

IMMUNOLOGY

MODULE	CONTENT	YEAR	TERM	CREDITS	TYPE
Medicine and Pharmacology	Immunology	3	1	6	Required
LECTURER(S)			Postal address, telephone nº, e-mail address		
<ul style="list-style-type: none"> Francisco Ruiz-Cabello Osuna (Group A) M^a del Carmen Ruiz Ruiz (Group B) Ignacio Molina Pineda de las Infantas (Group C) Federico Garrido Torres Puchol (Group D) Natalia Aptsiauri (Groups C and E) <p>Group C in English</p>			Department of Biochemistry and Molecular Biology III and Immunology, 11 th Floor, Tower C, Faculty of Medicine. E-mail: fruizc@ugr.es , mcarmenr@ugr.es , imolina@ugr.es , federico.garrido.sspa@juntadeandalucia.es , naptsiauri@ugr.es		
DEGREE WITHIN WHICH THE SUBJECT IS TAUGHT					
Pharmacy					
PREREQUISITES and/or RECOMMENDATIONS (if necessary)					
It is recommended that the students have completed the following subjects: Structural Biochemistry, Metabolic Biochemistry, Cellular and Human Physiology (I and II). Students must have an appropriate knowledge of English to understand scientific texts.					
BRIEF ACCOUNT OF THE SUBJECT PROGRAMME (ACCORDING TO THE DEGREE)					
<ul style="list-style-type: none"> Molecular and cellular basis of the Immune System. Mechanisms of the immune response. Human molecular immunopathology. Physiopathology of immunological disorders. Drugs of immunological origin. 					
GENERAL AND PARTICULAR ABILITIES					



General abilities:

- To identify, design, obtain, analyze, regulate and produce drugs and medicines as well as other products and substances of sanitary interest in human or veterinary use.
- To evaluate the therapeutic and toxic effects of substances with pharmacological activities.
- To know how to apply the scientific method and acquire skills in handling legislation, information sources, literature, development of protocols and other necessary aspects for the design and critical assessment of preclinical and clinical trials.
- To give therapeutic advice on pharmacotherapy and dietotherapy, as well as on the nutrition and food field in the establishment where they work.
- To take part in the activities for health promotion and disease prevention, at the individual, family and community level; with a comprehensive and multi-professional view of the health-disease process.
- To design, apply and evaluate reagents, methods and clinical analytical techniques, knowing the basis of clinical analysis and the characteristic and contents of the laboratory diagnostic reports.

Particular abilities:

- To know and understand the basis of clinical analysis and the characteristic and contents of the laboratory diagnostic reports.
- To evaluate the effects of substances with pharmacological activity.
- To know and understand the techniques used in the design and evaluation of preclinical and clinical trials.
- To acquire the necessary skills to give therapeutic advice on pharmacotherapy and dietotherapy as well as nutrition and food advice to the users of the establishment where they work.
- To know and understand the properties and mechanisms of action of drugs.
- To know and understand the structure and function of the human body, as well as the general mechanisms of disease, molecular, structural and functional disorders, syndromic expression and therapeutic tools for health recovery.
- To know the analytical techniques related to laboratory diagnostic, toxic substances, foods and environment.

OBJECTIVES (EXPRESSED IN TERMS OF EXPECTED RESULTS OF THE TEACHING PROGRAMME)

- To know the elements, cells and organs of the Immune System.
- To know and understand the types of immune response and the effector and regulatory mechanisms involved in them.
- To know the mechanisms involved in the most common diseases of the Immune System.
- To know the main drugs which modulate the immune response and the role of Immunology in pharmaceutical research and development.
- To learn the basic immunological techniques used in research and diagnostic laboratories.

DETAILED SUBJECT SYLLABUS



THEORETICAL LECTURES:

1. Introduction to Immunology. Components and characteristics of the Immune System. Types of immune response. Features of the innate and adaptive immune responses. Concepts of clonal selection, clonal expansion and memory in the immune response.
2. Hematopoiesis. Hematopoietic stem cells. Hematopoietic regulation by apoptosis. Hematopoietic differentiation.
3. Organs of the Immune System. Structure and function of the primary and secondary lymphoid organs. Germinal centers. Lymphocyte homing and recirculation.
4. Immunogenicity and antigenicity. Antigens. Epitopes. Antigenic peptides. Haptens. Adjuvants.
5. Immunoglobulin structure. Variable, hypervariable and constant regions. Isotypes. Three-dimensional structure of immunoglobulins.
6. Biological properties of immunoglobulins. Functions. Opsonization. Transcytosis. Fc receptors.
7. Molecular genetics of immunoglobulins. Recombination and recombinases. Generation of antibody diversity.
8. Differentiation and maturation of B lymphocytes. Expression and regulation of immunoglobulin genes during B-cell development in the bone marrow. B-cell selection.
9. Monoclonal antibodies. Production. Diagnosis and therapeutic applications.
10. The major histocompatibility complex. Classes of HLA molecules. Structure of HLA antigens. Genetic organization of MHC. HLA polymorphism.
11. Antigen processing and presentation. MHC class I and MHC class II antigen presentation. Cytosolic and endocytic pathways. Antigen-presenting cells. MHC restriction.
12. The T-cell receptor (TCR). Structure of the TCR/CD3 complex. TCR α/β and TCR γ/δ . Organization and rearrangement of the T-cell receptor genes. Generation of TCR diversity.
13. Differentiation and maturation of T lymphocytes in the thymus. Generation of central tolerance. Positive and negative selection.
14. T-cell activation. Intracellular signaling pathways activated by the TCR. Accessory molecules and co-stimulatory signals. Superantigens.
15. B-cell activation. The B-cell receptor (BCR) and the B-cell co-receptor. B-cell response to thymus-dependent and thymus-independent antigens. Changes in the structure and function of antibodies during the immune response.
16. Cytokines. General features and biological properties. Cytokine receptors. Th1, Th2 and Th17 cytokines: generation and function.
17. Mechanisms of immunosuppression. Generation of peripheral tolerance. Types of regulatory T cells. Anergy.
18. The complement system I. Three pathways of complement activation: the alternative pathway, the lectin pathway and the classical pathway.
19. The complement system II. Regulation of the complement system. Effector functions of complement. Complement deficiencies.
20. The inflammatory response I. Phases of inflammation. The inflammatory focus. First stage of the inflammatory response. Mast cells and basophils. Inflammatory mediators.
21. The inflammatory response II. Immune cells migration in inflammation. Chemokines: structure and function. Chemokine receptors. Interaction between leukocytes and endothelial cells. Adhesion molecules: structure and function. Neutrophils and macrophages.
22. The inflammatory response III. Acute-phase proteins. Pro-inflammatory cytokines. Chronic inflammation. Mechanisms regulating inflammation and tissue repair.
23. Effector mechanisms of cell-mediated immunity. Characteristic of effector and memory T cells. Mechanism of cytotoxicity. Cytotoxic T lymphocytes (CTL).
24. NK cells. The lytic function of NK cells. NK cell receptors. Signaling mechanisms of activating and



- inhibitory receptors. Antibody-dependent cell-mediated cytotoxicity (ADCC).
25. Receptors of the innate immune system. Pathogen-associated molecular patterns. Pattern recognition receptors: endocytic and signaling receptors. The TLR family: structure and function.
 26. Integration of innate and adaptive immune responses. The immune response against pathogens.
 27. Vaccines. Passive and active immunization. Types of vaccines.
 28. Hypersensitivity reactions. Types. Immediate or type I hypersensitivity. Type II (antibody-mediated) hypersensitivity. Immune complex-mediated type III hypersensitivity. Delay (Type IV) hypersensitivity. Diseases associated with hypersensitivity reactions.
 29. Autoimmunity. Mechanisms of autoimmunity. Factors involved in the development of autoimmunity. Autoimmune diseases. Therapy of autoimmune diseases. Therapy for autoimmune diseases. Features
 30. Primary immunodeficiencies. Types. Features. X-linked and autosomal primary immunodeficiencies.
 31. Acquired immunodeficiencies. Acquire immune deficiency syndrome. Mechanisms of HIV replication and destruction of the immune system. Immune response against HIV. HIV therapeutic and prevention strategies.
 32. Transplants. Strategies and requirements for transplantation of tissues and organs. Transplant rejection. Types of rejection. Graft-versus-host disease. Transplant immunopharmacology.
 33. Cancer and immune system. Tumor antigens. Mechanisms responsible for tumor evasion. Cancer immunotherapy.
 34. Immunological diagnostic techniques. Precipitation and agglutination reactions. Radioimmunoassay (RIA). Enzyme-linked immunosorbent assay (ELISA). Immunoprecipitation. Immunotransfer technique. Immunofluorescence and immunohistochemistry. HLA typing.

PRACTICAL CLASSES:

- Identification of lymphoid organs and extraction of lymphocytes. Phagocytosis assay with peritoneal macrophages.
- Protein immunodetection. Dot-blotting.
- Flow cytometry. Detection of membrane antigen.

READING

BASIC BIBLIOGRAPHY:

- A.K. Abbas, A.H. Lichtman and S. Pillai. *Cellular and Molecular Immunology*, 9th ed. Elsevier, 2017. (*)
- A.K. Abbas, A.H. Lichtman and S. Pillai. *Basic Immunology: Functions and Disorders of the Immune System*, 5th ed. Saunders, 2015. (*)
- H. Chapel, M. Haeney, S. Misbah and N. Snowden. *Essentials of Clinical Immunology*, 6th ed. Wiley Blackwell, 2014.
- J.E. Coligan. *Short protocols in Immunology*. John Wiley & Sons, 2005.
- J.M. Cruse and R.E. Lewis, *Illustrated Dictionary of Immunology*, 3rd ed. CRC Press, 2009.
- P.J. Delves, S. Martin, D. Burton and I. Roitt. *Roitt's Essential Immunology*, 13th ed. Wiley-Blackwell, 2017. (*)
- A.H. Lichtman, R. Malhotra, and V. Taqueti. *Review of Immunology*. W.B. Saunders Co., Philadelphia, 2005.
- D. Male, J. Brostoff, D. Roth and I. Roitt. *Immunology*, 8th ed. Saunders, 2012. (*)
- T.W. Mak and M.E. Saunders. *The Immune Response: Basic and Clinical Principles*. Elsevier Academic Press, 2006.
- K.P. Murphy and C. Weaver. *Janeway's Immunobiology*, 9th ed. Garland Science, 2016. (*)
- J.A Owen, J. Punt and S.A. Stranford. *Kuby Immunology*, 7th ed. Freeman 2013. (*)



- P. Parham. *The Immune System*, 4th ed. Garland Science, 2014. (*)
- W. E. Paul. *Fundamental Immunology*, 7th ed. Lippincott Williams & Wilkins, Philadelphia, 2012.
- A. Rabson, I. Roitt and P. Delves. *Really Essential Medical Immunology*, 2nd ed. Blackwell Publishing, Oxford, 2004.
- H.D. Zane. *Immunology: Theoretical & Practical Concepts in Laboratory Medicine*. W.B. Saunders Co, Philadelphia, 2001.

(*) Recommended

COMPLEMENTARY BIBLIOGRAPHY:

- Cell
- Current Opinion in Immunology
- Immunity
- Immunological Reviews
- Nature Immunology
- The Journal of Immunology
- Trends in Immunology

RECOMMENDED INTERNET LINKS

http://www.cellsalive.com/toc_immun.htm
<http://www.bioinf.org.uk/abs/>
<http://www.complement-genetics.uni-mainz.de/>
<http://stke.sciencemag.org/>
http://www.rndsystems.com/research_topic.aspx?r=4
<http://www.nature.com/ni/multimedia/index.html>
<http://www.immunology.utoronto.ca/immunology-videos>

