en el diseño de soluciones y resolución de problemas

Contribuir en el diseño, desarrollo y ejecución de soluciones que den respuesta a demandas sociales, teniendo en cuenta como referente los Objetivos de Desarrollo Sostenible

Demostrar razonamiento crítico y autocrítico en el ámbito de la titulación, considerando aspectos tales como la ética profesional, los valores morales y las implicaciones sociales de las diferentes actividades realizadas

Design protocols for the separation, purification and characterisation of biological molecules.

Disponer de conocimientos básicos sobre la base celular y molecular del sistema inmune y los fundamentos de los métodos experimentales con base inmunológica

Know how to use immunological techniques in qualitative and quantitative tests.

Manejar adecuadamente los equipos y el material propio de un laboratorio de bioquímica y biología molecular

Participate in multidisciplinary teams, engaging in teamwork and collaboration.

Properly handle the equipment and material of a biochemistry and molecular biology laboratory.

Propose creative and innovative solutions to complex situations or problems, typical of the area of ¿¿¿¿connection, to donate responses to the various professional and social needs

Que el estudiantado demuestre su capacidad para calcular correctamente los parámetros relevantes de un

proceso o un experimento mediante la representación de los datos experimentales

Saber comunicarse de manera efectiva, tanto de forma oral como escrita, adaptándose a las características de la situación y de la audiencia

Saber realizar análisis de expresión génica.

Saber utilizar las técnicas inmunológicas en ensayos cualitativos y cuantitativos

Saber utilizar las técnicas microscópicas en sus distintas aplicaciones.

Ser capaz de observar e interpretar los resultados obtenidos a través de microscopios ópticos

Use English to write reports and to interpret information from protocols, manuals and databases.

Work in laboratories, including safety procedures, waste management and accurate activity logging.

DESCRIPTION OF CONTENTS

1. Introduction.

Overview of the immune system. Historical approach. Innate immunity and acquired immunity. Primary response and secondary responses. Inflammation

2. Cells and tissues of the immune system.

Hematopoiesis. Primary and secondary lymphoid organs. Lymphatic circulation. Types of immune system cells.

3. Humoral response of the immune system. Phagocytes and their receptors.

Cytokines. Acute phase proteins. Complement system. Phagocyte receptors: DAMPs and PAMPs. Functions. Activation of innate immunity.

4. B lymphocytes and immunoglobulins.

Structure of immunoglobulins. Antigen-antibody interaction. Classes of immunoglobulins. Antigenic variants of immunoglobulins: isotypes, allotypes, and idiotypes. The B cell receptor (BCR). Cellular receptors for immunoglobulins. Germline organization of immunoglobulin genes: variable region gene rearrangements; mechanism of variable region rearrangements; mechanisms responsible for antibody diversity.

5. T lymphocytes and antigen presentation.

The T cell receptor (TCR). Antigen presentation to T lymphocytes. General organization and genetics of the major histocompatibility complex (MHC/HLA). The ternary interaction TCR-antigen-MHC. Influence of the MHC on the immune response. T cell restriction by the self MHC haplotype. Role of antigen-presenting cells. Antigen processing pathways.

6. Generation of effector T and B lymphocytes.

Activation of T lymphocytes. NK cells. Generation of effector B lymphocytes.

7. Pathology of the immune system.

Inflammatory diseases. Molecular mechanism of leukocyte extravasation. Termination and healing. Immunodeficiencies. Hypersensitivity reactions. Autoimmune diseases. Transplantation and rejection.

8. Production of antibodies.

Obtaining antisera. Production of monoclonal antibodies. Other antibody synthesis methods, production of recombinant antibodies. Some specific uses of monoclonal antibodies.

9. Antibody characterization.

Antibody titration. Specificity of interaction and cross-reactivity. Study of affinity and antigen-antibody interaction.

10. Immunoprecipitation.

Methods of identifying antibody-antigen complexes. Precipitin curve. Hemagglutination. Immunodiffusion. Assisted immunoprecipitation.

11. Analytical techniques

Radioimmunoassays. Immunoenzymatic assays: ELISA. Western blotting. Fluoroimmunoassay. Localization of antigens.

Characterization of the polyclonal antiserum anti-bovine serum albumin.

12. Immunology practical classes

Characterization of the polyclonal antiserum anti-bovine serum albumin.Titration of rabbit polyclonal antisera against bovine serum albumin by ELISA (Enzyme-Linked Immunosorbent Assay).

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	29,00
Laboratory	16,00
Total hours	**45,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	20,00
Independent study and work	20,00
Preparation of lessons	10,00
Preparation for assessment activities	17,50
Resolution of case studies	0,00
Total hours	**67,50**

TEACHING METHODOLOGY

The course is divided into 23 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 will prepare and present a seminar, in groups of at least 3 students, on topics related to the subject. The works will be posted in the virtual classroom and must be presented in class.

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 completion and active participation in the seminar will account for up to 10% of the final grade. For these points to be applied, it is necessary that the written exam score exceeds 4.

REFERENCES

- Inmunologia. Fundamentos (12ª ED). Roitt, Ivan M. y Delves, Peter J. Editorial Médica Panamericana, 2014.
- Inmunología Celular y Molecular (10ª ED). Abbas, Abul K , Lichtman, Andrew H and Pillai Shiv. Ediciones Elsevier, 2022.
- Inmunología aplicada y técnicas inmunológicas. Sanchez-Perez, Miguel. Editorial Síntesis S.A., 1998
- Inmunología. Biología y patología del sistema inmunitario (5ª ED). Regueiro Gonzalez J. R. y col. Editorial Médica Panamericana, 2021.
- Janeway's Immunobiology (10ª ED). Murphy y col. Oxford, 2022
- Immunology (5ª ED). Goldsby, Richard A y col. 2003
- 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
- Inmunología de Kuby (8ª ED). Kindt T y col. Editorial McGraw-Hill Interamericana, 2020 (disponible como ebook en biblioteca).