Universitat de Lleida

DEGREE CURRICULUM

IMMUNOLOGY AND ANIMAL CELL CULTURE

Coordination: MORA GIRAL, CONCEPCION

Academic year 2019-20

IMMUNOLOGY AND ANIMAL CELL CULTURE 2019-20

Subject's general information

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<tr><td>Subject name</td><td>IMMUNOLOGY AND ANIMAL CELL CULTURE</td></tr>
<tr><td>Code</td><td>101619</td></tr>
<tr><td>Semester</td><td>2nd Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
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<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Biotechnology</td><td>3</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><th>PRALAB</th><th>PRAULA</th><th>TEORIA</th></tr>
<tr><td>Number of credits</td><td>1.2</td><td>0.9</td><td>3.9</td></tr>
<tr><td>Number of groups</td><td>4</td><td>2</td><td>1</td></tr>
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<tr><td>Coordination</td><td>MORA GIRAL, CONCEPCION</td></tr>
<tr><td>Department</td><td>EXPERIMENTAL MEDICINE</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>60 contact hours
90 non-contact hours</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Catalan
Other: depending on the needs of the Group-Class</td></tr>
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IMMUNOLOGY AND ANIMAL CELL CULTURE 2019-20

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
LLOVERA TOMAS, MARTA	marta.llovera@udl.cat	4,6	
MORA GIRAL, CONCEPCION	conchi.mora@udl.cat	4,7	
ROSELL MASES, ESTELA	estela.rosell@udl.cat	1,2	

Subject's extra information

Immunology and Animal Cell Culture is a subject of the third year of the Biotechnology Degree taught during the second semester of the academic year. In this subject we want to provide students in the third year of Biotechnology studies with the basic and necessary knowledge to have an anatomical, cellular and molecular basis that allows them to understand the mechanisms of action of the immune system. These knowledge should know how to use to design experimental strategies to approach basic immunological knowledge and / or applied to immunopathology.

In addition to facilitating the acquisition of transversal core competencies, it is intended that students acquire terminological skills and basic concepts of Immunology, both structurally, cellularly and functionally.

Likewise, students will learn the basics and basic techniques of animal cell cultures and their applications in basic and applied research.
At the instrumental level, in addition to familiarizing students with the basic techniques used in the study of the immune system, they will collaborate in the acquisition of skills related to their communication skills, teamwork and the use of ICT (Information Technology Information and Communication) for obtaining and handling information.

To facilitate the monitoring of this subject it is advisable that students from

Baccalaureate have studied Biology.

As one of the competences that Biotechnology students must acquire is self-training using new technologies, a part of the subject will be taught virtually through the Virtual Campus of the UdL.

Recommendations:

To facilitate the follow-up of this subject, it is advisable that students from the Baccalaureate have completed Biology.

Learning objectives

The purpose of the course is to provide students with the basic knowledge that enables them to understand the functioning of the mammalian immune system in a healthy physiological context of defense towards potentially pathogenic external agents, as well as critical situations. It is also intended to train the student with basic tools of experimental design approach to the Basic and Clinical study of the immune system, and its application in the field of Biotechnology. On the other hand, the student will learn the basic techniques of manipulation of animal cells in culture and their application in the field of biotechnological research.

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IMMUNOLOGY AND ANIMAL CELLULAR CROPS 2016-17

To pass this subject, the student must achieve the following specific objectives:

1. To know the fundamental characteristics of the immune system (organs, cells, and molecules).

2 .To know and understand the characteristics of the innate immune system (or primary immune response).

3. To know and understand the characteristics of the acquired immune system performance (or secondary immune response) and the causes of various immunopathology.

4. Learn the applications of Immunology in Biotechnology.

5. Understand the basic requirements of animal cells in culture and know how to adapt the procedures for the maintenance of animal cells "in vitro".

In addition to knowing and knowing how to apply the concepts specified in the theoretical program established in the topics of theory and seminars, students must:

- To know the terminology and basic scientific language related to Immunology, and Molecular Biology

- To know how to use the concepts related to the thematic contents to design experimental approaches to understand the bases of mammalian immunophysiology, immunopathology and its biotechnological application.

- Be able to plan and carry out experiments with animal cells in culture "in vitro"

Competences

General competences

The graduate in Biotechnology must:

•To know the practice of microbial, animal and plant cell culture.

• Be able to use experimental techniques for molecular, cellular and physiological analysis.

• To know and know how to apply techniques for the analysis of molecular structures and for the detection and quantification of metabolites and macromolecules.

• To know and know how to apply the techniques of OMIC analysis and interpretation of the Results.

• To know the design of bioreactors for the development of specific production processes.

• To know the technological processes based on the use of living Beings and the optimization strategies of the SAME.

• Be able to calculate, interpret and rationalize bioindustrial processes based on the relevant parameters in transport phenomena and thermodynamic balances.

• To know the use of animal, plant and microbial cells in biotechnological processes.

• To know the main fields of application of Biotechnology and acquire basic training in some of them.

• Be able to Design the protocol of a Biotechnological Process COMPLEMENTS with the practical requirements necessary to take it to fit and the parameters of evaluation this.

• To know the Functioning and be able to Work in a biotechnology laboratory.

Specific competences (according to the Study Plan document)

• To know the molecular, cellular and physiological bases of the functioning of the mammalian immune system.

• To know and be able to use experimental techniques to analyze the immune system of mammals at the molecular, cellular and physiological level.

• To know the practice of microbial, animal and plant cell culture.

• Be able to use experimental techniques for molecular, cellular and physiological analysis.

• To be able to design the protocol of a specific biotechnological process with the practical requirements necessary to do so and its evaluation parameters.

• To know the operation and be able to work in a biotechnology laboratory.

Subject contents

The immune response can be divided into three main phases: one of recognition, one of activation and finally one of effector. In order to understand these mechanisms, the teaching program is divided into blocks: The first serves as an introduction to the general characteristics of the immune system and its anatomy. The second is dedicated to the different cell types of the immune system. The third is dedicated to the molecules and factors involved in the immune response. The basis of the immune response and its regulation are described in the fourth block. Finally, a final topic is intended to give a very general view of Immunopathology. The seminars will discuss biotechnological aspects of the application of immunology both at the biomedical, research and / or industrial level.

As for the part of animal cell cultures, it contains the basic knowledge for working with animal cells in culture and their biotechnological applications.

THEORETICAL SYLLABUS (SINGLE GROUP) IMMUNOLOGY:

Topic 1.- Introduction to Immunology

The immune system as a response device against aggressions. Elements of the immune system: organs (primary and secondary), cells, and molecules. Definition of natural (or primary) immunity and acquired (or adaptive) immunity.

Unit 2.- Anatomy of the Immune System.

Unit 3.- Innate Immunity.

Definition. Natural resistance mechanisms. External defense system, physical and chemical barriers. Phagocytes: polymorphonuclear phagocytes: neutrophils.

Macrophages Pattern recognition receivers (PRR), alternative and damper. Inflammatory answer. Antimicrobial chemical components: lysozyme,

defensins, ... Acute phase proteins: inflammation and fever. Mast cells

Unit 4.- Complement.
Introduction. Serum proteins, cascade activation enzyme system. Main effector and amplifier of humoral immunity. Nomenclature. Classic way Alternate way. Route of lectins. Regulation of the complement system. Receivers of the complement system.

Topic 5.- Acquired Immunity:
Definitions. Antigen presenting cells (APCs).

Definition of acquired immunity and main characteristics. Definition of immunogen, antigen, hapten, and epitope.

Professional antigen presenting cells: Macrophages, dendritic cells, and B lymphocytes. Functions and varieties according to their anatomical location. Markers. Initiation of the acquired response.

Unit 6.- MHC molecules. Processing and presentation of antigens. Definition and function of the MHC. Proteins encoded in the MHC. Structure of the MHC class I molecules. Structure of the MHC class II molecules. Differential characteristics of MHC class I and II molecules. Processing paths

Unit 7.- Acquired immunity: B lymphocytes, immunoglobulins and BCRs. Antigen-antibody interaction

Generalities Lymphocytes, types of lymphocytes, phenotypic and functional study of lymphocytes.

B lymphocytes: Ontogeny and maturation of B lymphocytes. Function of B cells during the immune response. Plasma cells and antibody production.

Subpopulations of B lymphocytes.

Immunoglobulins Molecular structure. Light chains (VL-CL) and heavy chains (VH-CH). Nomenclature. Properties and biological activities of immunoglobulins. BCR as a membrane antigen receptor: molecules that participate in the complex. Antigen-antibody interaction.

Unit 8.- Acquired immunity: T and TCR lymphocytes

T lymphocyte receptor (TCR). Ab receptor (alpha / beta); receiver? gd (gamma / delta). Biochemical structure of the receptor. Properties, restriction by the MHC.

CD3 complex. Restriction of the T response by the MHC.

T lymphocytes: Definition. Properties Ontogeny and maturation of T lymphocytes. Thymic selection. T lymphocytes TCR (alpha / beta) and TCR (gamma / delta). Interaction TCR, MHC and accessory molecules. CD4 + and CD8 + T lymphocytes. Functional subpopulations of CD4 + and CD8 + T cells.

Unit 9.- Cellular communication in the Immune System. Adhesion molecules.

Unit 10.- Cellular communication in the Immune System. Cytokines and chemokines.

Adhesion molecules. Definition and function Families. Definition of cytokines and chemokines. Function in hematopoiesis. Role of cytokines in the inflammatory response. Autocrine, paracrine and endocrine action. Cytokine patterns: TH1, TH2, TH3, TH17, ... Chemokines: Introduction. Chemotactic action and "homing" or leukocyte housing. Cytokines with chemotactic function. Families and their recipients.

Distribution of different cell populations in the lymphatic organs.

Unit 11.- Acquired response. Immune response against pathogens. Hypersensitivity

Acquired response. Type of immune responses. Induction of the T lymphocyte response. Helper function.

Specific cellular cytoxicitat and restricted by MHC molecules. B cell activation. Antibody production. Antibody responses to T-dependent antigens. Primary and secondary antibody response. Antibody responses to T-independent antigens.

Memory cells. Phenotypic characteristics Memory Maintenance

Mechanisms of evasion of the immune response by pathogens.

Mechanisms of hypersensitivity.

Unit 12.- Immune Tolerance and Autoimmunity.

IMMUNOLOGY SEMINARS: MEDIUM GROUP:

There will be 5 seminars in which various topics related to:

- Antibody obtaining technology

- Vaccine design

- Approaches to the study and therapeutic designs of different immunopathology

ANIMAL CELL CULTURES:

Unit 1. Introduction to the laboratory of animal cultures. The crop laboratory. The culture medium. Aseptic technique and contamination.

Biological safety in animal cell culture laboratories.

Unit 2. Techniques of manipulation of animal cells in culture. Basic methods of cell cultures: cell isolation, culture maintenance, characterization, and preservation. Immortalization techniques and the problem of immortal cells. The continuous cell lines.

Unit 3. Specialized cell cultures and associated techniques. The primary crop Undifferentiated cells vs. differentiated cells. Factors that control cell differentiation, specialized and conditioned media. Examples of primary crops. Organotypic cultures

Unit 4. Cell modification systems. Methods of introducing exogenous DNA into cultured animal cells. Establishment of stable expression lines, genetic selection in the crop. Transfection Electroporation Microinjection Viral infection.

Unit 5. Biotechnology and tissue engineering. Strategies: pluripotent cells ("stem cells") vs. specialized crops Technology of isolation and culture of pluripotential cells. Techniques of cell differentiation. Reconstruction of tissues and organs through co-culture of the primary type.

Unit 6. Applications of animal crops in Biotechnology and Biomedicine. Animal cells as production factories: drugs, proteins, antibodies, etc. Bioreactors for animal cells. Cell cultures as an alternative for the test of cosmetics and drugs in animals.

Practical activities:

The students:

1. Learn the following immunological techniques demonstratively:
- obtaining d'hibridomes

2. They will learn by dissection, the anatomical location of the primary and secondary lymphatic organs in rodents.

3. They will learn the flow cytometry technique to detect the different immune populations.

4. They will carry out the basic procedures for the maintenance of cell lines in culture: defrosting, sowing, viability counting, subculture and freezing.

5. Perform a colorimetric cell viability test

6. They will perform a transfection of cells in culture by the PEI method.

Methodology

- Master classes. (CM)

These will be done with all students and are not mandatory.

Its purpose is to give an overview of the thematic content highlighting those aspects that will be useful in their training as biotechnology professionals.

- Seminars. (Sem)

These will be done with the total number of students, they are mandatory and the presentations of the works will be made before the large group, each work group will consist, however, of a number of students not exceeding 5.

The seminars are intended for students to apply the theoretical concepts and to deepen these more relevant and more complex aspects of the topics.

- Practical activities. (P)

These activities will be carried out in the context of an internship laboratory where different basic immunological techniques, a small group immunological technique (8-10 students) or practically in groups of groups will be carried out demonstratively in groups of 8-10 students. 8 students the basic techniques of cell cultures ..

Evaluation

EXAMINATIONS	PRACTICES	CASE/PROBLEM ANALYSIS	OTHER ACTIVITIES
50%	32.5%		17,5%

Bibliography

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