



## Teaching Guide

Identifying Data					2015/16
<b>Subject (*)</b>	Inmunoloxía	<b>Code</b>	610441008		
<b>Study programme</b>	Mestrado Universitario en Bioloxía Molecular , Celular e Xenética				
Descriptors					
Cycle	Period	Year	Type	Credits	
Official Master's Degree	2nd four-month period	First	Optativa	3	
<b>Language</b>	Spanish				
<b>Teaching method</b>	Face-to-face				
<b>Prerequisites</b>					
<b>Department</b>	Bioloxía Celular e Molecular				
<b>Coordinador</b>	Gonzalez Fuentes, María Jose	<b>E-mail</b>	maria.jose.gfuentes@udc.es		
<b>Lecturers</b>	Domenech García, Nieves Gonzalez Fuentes, Maria Jose	<b>E-mail</b>	nieves.domenech.garcia@sergas.es maria.jose.gfuentes@udc.es		
<b>Web</b>					
<b>General description</b>	<p>Esta materia encádrase no Máster en Bioloxía Molecular, Celular e Xenética. Aínda que polas súas importantes aplicacións na investigación, sanidade e industria, a inmunoloxía tería que ser tratada coma unha materia con autonomía propia na Licenciatura de Bioloxía, a realidade é que as súas estreitas relacións con outras disciplinas biolóxicas, coma a Bioloxía celular, Bioquímica, Xenética e Microbioloxía propiciaron o feito de que se ministre de cotío de xeito pouco homoxéneo e fragmentado por áreas afíns diversas. Por iso, no presente curso do Máster preténdese ofrecer ao alumno unha información conxunta e actualizada sobre dos compoñentes e mecanismos de resposta do sistema inmunitario nas situacións fisiolóxicas e patolóxicas. Pola outra banda, executaranse e interpretaranse diversas técnicas básicas que, agardamos, os axuden a abordar algúns problemas ao longo do seu traballo de investigación.</p> <p>PENDIENTE DE INCLUIR POR LOS SERVICIOS DE XESCAMPUS LOS SIGUIENTES PROFESORES DEL INIBIC: Dra. Nieves Domenech García (NDomGar@canalejo.org)</p>				

## Study programme competences

Code	Study programme competences
A1	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.
A2	Skills of working in a sure way in the laboratories knowing operation handbooks and actions to avoid incidents of risk.
A5	Skills of understanding the microorganisms' role as pathogenic agents and as biotechnological tools.
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.
B5	Correct oral and written communication on scientific topics in the native language and at least in another International diffusion language.
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.
B9	Skills of preparation, show and defense of a work.
C1	Skills of expressing correctly, so much of oral form as written, in the official languages of the autonomous region.
C3	Skills of Using basic tools of the information technologies and communications (ICT) necessary to the exercise of his profession and for the apprenticeship over his life.



Learning outcomes			
Learning outcomes	Study programme competences		
- 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.	AR5 AR6 AR7 AR8		CC1
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.	AR5 AR7	BR5	CC1
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	BR4	CC1
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 BR5 BR6 BR9	CC1 CC3

Contents	
Topic	Sub-topic
The theoretical course program	- Subtopics of the theoretical course program
Topic 1. Introducción 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. Effector 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,. Effector 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 effector 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 to 2nd 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 cells . 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	<ul style="list-style-type: none"> <li>- Protocol for the extraction of the distinct populations of blood cells in the peripheral blood.</li> <li>* Separation of leucocytes by gradient of density with Histopaque.</li> <li>* Obtaining of mononuclear cells of the peripheral blood (lymphocytes and monocytes).</li> <li>* Obtaining of granulocytes.</li> <li>* Obtaining of platelets.</li> </ul>
Practice 2	- Flow Cytometry: antigenic determination of immune cells: Isolation of T lymphocytes by Sorter.
Practice 3	- ELISA (Essay by immunoabsorción 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	Ordinary class hours	Student?s personal work hours	Total hours
Laboratory practice	A1 A2 B4 C1	10	10	20
Objective test	A7 A8	2	0	2
Guest lecture / keynote speech	A5 A6 A7 C1	14	28	42
Seminar	B3 B4 B5 B6 B9 C1 C3	3	6	9
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 sessions. Besides, they will acquire the handle skills adapted for the development of simple experimental methodologies, own of the immunological techniques. The practices class will be realized in the INIBIC, where they will have the suitable infraestructura 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 subject 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 sessions, attend them and compulsory, on some of the corresponding contents to the program. In them will be explained the basic theoretical foundations of the subject 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 sessions will communicate in advance in the web page of the subject.



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 immunology, 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 of the class, during 1 hour, using computer tools.
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**Personalized attention**

Methodologies	Description
Seminar Guest lecture / keynote speech Laboratory practice Objective test	<p>- 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 tutorial, we will try that the schedule be the most accommodated for the professor and the student, coordinating it previously between both.</p> <p>Tutor schedule:</p> <ul style="list-style-type: none"> <li>- Dra. María José González Fuentes: Monday, Tuesday and Friday. The schedule will indicate the first day of the course. Area of Cellular Biology. Faculty of Sciences. University of the Coruña. Email: majoseg@udc.es</li> <li>- Dra. Nieves Domenech Garcia: please contact Professor by Email: Dr. Nieves.domenech.garcia @ sergas.es.</li> </ul>

**Assessment**

Methodologies	Competencies	Description	Qualification
Seminar	B3 B4 B5 B6 B9 C1 C3	<ul style="list-style-type: none"> <li>- 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.</li> <li>- The competences promoted in this activity are the following ones: A9, A11, B3, B4, B5, B6, B9.</li> </ul>	25
Guest lecture / keynote speech	A5 A6 A7 C1	<ul style="list-style-type: none"> <li>- The attendance to the masterclasses is fundamental for the domain of the contents of the matter.</li> <li>- The considered competitions are the following ones: A8, A9, A10, B1, B4, B5.</li> </ul>	0
Laboratory practice	A1 A2 B4 C1	<ul style="list-style-type: none"> <li>- 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.</li> <li>- The skills considered in this activity are the following ones: A3, A4, B4.</li> </ul>	20
Objective test	A7 A8	<ul style="list-style-type: none"> <li>- 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.</li> <li>- 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.</li> </ul>	55

**Assessment comments**



- Attendance at lectures and practice and the preparation and presentation of the guided work is a required condition to be evaluated in both the ordinary Announcement of May and July test proof. There is necessary the attendance and participation in, at least, 80 % of each one of the activities of the matter.
- Evaluation of the matter is based on an examination of theoretical content, practical examination content, and student participation in the development of guided work on some aspect of the theoretical program of matter.
- In the announcement of May, a final theory examination will be realized and in the Laboratory of the INIBIC will take place the practical examination for the evaluation of the learning. All the formative activities will have a score between 0 and 10 points. To calculate the final note, will be considered the following criteria:
  - 1. Evaluation of the theoretical learning. The note obtained in this section will suppose the 55 % of the final note.
  - 2. Evaluation of the practical learning. The note obtained in this section will suppose the 20 % of the final note.
  - 3. Evaluation of the student participation in the development of the guided work, attendance at scheduled tutoring with the teacher to resolve doubts during development and result in the final presentation of the same will suppose 25% of the final note.
- To surpass the matter in the May announcement, the total sum of those paragraphs should be between 5 and 10 points, being necessary to get, at least, 4 points in each one of the three sections. If it did not fulfil this requirement to final qualification would correspond with the one of the section that have lower value.
- The students that did not approve the subject in the announcement of May, or they did not present to the same one, they will try it again in the proof of July. In this case, the evaluation will consist of:
  - 1. In a test written on the theoretical contents of the matter. The note obtained in this section (comprised between 0 and 10 points) will suppose the 80 % of the final note.
  - 2. In a practical proof of identical nature to the mentioned previously. The note obtained in this section (comprised between 0 and 10 points) will suppose 20% of the final note.
- \*\*To surpass the matter in the July announcement, the global sum of the mentioned sections will have to be comprised between 5 and 10 points, being necessary to obtain, at least, 4 points in each one of the two sections. If this requirement was not fulfilled to final qualification would correspond with the one of the section that have lower value.
- The qualification of NO PRESENTED, will apply only if the student/to had not participated in any activity of the subject (master classes, practical classes, guided work and tests), or did not present in the final announcement of July.

### Sources of information

<b>Basic</b>	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.
<b>Complementary</b>	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: <a href="http://www.inmunologia.com">http://www.inmunologia.com</a> - J. Peña: <a href="http://www.inmunologiaenlinea.es">http://www.inmunologiaenlinea.es</a> - Sociedad Española de Inmunología <a href="http://www.inmunologia.org/home.php">http://www.inmunologia.org/home.php</a> . - <a href="http://pathmicro.med.sc.edu/book/immunolo-sta.htm">http://pathmicro.med.sc.edu/book/immunolo-sta.htm</a> - <a href="http://www.whfreeman.com/catalog/static/whf/kuby/con_index.htm">http://www.whfreeman.com/catalog/static/whf/kuby/con_index.htm</a> - <a href="http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/T/TOC.html">http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/T/TOC.html</a>

### Recommendations

Subjects that it is recommended to have taken before



Técnicas Celulares/610441001

Técnicas Moleculares/610441002

Señalización Celular/610441004

Mecanismos de xeración da variación xenética/610441005

**Subjects that are recommended to be taken simultaneously**

Microbioloxía Molecular/610441010

Xenética Humana/610441016

**Subjects that continue the syllabus**

Células Nai e Terapia Celular/610441009

**Other comments**

We recommend: - Attendance and active participation in the various activities of the discipline. - Read or work the subject of the lessons in the masterclass /work lessons in advance and take appropriate notes during his presentation. - The study and the periodic review of the matter, according to advance materials, using the bibliographic material to understand and examine the information received in class. - The search of information in diverse sources for the preparation, presentation and defense of the supervised works. - The clarification of possible doubts in the tutorships with the teacher

PENDIENTE DE INCLUIR POR LOS SERVICIOS DE XESCAMPUS LOS SIGUIENTES PROFESORES DEL INIBIC: &nbsp;&nbsp;&nbsp; Dra. Nieves Domenech García (NDomGar@canalejo.org)

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