UAB
Universitat Autònoma de Barcelona

Immunology

Code: 101008
Credits: 6

2026/2027

Degree programme	Type	Course
Microbiology	OB	2

Contact lecturer

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Group languages

You can consult this information at the end of the document.

Prerequisites

Students must have got the learning competences of the courses programmed during the first course of the Degree. It is highly recommended some formation in Biochemistry, Cytology, Anatomy, Genetics and Cell Biology.

Objectives

CONTEXTUALIZATION AND OBJECTIVES

In the Microbiology degree, the Immunology subject is a mandatory subject of 6 ECTS and belongs to the area of Sanitary Microbiology. It introduces students to the study of the physiological, cellular and molecular mechanisms of defense of organisms against, mainly, microorganisms and toxins. This subject is integrative and allows the student to study the interrelationship that is established between pathogen and host based on the knowledge acquired in cell biology, microbiology, biochemistry, genetics and animal biology.

Subject objectives:

The Immunology subject is divided into three thematic blocks for which objectives have been defined that the student must achieve once the subject has been completed.

Block I. Basic Immunology

- to know the concepts of innate immunity and specific/adaptive immunity and recognize the important role of each in the response against pathogens.

- to identify the elements that intervene in both responses.

- to know the structural and functional characteristics of each of the molecular and cellular components of innate and adaptive immunity.

-to explain the characteristics of lymphoid organs and the recirculation of lymphocytes.

Block II. Organization of the Immune Response

-to integrate the elements described in the lessons of Block I, in the three phases of the immune response: 1) activation phase, 2) effector phase and 3) regulation and homeostasis phase of the immune response.

-to identify the type of immune response that is launched depending on the type of infectious agent: bacteria, viruses, fungi and parasites.

Block III. Immunopathology and immunotherapy

-to identify the dysfunctions of the immune system that are the cause of each type of immunopathology: hypersensitivity, immunodeficiency and autoimmunity.

-to analyze the association of an inefficient response against infectious agents with certain immunopathologies.

- associate the targets of the immune response of different therapeutic and prophylactic treatments.

Learning outcomes

- CM14 (Integrate knowledge and skills in the field of microbiology applied to health, working individually and in groups, to prepare and present in writing or orally and publicly a scientific work either in English or in one's own language or others.) Integrate knowledge and skills in the field of microbiology applied to health, working individually and in groups, to prepare and present in writing or orally and publicly a scientific work either in English or in one's own language or others.
- KM19 (Identify the cellular and molecular relationships established between a microorganism or parasite and its host, including physiological and pathological mechanisms of defence and host response.) Identify the cellular and molecular relationships established between a microorganism or parasite and its host, including physiological and pathological mechanisms of defence and host response.
- SM19 (Use bibliography or internet tools, both in English and in one's own language or others, for the study of pathogenic microorganisms and their control.) Use bibliography or internet tools, both in English and in one's own language or others, for the study of pathogenic microorganisms and their control.
- SM21 (Relate the characteristics of pathogens and their mechanisms of virulence and pathogenicity with the type of infection, the pathology and the immune response that develops and with the mechanisms of action of vaccines and antimicrobial agents.) Relate the characteristics of pathogens and their mechanisms of virulence and pathogenicity with the type of infection, the pathology and the immune response that develops and with the mechanisms of action of vaccines and antimicrobial agents.

Contents

Each block is divided into teaching units (TU) organized by lessons.

Block I. BASIC IMMUNOLOGY: ELEMENTS OF THE IMMUNE SYSTEM

TU-1: Introduction, overview

Lesson 0. Brief introduction to the course

Description of the syllabus, recommended bibliography, study tips, evaluation.

Lesson 1. Introduction

What is Immunology? Elements of the immune system: organs, cells and molecules. Definition of innate or natural immunity and acquired or adaptive immunity. Concept of immune response. Humoral and cellular response. Concept of antigenic clonality.

TU-2: Innate Immunity

Lesson 2. Overview and molecules of the innate immunity

Definition of innate immunity. External defense system, physical and chemical barriers. Antimicrobial chemical components: lysozymes, defensins. Pathogen- and Danger-associated molecular patterns (DAMPs and PAMPS). Pattern recognition receptors (PRR). Soluble molecules of pattern recognition.

Lessons 3. Innate immune cells

Phagocytes: neutrophils and macrophages. Effector mechanisms: respiratory burst and phagocytosis. Other effector cells: basophils, eosinophils, mast cells and Natural Killer (NK) cells. Inflammation focus. Initiation of the adaptive response.

Lesson 4. The Complement system

Introduction. Enzyme activation cascade system. Nomenclature: Inactive precursors and molecules with enzymatic activity. Hydrolysis products. Complement activation pathways: classical pathway, alternative pathway and lectin pathway. Characteristics of each: activators, serum proteins involved. Formation of the membrane attack complex (MAC). Regulation of the complement system. Biological activity

TU-3: Antigen-specific receptors, presenting molecules and antigen recognition

Lesson 5. Structure of Immunoglobulins

Light chains (L) and heavy chains (H). Antigen binding site, hinge region, biological activity of the Fc region. Variable (V) and constant (C) domains. Variable domain: hypervariable region (CDRs). Isotypes: classes and subclasses of Immunoglobulins. B cell Receptor (BCR) as a membrane antigen receptor of B cells.

Lesson 6. Organization of immunoglobulin genes

Genes encoding light (L) and heavy (H) chains. Recombination of the gene segments of the variable region: V-D-J in the heavy chain (H); V-J in the light chain (L). Mechanism of somatic recombination. Imprecision in DNA recombination. Generation of diversity in the immunoglobulin repertoire.

Lesson 7. The T cell receptor (TCR)

Introduction. T cell receptor (TCR): structural characteristics, gene organization. Homology with the B cell receptor (BCR). TCRαβ receptor and TCRγδ receptor. CD3 complex: TCR signaling complex. Trimolecular TCR/MHC/antigen interaction. Epitopes recognized by the TCR. MHC restriction.

Lesson 8. Structure and function of the molecules of the Major Histocompatibility Complex (MHC)

Definition of the Major Histocompatibility Complex (MHC): class I and class II. Structural characteristics. Function of the MHC. Proteins encoded in the MHC gene complex. Three-dimensional structure. Peptide binding site. Characteristics of peptides that bind to class I and class II MHC molecules. Restriction of the T cell response by MHC. Polymorphism and peptide binding. MHC-peptide complex: interactions, conformational changes, recognition surface, molecular mimicry.

Lesson 9. Antigenic processing and recognition

Antigen processing. Synthesis of class I and class II MHC molecules. Processing pathways: endogenous and exogenous antigens. Peptides resulting from processing. Cross-presentation. Antigen presentation to T cells.

Lesson 10. Genetic organization of the MHC

Genetic organization of the MHC (HLA in humans). Location in the genome. Description of the class I region. "Classic" class I loci: HLA-A, B, C. Characteristics of class I genes. Description of the class II region: HLA-DP, HLA-DQ and HLA-DR. HLA-DM. Description of the class III region. Properties of the MHC: polymorphism, polygenicity and codominance. Some basic definitions: alleles, HLA phenotype, haplotype. Alloreactivity. Cellular distribution of HLA antigens. HLA and disease.

TU-4: Cells of the Adaptive Immune System

Lesson 11. B lymphocytes

General. Ontogeny and maturation of B lymphocytes. Types of lymphocytes. Phenotypic and functional differences of lymphocytes. Effector function of B lymphocytes: antibody production and antigen presentation (APC). Subpopulations of B lymphocytes: B-1 and B-2. T-dependent and T-independent antigens.

Lesson 12. T lymphocytes

Lymphocyte populations and their frequency in blood circulation. Ontogeny and maturation of T lymphocytes. Stages in the maturation of T lymphocytes. Thymic selection: positive and negative selection. Essential properties: restriction by MHC and tolerance to self-antigens. T lymphocyte populations: TCRαβ and TCRγδ. Functional subpopulations: helper T cells (Th), cytotoxic T cells (Tc), regulatory T cells (Treg) and NKT cells. Naïve and memory T lymphocytes.

Block II. ORGANIZATION OF THE IMMUNE RESPONSE

TU-5: Communication by cytokines and leukocyte recirculation

Lesson 13. Organization of the organs of the immune system

Primary and secondary lymphoid organs. Secondary Lymphoid Organs. Lymph nodes: anatomical structure; paracortex, high endothelial venules (HEV); cortex, primary and secondary lymphoid follicles; germinal centers. Spleen: periarteriolar sheaths (PALS). Mucosal-associated lymphoid system (MALT). Gut-associated lymphoid tissue (GALT), M cells.

Lesson 14. Leukocyte recirculation

Anatomy of the immune system: dispersion of the immune system. Adhesion molecules. Leukocyte extravasation. Concept of homing. Lymphocyte recirculation: rolling, activation, adhesion and migration through the endothelium (extravasation).

Lesson 15. Cytokines and Chemokines

Cytokines. Properties. Autocrine, paracrine and endocrine action. Functional redundancy. Cytokine families. Receptors. Cytokines of innate immunity. Cytokines of acquired immunity. Biological functions of the most relevant cytokines. Hematopoietic cytokines. Chemokines. Chemotactic action and homing of leukocytes. Cytokines with chemotactic function. Chemokine families and their receptors. Specificity, properties and main effects.

TU-6: Immune response

Lesson 16. Cellular immune response I

From innate to adaptive response. Professional antigen-presenting cells (APCs). Dendritic cells: general. Types of dendritic cells: conventional and plasmacytoid. Function and anatomical location. Antigen recognition by T cells, immunological synapse. Activation of T lymphocytes. First activation signal: interaction between TCR and MHC, accessory molecules. Second activation signal: costimulation. Transduction of signals inside the cell, second messengers. Third activation signal: cytokine microenvironment.

Lesson 17. Cellular immune response II

Phenotypic characteristics. Effector T lymphocytes. Helper T lymphocytes: Th1, Th2, Th17. Cytotoxic T lymphocytes. Mechanisms of cytotoxicity: perforin and granzymes, lymphotoxins and Fas-FasL. Memory T

cells.

Lesson 18. Humoral Immune Response I

Activation of B lymphocytes. Antigen recognition. Second signal. Signal transduction. Follicular Th cells (Tfh). Lymphoid follicles and germinal center formation. Somatic hypermutation. Affinity maturation.

Lesson 19. Humoral Immune Response II

Isotype and microenvironmental change in the lymph node. Humoral responses against T-independent and T-dependent antigens. Effector function of antibodies. Anatomical distribution of antibodies. Memory B cells.

Lesson 20. Regulation of the immune response

Self-regulation as an essential property of the immune system. Immunological tolerance: central tolerance (clonal deletion) and peripheral tolerance (ignorance, anergy, deletion, suppression). Mechanisms and elements of regulation during and after the immune response. Activation-Induced Cell Death (AICD). Regulatory T lymphocytes: natural regulators (nTreg), induced regulators (iTreg), NKT.

TU-7: Immune response to pathogens and mechanisms of evasion

Lesson 21. Immune response to bacteria, fungi and parasites I

General. Host and microorganisms: a delicately balanced relationship. Bacteria: general. Effector mechanisms of response (innate and acquired) to extracellular and intracellular bacteria.

Lesson 22. Immune response to bacteria, fungi and parasites II

Bacterial mechanisms of evasion of the immune response. Fungi: general mechanism of immune response to fungi. Parasites: general. Mechanism of response.

Lesson 23. Immune response to viruses

General. Pathology and pathogenesis of viral infections. Mechanism of innate and acquired immune response to viruses. Immunological memory. Viral mechanisms of evasion of the immune response. Autoimmunity as a consequence of a viral infection. HIV infection.

Block III. IMMUNOPATHOLOGY AND IMMUNOTHERAPY

TU-8: Immunopathology

Lesson 24. Hypersensitivity Reactions I

Concept of hypersensitivity. Types of hypersensitivity reactions. Type I hypersensitivity. Atopy. Properties and levels of IgE. Molecular and biochemical bases of the allergic response. Receptors of the constant fractions of Immunoglobulins (Fc).

Lesson 25. Hypersensitivity Reactions II

Type II hypersensitivity. Examples: transfusion reactions, hemolytic disease of the newborn, autoimmune hemolytic anemias. Type III hypersensitivity. Experimental models of lesions by immune complexes. Arthus reaction. Examples of diseases produced by immune complexes associated with infections. Type IV hypersensitivity. Contact hypersensitivity. Hypersensitivity with granuloma formation. Diseases that proceed with delayed hypersensitivity: tuberculosis, leprosy, schistosomiasis.

Lesson 26. Autoimmunity

Introduction. Tolerance and autoimmunity. Predisposing factors. The spectrum of autoimmune diseases.

Idiopathic autoimmune diseases: systemic and organ-specific. Mechanisms of autoimmunity and examples: by autoantibodies, by immune complexes, by CD8+ T cells and by CD4+ T cells.

Lesson 27. Immunodeficiencies I

General. Classifications. Primary or congenital immunodeficiencies. Immunodeficiencies that affect innate immunity. Immunodeficiencies that affect adaptive immunity.

Lesson 28. Immunodeficiencies II

Secondary or acquired immunodeficiencies. Mechanisms causing acquired immunodeficiencies: infections, malnutrition, drugs, toxins, radiation. Acquired Immunodeficiency Syndrome (AIDS). Animal models of nude and scid mice.

Lesson 29: Immunotherapy. Vaccines

Immunization methods. Passive and active immunization. Immunization guidelines and routes. Adjuvants. Inactivated vaccines. Live attenuated vaccines. Use of recombinant DNA to obtain vaccines. Immunomodulators. Immunosuppressants.

Lesson 30. Tumor immunology

Characteristics of tumors. Immune mechanisms of tumor control. Anti-tumor immunotherapy strategies. Use of microorganisms for anti-tumor therapy.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Classroom practices	15	0.6	CM14, KM19, SM19, SM21
Preparation of oral presentation and solving of problems/cases (bibliographic search, reading, experimental techniques)	34	1.36	CM14, KM19, SM19, SM21
Theory lessons	30	1.2	CM14, KM19, SM19, SM21
Study	66	2.64	CM14, KM19, SM19, SM21

Educational activities scheduled for the Immunology subject in the Microbiology Degree are:

- EXPOSITIVE LESSONSThe lessons of the Teaching Units (theory) will be taught in 30 sessions.

-CLASSROOM PRACTICES

For the classroom practices, all students will be divided into two groups, G1 and G2. A total of 15 sessions will be taught per group.

Some sessions will be dedicated to the presentation of talks given by subgroups of 4-5 students, who will

prepare them cooperatively. These talks can be about original research articles on the immune response to pathogens, relevant current issues or fundamental discoveries in the History of Immunology corresponding to a thematic set of those already given in class. The objective is to know how to search for and select the appropriate information, synthesizing and conceptualizing the most relevant aspects of interest to the specific audience, with an analytical and critical spirit, to present it in public and to discuss relevant issues. While one groups exposes the presentation, the rest of students will complete a test about the content of the presentation. Information about each work and application guidelines will be saved in the Virtual Campus (VC). Each subgroup will prepare, throughout the semester, 2 oral presentations with the support of Power point (or similar). In each classroom practice session (1h) 2 groups will present (18-20 min of presentation + 5-7 min of questions/discussion). The teacher and the other students will ask questions about aspects of the topic presented. The final presentation (in PDF format) must be saved by the students to their VC before the day of the presentation.

In other sessions, at group level (G1/G2):

- problems or clinical cases to be solved will be worked on, which will have been raised at the VC and for which students will have to seek information outside the classroom, and will be discussed together in the classroom, and tests anout the content will be completed by the students.

-experimental techniques will be explained.

-self-test and resolution of doubts will be carried out.

Annotation: within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Partial exam 1	40%	2.5	0.1	CM14, KM19, SM19, SM21
Oral presentations	20%	0	0	CM14, KM19, SM19, SM21
Partial exam 2	40%	2.5	0.1	CM14, KM19, SM19, SM21

Assessable activities:

1)Exams: they assess the assimilation of the content given in the lessons/theory. They are worth 80% of the final grade. At the beginning of the semester, students can choose between two alternatives:

Continuous assessment by partial exams: Two partial exams are scheduled, at the end of blocks I and III respectively. Each partial exam will be worth 40% of the final grade, and between the two they will be worth 80%. They will be multiple-choice exams of 40 questions with 5 options to choose one from. 1/5 of the value of each question will be subtracted from the grade for every incorrect answer. 70% of the questions in the exam must be answered for it to be assessable. The duration of each test will be a minimum of 2 hours. To consider the grades of the partial exams in the global grade, the student will have to obtain a minimum of 4 points in both partial exams. The partial exams are recoverable.

Unique assessment by single exam: For students who choose the single assessment option at the beginning of the course, the entire theory (80%) will be examined in a single exam that will be held on the same day as the second partial exam. This will be multiple-choice exam with 80 questions with 5 options to choose from. 1/5 of the value of each question will be deducted from the grade for each incorrect answer. 70% of the exam questions must be answered for it to be assessable. The duration may be 4 hours or more. In order to be taken into account in the calculation of the overall grade, the final exam grade must be a minimum of 4 points (out of 10). The same recovery system and the same day as for the continuous assessment will be applied.

2) Presentations in classroom practices: Presentations made in classroom practices and the tests completed about the content of the presentations will be assessed. The overall evaluation of the classroom practices will represent 20% of the final grade. Attendance at the classroom practices is mandatory for them to be assessable, and the student will obtain the grade of "Not Assessable" when the absence is greater than 20% of the scheduled sessions. The content of the presentation, the oral presentation, the clarity of the slides and the defense of the lesson will be assessed. The grade will be given for the entire group and the students will be the ones who will have to distribute the grade depending on the effort and individual contribution to the group. The grade of the classroom practices is not recoverable.

Calculation of the overall grade: The subject can be passed provided that at least 4 points out of 10 have been obtained in the exams and that the weighting of exam grades (80%) and classroom practices grades (20%) makes at least 5 out of 10.

Retake Exam: A remedial exam will be scheduled for students who have not obtained the minimum required (less than 5 in the total of the subject or less than 4 in any of the exams) or who want to raise their grade. The remedial exam will cover the content taught in the theory classes and will be formed by 2 partial exams; each partial exam will have 40 multiple-choice questions and a value of 40%. The exam will last a minimum of 2 hours.

Students who have not obtained the minimum required may take the two partial exams or one of them to remediate.

Students who wish to take the retake exam to improve their grade may do so in both parts or in one of the two. They will have to waive the grade they have from the exam or exams they wish to improve their grade on and will keep the corresponding grade they get in the part corresponding to the retake exam.

To be able to take the retake exam, students must have previously been assessed in a set of evaluation activities (partial exams and/or classroom practices) whose weight is equivalent to a minimum of two-thirds of the total grade for the subject. Therefore, the student will obtain the grade of "Not Assessable" when the assessment activities carried out have a weighting of less than 67% in the final grade.

The grade of the retaken part will replace the previous grade of the corresponding part in the calculation of the overall grade.

The commission of any irregularity in an assessment act (academic fraud, plagiarism or improper use of AI, unless this use is expressly authorized in the teaching guide), which may lead to a significant variation in the grade, means that this act will be graded with a 0. In the event that the teaching guide provides that in order to pass the subject it is an essential requirement to have obtained a minimum grade in this assessment act or that several irregularities occur in the assessment acts of the same subject, the final grade for this subject is 0. Apart from this, a disciplinary process may be initiated against the student who incurs any of these irregularities.

Bibliography

BIBLIOGRAPHY

- Books in English:

Janeway's Immunobiology by K Murphy. Ltd/Garland Science, NY & London, 8th ed., (2012).

Kuby Immunology (with web support) by J.A. Owen, J Punt, S. A. Stranford. W.H. Freeman Co., 7th ed, (2013).

Cellular and Molecular Immunology by Abul K. Abbas, Andrew H. Lichtman, Shiv Pillai. Saunders, 8th ed, (2014).

Roitt's Essential Immunology, by Peter Delves, Seamus Martin, Dennis Burton, Ivan Roitt. Wiley-Blackwell Ed., 12th ed., (2011).

Immunology, 7 th Edition by David K. Male, Jonathan Brostoff, Ivan Maurice Roitt, David B. Roth Mosby Elsevier Ed. (2006).

Immunology, Infection and Immunity by Pier GB, Lyczak JB & Wetzler LM. ASM International (2004).

Medical Microbiology and Immunology by Warren Levinson. Lange Medical Books / McGraw-Hill, 10 th ed. (2006).

Review of Medical Microbiology and Immunology by Warren Levinson. Lange Basic Sicence / McGraw - Hill, 11th (2010).

- Books in Spanish:

IMMUNOBIOLOGIA: El sistema inmunitario en condiciones de salud y enfermedad de C. Janeway Jr., P. Travers, L. Walport, M. J. Shlomchik. Traducción de la 4ª edición. Editorial Masson, S.A. Barcelona, (2003).

Inmunología Celular y Molecular de A.Abbas, W. Lichtman, R. Pober. W. B. Saunders Co., Philadelphia, 5ª edición, (2004).

Introducción a la Inmunología Humana de L. Faimboim, J. Geffner. Ed Medica Panamericana, 5ª edición (2005).

Kuby Immunology (en español) by T.J. Kindt, R.A. Goldsby, B.A. Osborne. W.H. Freeman Co., 6 th ed, (2007).

Inmunología de P. Parham. Ed. Panamericana, 2ª ed. (2006).

Fundamentos de Inmunología de Roitt,I. M. Panamericana, 10ª ed. (2003).

Inmunología de I. Roitt, J. Brostoff, D. Male. Hartcourt Brace, 5ª ed. (2003).

COMPLEMENTARY BIBLIOGRAPHY.

- Journals

Advances in Immunology

http://www.elsevier.com/wps/find/bookdescription.cws_home/716912/description#description

http://www.sciencedirect.com/science/bookseries/00652776

Annual Review of Immunology

http://arjournals.annualreviews.org/loi/immunol

Current Opinion in Immunology

http://www.elsevier.com/wps/find/journaldescription.cws_home/601305/description#description

http://www.sciencedirect.com/science/journal/09527915

Journal of Microbiology, Immunology and Infection

http://www.jmii.org/

Microbiology and Immunology

http://www.wiley.com/bw/journal.asp?ref=0385-5600

http://www3.interscience.wiley.com/journal/118503650/home

Nature Reviews in Immunology

http://www.nature.com/nri/index.html

Seminars in Immunology

http://www.elsevier.com/wps/find/journaldescription.cws_home/622945/description#description

Trends in Immunology

http://www.cell.com/trends/immunology/

Trends in Microbiology

http://www.cell.com/trends/microbiology/

- WEBS

Immunobiology by C. A. Janeway, P. Travers, M. Walport and M. Shlomchik. Garland Science2001

http://www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=imm

Roitt's Essential Immunology, by Peter Delves, Seamus Martin, Dennis Burton, Ivan Roitt. Wiley-Blackwell Ed., 11 th ed., (2006).

http://www.roitt.com/

Kuby Immunology (with web support) by T.J. Kindt, R.A. Goldsby, B.A. Osborne. W.H. Freeman Co., 6 th ed, (2006).

http://www.whfreeman.com/kuby/

http://bcs.whfreeman.com/immunology6e/

Microbiology and Immunology On line. School of Medicine, University of South Carolina

http://pathmicro.med.sc.edu/book/welcome.htm

Faculty of Medicine, Dalhouse University (Halifax, Nova Scotia, Canada)

http://immunology.medicine.dal.ca/bookcase/

The Infectious Diseases WebLink

http://webpages.charter.net/deziel/

Immunobiology

http://www.skidmore.edu/academics/biology/courses/erubenst/BI348/pages/resources.html

Janeway's animations (també en podeu trobar d'animacions del llibre Janeway's Immunology a la web del yooutube)

http://www.blink.biz/immunoanimations/

Software

- Microsoft PowerPoint.

- Adobe PDF.

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this link. To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TE) Theory	72	Catalan	first semester	afternoon
(SEM) Seminars	721	Catalan	first semester	morning-mixed
(SEM) Seminars	722	Catalan	first semester	morning-mixed