UNIVERSIDADE DA CORUÑA

Teaching Guide				
Identifying Data				2024/25
Subject (*)	Immunology		Code	610441009
Study programme	Máster Universitario en Bioloxía Molecular, Celular e Xenética			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Optional	3
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	BioloxíaCiencias Biomédicas, Medicina e FisioterapiaFisioterapia, Medicina e Ciencias Biomédicas			
Coordinador	Lamas Criado, Iban	E-mail	iban.lamas@udc.es	
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Web				
General description	This subject is part of the Master's Degree in Molecular, Cellular and Genetic Biology. Although due to its important applications in research, health and industry, immunology would have to be treated as a subject with its own autonomy in the Bachelor of Biology, the reality is that its close relationships with other biological disciplines, such as Cell Biology, Biochemistry, Genetics and Microbiology led to the fact that it is often imparted in a not very homogeneous way, and fragmented by diverse related areas. For this reason, this Master's course aims to offer the student basic, joint and updated information on the components and response mechanisms of the immune system in physiological and pathological situations. On the other hand, various basic techniques will be performed and interpreted which, we hope, will help you address some problems throughout your research work.			

Study programme competences / results	
Code	Study programme competences / results
A1	Skills of working in a sure way in the laboratories knowing operation handbooks and actions to avoid incidents of risk.
A2	Skills of using usual techniques and instruments in the cellular, biological and molecular research: that are able to use techniques and instruments as well as understanding potentials of their uses and applications.
A6	Skills of understanding the functioning of cells through the structural organization, biochemistry, gene expression and genetic variability.
A7	Skills of knowing and analyzing specific cellular systems as stem cells, nerve cells, cells of the immune system, or other cells related to several pathologies.
A8	Skills of having an integrated view of the previously acquired knowledge about Molecular and Cellular Biology and Genetics, with an interdisciplinary approach and experimental work.
B3	Skills of management of the information: that are able to gather and to understand relevant information and results, obtaining conclusions and to prepare reasoned reports on scientific and biotechnological questions
B4	Organization and work planning skills: that are able to manage the use of the time as well as available resources and to organize the work in the laboratory.
B6	Skills of team work: that are able to keep efficient interpersonal relationships in an interdisciplinary and international work context, with respect for the cultural diversity.

Learning outcomes			
Learning outcomes	Study programme competences / results		
The student understand the basic types of immune responses triggered in front of the recognizing a pathogen or an antigen and the regulators and effectors mechanisms involved in each one of these responses.	AR6 AR8		

Learn the basic techniques and protocols and acquire the necessary skills required to handle, safely, the material used in the laboratory and to organize work in it. You will also learn to recognize the importance of their use in different contexts..	AR1 AR2		
The student understand the basic types of immune responses triggered in front of the recognizing a pathogen or an antigen and the regulators and effectors mechanisms involved in each one of these responses.	AR6 AR7 AR8		
- At the end of the master, it is expected that students know the molecular, cellular, tissue and organic components of the immune system, and understand its integrated function in health and disease conditions.	AR7 AR8		
Collaborate in the performance of a work in small groups (2 people maximum) on some aspect of the contents of the matter theoretical program. You'll need to gather the right information, organize work, study the available resources to manage time. After processing, the work will be exposed orally by the authors, using computer tools and the appropriate terminology.		BR3 BR4 BR6	

Contents	
Topic	**Sub-topic**
The theoretical course program	- Subtopics of the theoretical course program
Topic 1. Introdución to the Immunology..	- A brief history
Topic 2. Components of the immune system.	- Immune System Cells: genesis and lineages. Primary and secondary lymphoid organs: structure and function. Lymphocyte circulation: Cellular traffic and involved molecules.
Topic 3. The innate immune system.	- Concept. Features. Physical, chemical and biological defense barriers. Cellular components. Humoral components. Receptors of the innate immune system. Effectory mechanisms of innate immunity. Phagocytosis and inflammation: phases, effector cells and molecules involved. Interactions with the adaptive response.
Topic 4. The adaptive / specific immune system	- Concept. Characteristics and properties (specificity, clonal nature, adaptability, memory). Cellular components: B lymphocytes and T antigen presenting cells. Phases of adaptive mechanism. Antigen recognition: T surface receptor (TCR) and B (BCR) cells. Phase of cell activation and proliferation: Mechanism of clonal selection and expansion. Phase of cell differentiation: Differentiation of T and B lymphocyte,. Effectory phase. Immune mechanisms: cellular immunity. Humoral immunity.
Topic 5. Antigens / immunogens / haptens.	- Antigen concept. Chemical nature. Properties. Immunogen concept. Epitope concept: nature and types. Haptens and hapten-carrier conjugates. Types of antigens: conformational and sequential, T dependent and independent. Multivalent, Superantigens, Autoantigen and Mitogens. .
Topic 6: Antibodies (immunoglobulins).	- Concept. Molecular structure: characters. Variable regions and antigen binding. Constant regions and effectory function. Classification (classes, subclasses). Expression of membrane and secreted immunoglobulins. Biological functions and distribution of antibodies. .
Topic 7. antigen-antibody reactions	- The paratope structure. Complementarity between antigen and antibody. Characteristics of the antigen-antibody binding: affinity, avidity and specificity. Biological meaning: neutralization, opsonization, complement activation, cell cytotoxicity antibody-dependent (ADCC)..
Topic 8. Citoquinas.	- Concept. General Properties. Mechanisms of biological action. Cytokine receptors: types. Regulating effects of the cytokines. Functional classification: cytokines that mediate immune responses..
Topic 9. The system of the complement	- Concept. Components. Nomenclature. Activation of the complement system: Alternative pathway. Classical pathway. Lectin pathway. Lytic pathway. Receptor proteins of the complement. Regulation. Biological functions.

Topic 10. The molecules of Histocompatibility.	- Concept. Major histocompatibility complex (CPH / MHC). Histocompatibility genes: Properties. Structure of histocompatibility molecules: Class I and II. Binding peptide-MHC molecules: Characters. Polymorphism of the MHC molecules on their binding peptides. Expression of MHC molecules. Biological functions..
Topic 11. The Processing and presentation of antigens.	- The antigen presenting cells: function. Recognition of peptide antigen. Antigen processing (degradation): endocytic (extracellular) and cytosolic (intracellular) pathways. Assembly of the peptides to MHC molecules. Presentation and expression of complex peptide-class I / II on the surface of the CPA.
Topic 12. Development, maturation, activation and differentiation of B lymphocytes	- Development and maturation in the bone marrow. Differentiation of B lymphocytes antigen independent: Expression of surface markers (CD19, 10). The functional antigen receptor (BCR). Maturation of B cells: mechanisms of negative and positive clonal selection. Production of virgin mature B lymphocytes. Migration to2nd lymphoid organs antigen-dependent: Activation of B lymphocyte by antigen. Structure and function of the BCR receptor. B cell proliferation through activation of T helper lymphocytes (CD4). Differentiation into plasma cells. B cell migration into primary follicles: Differentiation of B cells activated in memory B cells
Topic 13. Chap.13. Development, maturation, activation and differentiation of T lymphocytes	- Migration of T cell precursors to the thymus. Development and differentiation of T lymphocyte antigen-independent: Expression of surface markers (CD3, 4, 8). Maturation of T cells: mechanisms of positive and negative clonal selection. Production of virgin mature T cells. Migration to secondary lymphoid organs. Activation of mature T cells by antigen: TCR receptor: structure and function. Receptor interactions T cell / MHC-specific ligand: Activation of T lymphocytes proliferation of mature T lymphocytes. Differentiation into effector T lymphocytes. Subpopulations of effector T lymphocytes: cytotoxic T: CD8). T helper cells (Helper: CD4): Role of Th1 and Th2 subclasses. Production of T cell memory.
Topic 14. The immune response.	- Concept. Action mechanisms. Response types. Cellular Immune Response: characteristics of cellular cooperation. The influence of the antigen and of the microenvironment. The effector cells involved. Humoral immune response: Characteristics. Phases of activation, proliferation and differentiation of lymphocytes. Primary immune response. Immunological memory. Secondary immune response
Topic 15. Immune Tolerance.	- Concept of immune tolerance. General properties. Mechanisms of immunological tolerance. Central and peripheral tolerance of T and B cels . Mechanisms of induction of tolerance: Delección clonal, anergia clonal. Immunological ignorance. Supresors/regulatory T cells. Cell-cell interactions: help and suppression. Tolerance to the own and foreign antigens.
Program of practical classes	- Practices to develop in the (INIBIC) laboratory
Practice 1	- Protocol for the extraction of the distinct populations of blood cells in the peripheral blood. * Separation of leucocytes by gradient of density with Histopaque. * Obtaining of mononuclears cells of the peripheral blood (lymphocytes and monocytes). * Obtaining of granulocytes. * Obtaining of platelets.

Practice 2	- Flow Cytometry: antigénic determination of immune cells: Isolation of T lymphocytes by Sorter.
Practice 3	- ELISA (Essay by inmunoabsorción tied to enzymes: detection of specific antibodies or of soluble cytokines in serums).
Practice 4.	- Immunohistochemistry: Identification of antigenic markers on frozen or paraffin-embedded tissue by fluorescence techniques or enzyme samples.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Laboratory practice	A2 A1	7	7	14
Objective test	A6 A7 A8	3.5	0	3.5
Guest lecture / keynote speech	A6 A7 A8 B6	14	28	42
Seminar	B3 B4 B6	4.5	9	13.5
Personalized attention		2	0	2
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Laboratory practice	- The student must realize 10 hours of practical class in the laboratory, compulsory and presentials, after the theoretical classes have finished. In the lab, they will develop different activities of experimental character (demonstrations, problems) that will allow to approach some aspects of the theoretical knowledge acquired in the magistral sesions. Besides, they will adquire the handle skills adapted for the development of simple experimental metho-dologies, own of the immnunological techniques. The practices class will be realized in the INIBIC, where they will have the suitable infrastructura to the aims of the practice, and also will take place the practical examination.
Objective test	- The student will realise a final examination on the theoretical contents of the subjet that can combine different types of questions: type test questions of multiple answer, short questions, of ordination, to complete, of association. Also is possible to construct it with one only type of these questions. The date and place of celebration of the final examination (Official Announcement of May) will warn with antelación. If the student suspended, or did not appear to the examination in May, he will have the possibility to present in the test of the month of July, whose date and place of celebracion will warn previously
Guest lecture / keynote speech	- During the course the teacher will give between 14-15 master class sesions, attend them and compulsory, on some of the corresponding contents to the program. In them will be explained the basic theoretical foundations of the subjet employing computer tools. For a better improvement, recommends that the student have read in advance the fundamental aspects of the topics mentioned in the recommended texts and also in the Moodle platform. The calendar and final schedule of the keynote sesions will communicate in advance in the web page of the subjet.
Seminar	-At the beginning of the course the teacher will suggest the accomplishment of a supervised study to the student in small groups (2 at most people) on some aspects of a topic of the theoretical immunology program. The student shall organize, prepare and discuss, along the course, under the teacher guide (3 tutorships max). The student will receive in advance the material object of the seminar, which will target towards current aspects of inmunology, in order to seek the needed information. The teacher will effect a pooling in common, in which they will discuss and resolve issues related to their contents and the conclusions they should reach all members of the group.The result of the study will be exposed by the authors to the rest gives class, during 1 hour, using computer tools.

Personalized attention	
Methodologies	Description

Laboratory practice Objective test Guest lecture / keynote speech Seminar	- The student can check your specific doubts during the keynote sessions and, more at wide, in the sharings of the seminars. Besides, it will have personal tutorials to solve any question related with the theoretical, practical and with the planned activities in the discipline matter. Given the purpose of this tutoríal, we will try that the schedule be the most accommodated for the professor and the student, coordinating it previously between both. Those students with part-time dedication or academic exemption, will only have to carry out the practical part of the subject in an indispensable way to be evaluated.

Assessment			
Methodologies	Competencies / Results	Description	**Qualification**
Laboratory practice	A2 A1	- At the end of the practical classes, it will realise a final examination of the contents worked on them, in the own laboratory of the INIBIC. The attendance at the (compulsory) practical classes and the participation in all activities is a key requirement for his overcoming, and will suppose 20% of the final qualification of the matter. - The skills considered in this activity are the following ones: A3, A4, B4.	20
Objective test	A6 A7 A8	- At the end of the lectures will realise a final examination of the theoretical contents of the course. The attendance to the theoretical classes and the participation in its activities is compulsory, and will suppose 55% of the final qualification. - With the objective proof, the student will show the level of knowledge and skills purchased along the course, as well as the capacity of synthesis and abstraction developed.	60
Guest lecture / keynote speech	A6 A7 A8 B6	- The attendance to the masterclasses is fundamental for the domain of the contents of the matter. - The considered competitions are the following ones: A8, A9, A10, B1, B4, B5.	0
Seminar	B3 B4 B6	- It will evaluate the work in group, considering also the attendance and participation in the various activities carried out during the preparation of the guided work, the adecuación to the proposed topic, the ability of understanding and presentation and the bibliography used. All this will represent 25% of the final qualification. - The competences promoted in this activity are the following ones: A9, A11, B3, B4, B5, B6, B9.	20

Assessment comments

Attendance at theoretical and practical classes and the preparation and presentation of the supervised work is an essential condition & nbsp; to be evaluated both in the ordinary June call and in the July test. Attendance and participation in, at least, 80% of each of the face-to-face activities of the subject is necessary. - The evaluation of the subject will be based on a theoretical content exam, a practical content exam, and the student's participation in the preparation of directed work on some aspect of the theoretical program of the subject.
- In the May session there will be a final theoretical exam & nbsp; and in the INIBIC Laboratory the practical exam for the evaluation of learning will take place. All training activities will have a score between 0 and 10 points. To calculate the final grade the following criteria will be taken into account:
1. Assessment of theoretical learning. The mark obtained in this section will be 60% of the final mark.
2. Assessment of practical learning. The grade obtained in this section will be 20% of the final grade.
3. Evaluation of the student's participation in the preparation of the supervised work, of their attendance at the tutorials scheduled with the teacher for the resolution of doubts during its development and the result obtained in the final presentation of the same will mean 20% of the grade final.
To pass the subject in the first call; the global sum of the aforementioned sections must be between 5 and 10 points, being necessary to obtain at least 4 points in each of the three sections. If this requirement is not met, the final grade would correspond to that of the section with the lowest value.
Students who did not pass the subject in the May session, or did not attend it, will be able to try again in the July test. In this case, the evaluation will consist of:
1. In a written test on the contents & nbsp; subject theorists. The mark obtained in this section (between 0 and 10 points) will account for 80% of the final mark.
2. In a practical test of the same nature as the one mentioned above. The mark obtained in this section (between 0 and 10 points) will represent 20% of the final mark.
To pass the subject in the July call, the global sum of the aforementioned sections must be between 5 and 10 points, being necessary to obtain at least 4 points in each of the two sections. If this requirement is not met, the final grade would correspond to that of the section with the lowest value.
The qualification of NOT PRESENTED, will be applied only in case the student had not participated in any activity of the subject (lectures, practical classes, supervised work and objective tests), or did not appear in the final call of July.

Students who request to be evaluated in the extraordinary call of December, both the theoretical contents as well as the evaluation criteria will correspond to the 2023-2024 academic year.
All aspects related to "academic
exemption", "dedication to study", "permanence" and
"academic fraud" will be governed in accordance with current UDC
regulations.

Sources of information	
Basic	Bibliografía básica - (*) Abbas, A. K.; Lichtman, A. H; Pillai, S. (2012). " Inmunología celular y molecular" . 7ª ed. Elsevier: Barcelona. - (*) Murphy, K.P. (2012). " Janeway´s Immunobiology. 8ª ed. Garland Science. - Regueiro G, J.R.; López L, C.; González R, S.; Martínez N, E. (2010). " Inmunología: Biología y patología del sistema inmunitario". 4ªed. Médica Panamericana.
Complementary	Bibliografía complementaria - Abbas, A. K.; Lichtman, A. H; Pillai, S. (2009). " Inmunología celular y molecular" . 6ª ed. Elsevier: Barcelona. - Delves, P.J.;Martin, S.; Burton, D.;Roitt, I. (2008). " Roitt Inmunología. Fundamentos". 11 ed. Panamericana. - Janeway, C.A.; Travers, P.; Walport, M.; Shlomchik,M.J.(2006)." Immunobiology. The immune system in health and disease". 6ed. Garland Science Publishing. - Parham, P. (2006). " Inmunología" 2ª ed. Médica Panamericana. BIBLIOGRAFÍA PARA PRÁCTICAS - Autor : Campos Ferrer, A. (2004). "Manual de prácticas de inmunología" Masson: Barcelona. PÁGINAS WEB RELACIONADAS CON INMUNOLOGÍA - RevistaInmunología. Libre acceso en la página de la Sociedad Española de Inmunología: http:www.inmunologia.com - J. Peña: http://www.inmunologiaenlinea.es - Sociedad Española de Inmunología http://www.inmunologia.org/home.php. - http://pathmicro.med.sc.edu/book/immunolo-sta.htm - http://www.whfreeman.com/catalog/static/whf/kuby/con_index.htm - http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/T/TOC.html

Recommendations
Subjects that it is recommended to have taken before
Cellular Techniques/610441001 Molecular Techniques/610441002 Cell Signaling/610441004 Genetic Variation Mechanisms/610441005
Subjects that are recommended to be taken simultaneously
Human Genetics/610441017 Molecular Microbiology /610441011
Subjects that continue the syllabus
Stem Cells and Cell Therapy/610441010
Other comments
- Attendance and active participation in the different activities of the discipline. - Read or work on the topic of the talks / tasks in advance and take the corresponding notes during their presentation. - The study and periodic review of the subject, as it progresses, using the bibliographic material to understand and deepen the information received in the classes. - The search for information in various sources for the preparation, presentation and defense of supervised work. - The clarification of possible doubts in the tutorials with the teacher.

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.