Immunology of Infectious Diseases

Code: 101931
ECTS Credits: 6

2024/2025

Degree	Type	Year
2501230 Biomedical Sciences	OT	4

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Teaching groups languages

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

Prerequisites

To access to study "Immunology of Infectious Diseases", the student must have attained the learning skills of Immunology in the course corresponding to their degree.

Objectives and Contextualisation

BLOCK 1

1.1 Overview of the immune response.

-Overview of innate immune response: cells of innate immunity, PRRs, PAMPs, DAMPs, complement system, natural killer cells, epithelial barriers, the inflammatory response, the antiviral response.

-Overview of adaptive immune response: Antigen presentation to T lymphocytes, B-cell response, T-cell dependent antibody response, T-cell independent B cell response, T cell response, T cell activation, differentiation and functions of CD4+ effector T cells, differentiation and functions of CD8+ effector T cells.

-Overview of mucosal immunology (MALT): MALT, structure of GALT, small vs large intestine, lamina propria, peyer patches, M cells, innate immunity in GALT, adaptive immunity in GALT, lymphocyte homing in GALT, humoral response in GALT (IgA), T cell response in GALT.

BLOCK 2

2.1 Immune response to viruses.

-General characteristics of virus, tropism, kinetics of immune response to viral infections, innate immunity against virus, viral danger signals, virus recognition by innate immunity, type-I interferons, the antiviral response, plasmacytoid dendrític cells, natural killer cells.

-Adaptive antiviral immune response: humoral response, antibodies, kinetics of antibody response in viral infection, antibody-dependent enhancement, T-cell response against virus, cross-presentation, cytotoxicity, inhibitory mechanisms, T-cell exhaustion, memory cells.

2.2 Inborn errors of immunity (IEI, also known as primary immunodeficiencies) that cause severe viral infections.

-TLR3 deficiency underlying herpes simplex encephalitis, RNA polymerase III (Pol III) deficiency underlying severe varicella zoster infection, IEI predisposing to EBV infection, IEI underlying severe papillomavirus infections, IEI predisposing to severe influenza virus infections.

2.3 Seminars by specialists.

BLOCK 3

3.1 Immune response to bacteria.

-Immune response to extracellular bacteria: General concepts about bacteria, innate immune response to extracellular bacteria: TLRs, NLRs, inflammasome and pyroptosis, role of phagocytes, neutrophils and NETs. Adaptive immune response to extracellular bacteria: humoral immune response, cellular immune response (CD4 T cells, Th17 cells), pathological consequences of immune responses to extracellular bacteria.

-Immune response to intracellular bacteria: Clinical characteristics of infections with intracellular bacteria, innate immune response: autophagy, inflammasome, role of interferons, NK cells. Adaptive immune response: development and functions of Th1 cells, role of Th17 cells, role of CD8 T cells; granulomas (formation, structure, composition, dynamics).

3.2 Inborn errors of immunity (primary immunodeficiencies) that cause severe bacterial infections.

-Inborn errors of Immunity (IEI) predisposing to extracellular bacterial infections: IRAK4 and MYD88 deficiencies underlying pyogenic bacterial infections. RPSA deficiency causing isolated congenital asplenia and infections. IEI of IL6 receptor and severe bacterial infections. IEI of the complement system and extracellular bacterial infections.

-Inborn errors of Immunity (IEI) predisposing to intracellular bacterial infections: Mendelian susceptibility to mycobacterial disease (MSMD): impairment of IFN-gamma production or response, IL12R deficiency, IL23R deficiency, other defects.

3.3 Seminars by specialists.

BLOCK 4

4.1 Immune response to fungi.

- Mycobioma, fungal infections in humans, fungi PAMPs, detecting fungi by PRRs (c-type lectin receptors), innate immunity (macrophages and DCs), cellular adaptive immune response against fungal infections (role of Th17 cells), humoral adaptive immunity in fungal infections.

4.2 Inborn errors of immunity (primary immunodeficiencies) that cause severe fungal infections.

- CARD9 deficiency and severe fungal infections, IL17-IL17R deficiencies and chronic mucocutaneous candidiasis (CMC), AIRE deficiency and CMC, STAT1 gain-of-function mutations and CMC.

BLOCK 5

5.1 Immune response to parasites.

-General aspects of the immune response to parasites. Immune response to helminths: ILC2 cells, stromal cells and type 2 cytokines (TSLP, IL25, IL33), Th2 cells (IL4, IL13, IL5), eosinophils, basophils, mast cells and M2 macrophages, B cell response (IgE) and mast cells.

5.2 Seminars by specialists.

Competences

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Display knowledge of the bases and elements applicable to the development and validation of diagnostic and therapeutic techniques.
- Display knowledge of the basic life processes on several levels of organisation: molecular, cellular, tissues, organs, individual and populations.
- Display knowledge of the concepts and language of biomedical sciences in order to follow biomedical literature correctly.
- Display theoretical and practical knowledge of the major molecular and cellular bases of human and animal pathologies.
- Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
- Read and critically analyse original and review papers on biomedical issues and assess and choose the appropriate methodological descriptions for biomedical laboratory research work.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
- Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
- Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
- Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
- Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
- Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

Learning Outcomes

1. Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
2. Analyse the relationship between the nature of the immune response and the molecular and physical characteristics of the antigens that induce it.
3. Display practical skills in performing a diagnostic analysis in immunopathology.
4. Explain the mechanisms of activation and regulation of the cellular and humoral immune response and their link to immunopathology.
5. Explain the relationships between a possible pathogen and its host.
6. Identify the principal elements intervening in the immune response to infections and tumours, and in the situation of allogeneic transplant.
7. Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
8. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
9. Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
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11. Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
12. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
13. Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
14. Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
15. Understand scientific texts and write review papers on immunology and biology.
16. Understand the scientific literature and the databases specialising in problems of immunology and immunopathology, and interpret the results of a scientific project.
17. Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

Content

BLOCK 1

1.1 Overview of the immune response.

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5.2 Seminars by specialists.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Classes	30	1.2	2, 4, 5, 6
Classroom practicals	12	0.48	2, 16, 15, 3, 4, 5, 6, 17
Type: Supervised			
Preparation of oral presentation	17	0.68	2, 16, 15, 3, 4, 5, 6, 17
Preparation of written report	17	0.68	2, 16, 15, 3, 4, 5, 6, 17
Type: Autonomous			
Interpretation of data from a scientific publication or from a clinical case	20	0.8	2, 16, 15, 3, 4, 5, 6, 17
Study hours	50	2	2, 16, 15, 3, 4, 5, 6

Teaching methodology of the course

LECTURES:

The topics of the different blocks will be taught in approximately 30 sessions. Some of the sessions will be given by guest lecturers and specialists in the field of clinical research of diseases caused by pathogens. The content of the theory program will be taught by the professor responsible for the course in the form of lectures with audiovisual support. The presentations used in class by the professor will be previously available in the Virtual Campus of the subject.

AUTONOMOUS LEARNING:

Autonomous learning will be based on achieving the specific learning competencies that will accompany the beginning of each block in which the program of the subject is divided. Students are advised to regularly consult the books recommended in the bibliography section of this teaching guide to consolidate and clarify, if necessary, the contents explained in class.

COOPERATIVE LEARNING:

Cooperative learning sessions will be scheduled: groups of students will be made to work on a specific topic. The tasks of each group will be:

1) Elaborate an oral presentation: choose the fundamental parts of the work and expose it to the rest of the class.

2) Linked to the oral presentation, an infographic will be made together with a descriptive summary of the same.

The details of the work will be given during the presentation of the subject.

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

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Partial Examination P1	35%	1.5	0.06	2, 3, 4, 5, 6
Partial Examination P2	35%	1.5	0.06	2, 16, 15, 3, 4, 5, 6
Presentation of team work	30%	1	0.04	1, 14, 13, 2, 16, 15, 3, 4, 5, 6, 7, 12, 11, 10, 8, 9, 17

The evaluation of the course will be individual and continuous through tests that will assess:

-The individual learning of the student from partial exams.

-The cooperative learning from the formative activities programmed in the classroom practices, written and oral presentation of a pathogen following the competences of the subject.

The evaluation activities programmed in the subject of Immunology are:

Midterm (partial) exams: two midterm exams. Each test will count 35% of the final grade (70% of the final grade between both midterm exams). They will be multiple-choice exams of at least 30 questions with 5 options and only one correct one. In the correction, 1/5 of the value of each question will be subtracted for an incorrect answer. To pass this part of the course, the average grade of the two midterm exams must be equal or higher than 5. Students must achieve a minimum grade of 4 in the midterm exams in order to average them.

Cooperative learning: It is proposed as cooperative work in groups of 3-6 students. The objective is that students develop their self-learning skills, search and selection of information and finally develop the ability to synthesize and written communication. The ability to work in groups is also valued.

The evaluation of cooperative learning will represent 30% of the final grade of the course. For the grade of the group work, the content of the work, format, oral presentation and subsequent discussion will be evaluated.

In order to pass this part of the course, the grade for the cooperative learning will be equal or higher than 5.

The final grade of the subject will be composed by the score obtained from the two partial (70% of the grade) plus the score of the cooperative learning work (30% of the grade).

REMARKS:

-In case of not passing any of the midterm exams or if the student wants to raise the grade, he/she will have the option of taking a final exam that is composed by midterm exams (i.e. the student has the option of taking only one of the midterms or both, as appropriate). The format of the make-up exam may be multiple-choice and/or short questions. The format of the make-up exam will be announced in advance.

-Students who wish to raise their grade lose their previous grade.

-Failure to attend any of the exams must be justified. Failure to attend any of the midterm exams (regardless of the reason, even if justified) implies that the student will have to retake that midterm exam during the final exam/recovery.

-To participate in the recovery, students must have been previously evaluated in a set of activities whose weight is equivalent to a minimum of two thirds of the total grade of the subject. Therefore, the student will obtain the grade of Not Evaluable when the evaluation activities performed have a weight of less than 67% in the final grade.

SINGLE EVALUATION:

Students have the possibility to apply for the single evaluation. The single evaluation consists of the following:

-Students waive to take the two partial exams separately and will take a single exam (single evaluation exam) on the same date as the second partial exam is taken. This exam will have the content of the whole course and will account for 70% of the final grade. In order to pass this part of the course, the grade of the single evaluation exam must be equal or higher than a 5. The format of the single evaluation exam will be informed in advance.

-RECOVERY: The same recovery system will be applied as for the continuous evaluation.

-Students who opt for the single evaluation must also take the cooperative learning part (30% of the final grade) and will have to attend the classroom practices (which are compulsory for all students).

-Students who opt for the single evaluation must communicate it to the teacher responsible for the subject before the end of September.

Bibliography

Primer to the Immune Response, 2nd Edition, by Tak W. Mak, Mary Saunders and Bradley Jett. 2n Edition, ELSEVIER (2014). ISBN: 9780123852458

Review of Medical Microbiology and Immunology by W. Levinson, P. Chin-Hong, E.A. Joyce, J. Nussbaum, B. Schwartz. McGraw-Hill, 16th edition, (2020). ISBN-13: 978-1260116717.

Deja Review Microbiology and Immunology. E. Chen, S. Kasturi. McGraw-Hill Ed. 2nd ed (2010). ISBN-13: 978-0071627153.

Elsevier's Integrated Review Immunology and Microbiology: With STUDENT CONSULT Online Access, by Jeffrey K. Actor - Elsevier Science Health Science Division (2012). ISBN: 978-0323074476.

BRS Microbiology and Immunology, by Arthur G. Johnson, Richard J. Ziegler, Louise Hawley. Lippincott Williams & Wilkins 5th (2009). ISBN: 9780781789127.

Janeway's Immunobiology by K. Murphy, C. Weaver. Ltd/Garland Science, NY & London, 9th ed (2016). ISBN: 9780815345053.

Kuby Immunology (with web support) by J. Punt, S. Stranford, P Jones and J. Owen.W.H. Freeman and Co. Ltd, 8th ed (2018). ISBN13: 9781319114701

Cellular and Molecular Immunology by Abul K. Abbas, Andrew H. Lichtman, Shiv Pillai, Saunders, 10th ed (2021). ISBN13: 978-0323757485.

Roitt's Essential Immunology, by Peter Delves, Seamus Martin, Dennis Burton, Ivan Roitt, Wiley-Blackwell Ed., 13th ed (2017). ISBN 9781118415771.

Principles of Mucosal Immunology (Society for Mucosal Immunology), by Phillip D. Smith, Thomas T. McDonald, Richard S. Blumberg Ed. Garland Science 2nd ed. (2020). ISBN 9780815345558.

Mim's Pathogenesis of Infectious disease. A.A; Nash, R.G. Dalziel & J. R. Fitzgerald. Academic Press Ed. 6th Edition. (2015). EBook ISBN: 978012397781; Paperback ISBN: 9780123971883

Principles of Molecular Virology.A.J Cann. Academic Press Ed. 6th Edition. (2016). EBook ISBN: 9780128019559; Paperback ISBN: 9780128019467.

Unifying Michobial Mechanisms. M. F. Cole. Garland Science 1st ed. (2019). eBook ISBN: 9780429262777.

- Complementary Bibliography

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

Immunological Reviews

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/

Microbiology and Immunology

http://onlinelibrary.wiley.com/journal/10.1111/%28ISSN%291348-0421

Journal of Microbiology, Immunology and Infection

http://www.e-jmii.com/

Comparative Immunology, Microbiology and Infectious Diseases

http://www.elsevier.com/wps/find/journaldescription.cws_home/496/description#description

Software

Microsoft Office is sufficient to carry out this subject.

Language list

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	741	English	first semester	morning-mixed
(TE) Theory	74	English	first semester	morning-mixed