ETS Ingeniería Agronómica, Alimentaria y de Biosistemas	
Program	20BT– Degree in Biotechnology

Course number and name	
Number	20504321
Name	Immunology
Semester	S1 [(September-January)], 3rd Year

Credits and contact hours	
ECTS Credits	6
Contact hours	72

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Specific course information

Description of course content

Functional bases of the immune system. Antigens, antibodies and diagnostic techniques. Maturation, activation and regulation of lymphocytes. Immune response to infectious diseases. Pathology of the immune system; Immunology and industry.

List of topics to be covered

I. The immune system

1. Introduction to the immune system. Innate and adaptive immunity. Recognition and receptors: keys to immunity. Evolution of immune responses. Cells involved in immunity: hematopoietic system.
2. Ethology of immunity. Comparison of the evolution of the innate and adaptive immune systems. Summarize the antigen-independent and antigen-dependent development of T and B cells. Identify the role of the thymus and bone marrow as important central organs of the developing immune system. Describe the organization and function of the immune organs. Explain the importance and mechanism of lymphocyte recirculation. Summarize the ontogeny of the adaptive immune system and its clinical applications.

II. Molecular basis of the immune response

3. Innate immunity. The early defense against aggression. Overview of innate immunity. Recognition of microbes and damaged self by the innate immune system. Pattern recognition receptors associated with innate immune cells and sensors. Cellular components of the innate immune system. Soluble effector molecules of innate immunity. The inflammatory response .The antiviral response. Stimulation of adaptive immunity. Mechanisms to stop the innate response.

4. Antigen capture and presentation to lymphocytes. Properties of antigens recognized by lymphocytes Antigen capture and the functions of APC. General properties of antigen-presenting cells Role of dendritic cells in antigen capture and display .Functions of other antigen-presenting cells The major histocompatibility complex .Discovery of the major histocompatibility complex genes. Structure of MHC molecules. Binding of peptides to MHC molecules. Processing of protein antigens. The MHC class I pathway. The MHC class II pathway. Cross-presentation. Physiological significance of MHC-associated antigen presentation. Presentation of non-protein antigens to T cells .
5. Activation and differentiation of T-lymphocytes . Overview of T-lymphocyte activation . Signals for T-lymphocyte activation. Functional T-lymphocyte responses. Downregulation of T-cell responses.
6. Overview of CD4+ T-cell-mediated immune responses. Subsets of CD4+ effector T cells. Th1 cells. Th2 cells. Th17 cells. Functions of other T-cell subsets. Differentiation of CD8+ T-cells into cytotoxic T-lymphocytes. Role of CD8+ CTLs in defence.
7 . B-lymphocyte activation and antibody production. Overview of humoral immune responses. Antigen recognition and antigen-induced B-cell activation. T helper cell-dependent antibody responses to antigens. Protein-dependent antibody responses to antigens. Antibody responses to t-independent antigens.
8. Humoral response. Overview of humoral immunity. Neutralization of microbes and microbial toxins. Antibody mediated opsonisation and phagocytosis. The complement system. Neonatal immunity.
9. Mucosal immune system and privileged tissues. General features of epithelial barrier immunity. Immunity in the gastrointestinal system. Immunity in other mucous membranes Cutaneous immune system. Privileged tissues.

III. Immune response
10. Immunological tolerance and autoimmunity. General characteristics of tolerance. T-lymphocyte tolerance. B-lymphocyte tolerance. Tolerance to commensal microbes and foreign antigens. Mechanisms of autoimmunity.
11. Congenital and acquired immunodeficiencies. General features of immunodeficiency. Primary or congenital immunodeficiencies. Secondary or acquired immunodeficiencies. Acquired immunodeficiency syndrome.
12.Immune response to microbes. Immunity against extracellular bacteria. Immunity against intracellular bacteria. Immunity against fungi .Immunity against viruses. Immunity to parasites.
13. Transplantation immunity. General characteristics of transplantation immunity. Adaptive response to transplantation. Patterns and mechanisms of transplant rejection. Prevention of transplantation. Xenogeneic transplantation. Blood transfusions. Bone marrow transplantation.
14. Immunity to tumors. Tumor antigens. Immune response to tumors. Evasion of the immune system by tumors. Immunotherapy against tumors.
15. Comparative immunity.

Recommended requisites or co-requisites

- Metabolism and its Regulation
- Molecular genetics and regulation of gene expression
- Genetics
- Cell Biology and Histology

Course category in the program

Mandatory	

Specific for course objectives

Specific learning outcomes

RA134 - Know the bases of the immune reaction, with special attention to humoral immunity
RA132 - Know the applications of immunology to the diagnosis of diseases
RA133 - Know the fundamental concepts of cellular immunity, autoimmunity and reactions of hypersensitivity, at an elementary level.
RA129 - Know the molecular bases of diseases caused by transmissible agents, deficiencies of the immune system and defects of molecular structures
RA131 - Know the applications of immunology to the prevention and treatment of diseases.

Further reading and supplementary materials

Molecular and cellular immunology. 10 ed. A.K. Abbas, A.H. Lichtman y S. Pillai. 2021. Elsevier. ISBN: 9788480863117
Janeway's Immunobiology. 9th edition. Authors: Kenner M, and Weaver C
Immunology (Roitt) 9 ed David Male (Autor), Jonathan Brostoff (Autor), David Roth (Autor), Ivan Roitt (Autor), David Male MA PhD

Teaching methodology

lectures	problem solving sessions	collaborative actions	laboratory sessions
Other:			

Evaluation Criteria

The marks for the students follow a progressive evaluation made up of:
1- Evaluation of the Thematic Units developed in the classroom. These will be evaluated by performing two exams that will include theory questions of the topics developed in each unit. The first exam will be of an eliminatory nature for those students who pass the mark of 5. The weight of these exams in their set represents 80% of the overall rating. To carry out the summative evaluation at the end of the course they must obtain a minimum of 5 out of 10 in each of the thematic units.
2- Evaluation of the laboratory practices that will consist of the evaluation of the practice report, written individually in English with an original article format. The sum of these qualifications represents 15% of the overall qualification and attendance at practices is compulsory. Failure to attend one or more practices will lead to failure of the subject. In case of failing the subject, the practical qualification will be kept for future calls for new enrollment.
3- Evaluation of multiple choice tests. Two tests will be carried out with a weight of 5% of the total evaluation.
The global evaluation of the students is obtained from the weighting of the results obtained in each and every one of these activities.