

**Immunology**

Code: 101008  
 ECTS Credits: 6

Degree	Type	Year	Semester
2500502 Microbiology	OB	2	1

**Contact**

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**Use of languages**

Principal working language: spanish (spa)

Some groups entirely in English: No

Some groups entirely in Catalan: No

Some groups entirely in Spanish: No

**Prerequisites**

The student 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, Genetics and Cell Biology.

**Objectives and Contextualisation**

**CONTEXTUALIZATION AND OBJECTIVES**

Immunology is an obligatory course, specific of the Microbiology degree and included in the Area "Sanitary Microbiology". Immunology introduces students in the study of physiological and pathological mechanisms of defence and specific response of the organisms against the presence of antigens, as microorganisms and toxins. This course is integrative and students can address the inter-relation between pathogens and hosts from their knowledge acquired in cell biology, microbiology, biochemistry, genetics and animal biology.

**Objectives of the course:**

The 6 ECTS course of Immunology is split in three blocks with different objectives that the student will have to achieve at the end of the course.

**Block I. Basic Immunology**

- to know the concepts of innate and specific immunology and to recognize the important role of each of them during the response against pathogens.
- to identify the elements that play a role in both responses.
- to enumerate and explain the structural and functional features of the molecular and cellular components of the innate and adaptive immunity.
- to explain the features of the lymphoid organs and the recirculation of lymphocytes.

**Block I. Organization of the Immune Response**

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

- to identify the type of immune responses activated for each infectious agent: bacteria, virus, fung and parasites.

### ***Block III. Immunopathology and Immunotherapy***

- to identify the dysfunction of the immune system which is the cause of the immunopathologies: hypersensitivity, immunodeficiencies and autoimmunity.
- to analyze the association of an inefficient response against infectious agents and certain immunopathologies.
- to associate the targets of the immune response of different palliative and profilactic treatments.

## **Skills**

- Identify and solve problems.
- Identify the molecular mechanisms of pathogenesis and relate them to the response to infection in order to design and develop strategies for diagnosing and combating diseases caused by microorganisms.
- Obtain, select and manage information.
- Use bibliography or internet tools, specific to microbiology or other related disciplines, both in English and in the first language.
- Work individually or in groups, in multidisciplinary teams and in an international context.

## **Learning outcomes**

1. Analyse the relationship between the type of immune response that is developing and the characteristics of the pathogen: the entry pathway and anatomical location, the mechanisms that trigger response and evasion.
2. Explain the mechanisms of activation and regulation of the cellular and humoral immune response and their link to immunopathology.
3. Identify and solve problems.
4. Know and define the properties that distinguish the adaptive immune response from the innate response and explain the theory of clonality: one lymphocyte, one antigen receptor.
5. Obtain, select and manage information.
6. Understand the theoretical principles behind the immunological techniques used in the characterisation and study of microorganisms.
7. Use bibliography or internet tools, specific to microbiology or other related disciplines, both in English and in the first language.
8. Work individually or in groups, in multidisciplinary teams and in an international context.

## **Content**

Each block is divided in teaching units (TU) organized by lessons defining the specific learning descriptors associated to the corresponding competences.

### **Block I. BASIC IMMUNOLOGY: ELEMENTS OF THE IMMUNE SYSTEM**

#### **Lesson 1. Introduction**

##### **TU-1. Innate immunity**

##### **Lesson 2. Innate immunity**

##### **Lesson 3. The complement system**

##### **Lesson 4. Cells of the innate immunity**

##### ***TU-2. Antigen specific receptors, presenting molecules and antigen recognition***

**Lesson 5. Structure of immunoglobulins**

**Lesson 6. Organization of the genes of immunoglobulins**

**Lesson 7. T cell receptor (TCR)**

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

**Lesson 9. Antigen processing and recognition**

**Lesson 10. Genetic organization of the MHC**

***TU-3. Cells of the immune system***

**Lesson 11. T lymphocytes**

**Lesson 12. B lymphocytes and antigen presenting cells**

***TU-4. Organs of the immune system and lymphocyte recirculation***

**Lesson 13. Organization of the organs of the immune system**

**Lesson 14. Cytokines and chemokines**

**Lesson 15. Leukocyte recirculation**

**Block II. ORGANIZATION OF THE IMMUNE RESPONSE**

***UD-5. Immune response***

**Lesson 16. Cellular immune system I**

**Lesson 17. Cellular immune system II**

**Lesson 18. Humoral immune system I**

**Lesson 19. Humoral immune system II**

**Lesson 20. Regulation of the immune response**

***UD-6. Immune response against pathogens and mechanisms of action***

**Lesson 21. Immune response against bacteria, fungi and parasites I**

**Lesson 22. Immune response against bacteria, fungi and parasites II**

**Lesson 23. Immune response against virus**

**Block III. IMMUNOPATHOLOGY AND IMMUNOTHERAPY**

***UD-7. Immunopathology***

**Lesson 24. Reactions of hypersensitivity I**

**Lesson 25. Reactions of hypersensitivity II**

**Lesson 26. Autoimmunity**

**Lesson 27. Immunodeficiencies I**

**Lesson 28. Immunodeficiencies II**

## **Lesson 29. Immunotherapy. Vaccines**

## **Lesson 30. Tumor immunology**

### **Methodology**

Educational activities programmed for the course of Immunology of Microbiology degree are:

#### **- EXPOSITIVE LESSONS**

Lessons of the Didactic Units (UD) will be taught in 30 sessions.

#### **- SEMINARS**

For the seminars, the group will be split in two subgroups, G1-IMM and G2-IMM, with an estimated number of 30 students per group. A total of 15 sessions per group will be given with the following programmed activities:

1. EXPERIMENTAL TECHNIQUES (TE, 4 sessions).
2. CASES (ABP, 2 sessions).
3. RESEARCH ARTICLE (ART, 4 sessions).
4. SEMINARS (SEM, 3 sessions).
5. AUTOEVALUATION (AUT, 2 sessions).

#### **1. 1. EXPERIMENTAL TECHNIQUES (TE)**

Immunology is an experimental science and it is important that the student get the competences required to work in a laboratory. Some techniques based in the antigen-antibody recognition and others used in an Immunology laboratory will be explained.

Exams will include 3-5 questions for the evaluation of these activities (they will be a 10% of the partial qualification, that is, a 7% of the final qualification).

There are programmed 4 sessions to explain the concepts on which these techniques are based and the expected result will be obtained for each:

TE1 and TE2: Techniques based on the antigen-antibody interaction.

TE3 and TE4: Techniques used for the study of T lymphocytes.

#### **1. 2. CASES (ABP)**

Two cases have been programmed. To solve the cases, students must work in groups. The design and pauses of the case will be included in the programming of the Blocks. Information of the cases will be uploaded by the teacher in the Virtual Campus (CV). In class the students ask the doubts about the case. The teacher will upload the questions in the CV and the students will answer them in groups.

#### **1. 3. RESEARCH ARTICLE**

This activity will consist in the oral presentation of a research article. The final objective is to learn to expose clearly a research article (introduction, hypothesis, exposition and interpretation of the results and discussion of them). Four sessions will be done in which students will expose an article with questions

#### **1. 4. SEMINARS**

It has been programmed 3 sessions of Seminars by professionals of the field of Immunology and Microbiology. These sessions will serve to consolidate the learning of the theoretical lessons.

## **Activities**

Title	Hours	ECTS	Learning outcomes
<b>Type: Directed</b>			
Seminars	15	0.6	1, 6, 3, 5, 8, 7
Theory lessons	30	1.2	1, 4, 2, 5, 7
<b>Type: Autonomous</b>			
Preparation of a research article (bibliographic search, reading, experimental techniques)	15	0.6	1, 6, 2, 3, 5, 8, 7
Resolution of cases / ABP (bibliographic search and text reading)	20	0.8	1, 6, 3, 5, 8, 7
Study	66	2.64	1, 6, 4, 2, 3, 5, 8, 7

## Evaluation

Evaluation of the course will be individual and continuous through the next proves:

- Individual learning by parcial exams.
- Cooperative learning through forming activities during the seminar lessons.

The evaluation activities are:

**Partial exams:** Two partial exams at the end of Blocks I and III. The value of the first partial is 30% and of the second partial 40% of the final qualification. They will consist in test exams with 30 questions, 5 options and one unique correct response. To be evaluated, the student will have to answer at least 70% of the exam (21 questions). Each wrong response will diminish  $\frac{1}{4}$  of the value. Non-answered questions will not have penalization. Three questions about experimental techniques (TE) will be included with a value of 10% of the exam (3% and 4% of the final course qualification, respectively). The duration of the exams will be of 2 hours. To the exams be considered, students must obtain a minimum of 3.5 points (over 10 points, 1.05 over 3) in the first partial and 4 points (over 10 points, 1.6 over 4) in the second exam. The average qualification must be at least of 4 over 10 (2.8 over 7).

**Cases (ABP):** Cases will be a cooperative work in 4-students groups. They can be practical problems or clinical cases. The objective is to develop auto-learning, synthesis and written communication capacities.

Evaluation will represent 15% (5% for the first case and 10% for the second one) of the final qualification. Written presentation, answers and own aportation will be considered.

**Articles (ART):** Articles will be uploaded some weeks befor the exposition. Class sessions will consist in the presentation of the article by the group members and some questions by the teacher.

Evaluation of the oral presentation will represent 15% of the final qualification. Contents, oral exposition, clarity of slides and defense of the issues will be considered.

As the groups will be maintained during the course, the qualification of ABP and ART (30% of the final qualification) will be given to the full group. Students will have to distribute individual qualifications depending individual contribution. The individual qualification must not be higher than 3 points.

**Retake exam:** A final exam will be programmed for students which could not obtain the minimum to pass the course or for those students which can increase the qualification. The value of the exam will be 70% of the

qualification. The exam will consist in 50 test questions (with 5 questions on TE) and only students that have participated in the continuous evaluation proves (partial exams) can access to the final exam. The exam will have a duration of 2 hours.

To pass the course the student must obtain a minimum of 50% after the addition of the values of individual and cooperative work modules. Students that will not obtain a minimum of 40% of the individual work will have access to pass the course in the final exam.

Students which want to increase the qualification must renounce to the obtained qualification during the partial exams and accept the qualification obtained in the final exam.

To be eligible for the retake process, the student should have been previously evaluated in a set of activities equaling at least two thirds of the final score of the course or module. Thus, the student will be graded as "Not Evaluable" if the weighting of all conducted evaluation activities is less than 67% of the final score.

## Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Cases	15%	0	0	1, 6, 3, 5, 8, 7
Partial exam 1	30% (27% + questions TE 3%)	2	0.08	1, 6, 4, 2
Partial exam 2	40% (36% + questions TE 4%)	2	0.08	1, 6, 4, 2
Research article	15%	0	0	1, 6, 2, 3, 5, 8, 7

## 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 Siccience / 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 4<sup>a</sup> edición. Editorial Masson, S.A. Barcelona, (2003).

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

**Introducción a la Inmunología Humana** de L. Faimboim, J. Geffner. Ed Medica Panamericana, 5<sup>a</sup> 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, 2<sup>a</sup> ed. (2006).

**Fundamentos de Inmunología** de Roitt,I. M. Panamericana, 10<sup>a</sup> ed. (2003).

**Inmunología** de I. Roitt, J. Brostoff, D. Male. Hartcourt Brace, 5<sup>a</sup> ed. (2003).

## **COMPLEMENTARY BIBLIOGRAPHY.**

- Journals

*Advances in Immunology*

[http://www.elsevier.com/wps/find/bookdescription.cws\\_home/716912/description#description](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.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](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 Science 2001

<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, Dalhousie 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 youtube)**

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