UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Immunology

2627-2-E0202Q051

Aims

The course aims at providing the basic concepts on the organization and functioning of the immune system. Students attending Immunology teaching are expected to achieve the following goals:
Knowledge and understanding. Knowledge on the bases of innate and adaptive immunity, the mechanisms underlying inflammation, the generation of antigen-receptor diversity, the activation of T and B lymphocytes, the structure and function of antibodies. Knowledge on the basic concepts and principles concerning vaccination.
Applying knowledge and understanding. Students will be able to understand the key role of the immune system in different pathologies and the importance of immunology, also through history.
Making judgments. Students will be able to link the different topics, judge the resolved and unresolved aspects concerning the complexity of the immune system, highlight the shortcomings of current knowledge on the functioning of the immune system.
Critical thinking and judgment skills are developed during the lectures through guided discussions, case analyses, and problem-solving activities proposed by the instructor in class.
Communication skills. Students will be able to effectively describe the contents of the course, in both written and oral form, using the most appropriate technical terms.
Learning skills. Students will be able to consult scientific texts regarding the topics covered and integrate the knowledge acquired with the contents of other scientific disciplines (i.e. cellular and molecular biology, biochemistry etc).

Contents

1) General features of the immune system
2) The antigen
3) The B cell antigen receptor (BCR)
4) The T cell antigen receptor (TCR)
5) The major hystocompatibility complex (MHC)
6) The process of antigen presentation

7) T and B lymphocyte activation
8) Cytokines and their receptors
9) Pattern Recognition Receptors
10) cells of the innate immunity: myeloid cells and lymphoid cells
11) Complement
12) The inflammatory process
13) Effector mechanisms of humoral immunity
14) Effector mechanisms of cell-mediated immunity
15) Tolerance
16) Autoimmunty
17) Vaccines
18) Monoclonal antibodies

Detailed program

1: General characteristics of the immune system
Description : Innate and adaptive immunity; Organization of the immune system, general cahracteristics of organs, tissues and cells of the immune system. Primary and secondary lymphoid organs. Distribution and circulation of the cells of the immune system .

2: The antigen
Description: Concept of antigen, immunogen, antigenic detrminat or epitope, carrier, aptene.

3: The B cell antigen receptor (BCR)
Description: Immunoglobulins. structure nad function of antibodiese and of the BCR. The generation of repertoire diversity. Isotypes and idiotypes. Biological functions of immunoglobulins classes and subclasses. Cellular distribution of FC receptors . Cellular functions ediated by antibodies. monoclonal antibodies. Concept, methodology, applications.

4: The T cell receptor (TCR)
Description: organization, rearrangements and expression of TCR and coreceptors; biochemical structure of the TCR; generation of the repertoire diversity

5: The major histocompatibility complex (MHC)
Description: Genic organizationa and polymorphisms. Molecular structure and classification of MHC di class I and II molecules. The groove fro antigen binding. MHC di class I and II in antigen presentation. The ternary complex, MHC-peptide-TCR

6: Antigen presentation
Description: Antigen recognition by T and B cells. Extracellular and intracellular antigen processing.

7: Professional antigen presenting cells
Description: Dendritic cells

8: B and T cell activation.
Description: Signal transduction. Adhesion molecules and costimulatory molecules for T cell activation.

9: Cytokines and their receptors.
Description: Origine and molecular structure. Mechanism of action and target cells.Role of cytokine in leukocytes differentiation. Role of cytokines in Th1, Th2 and Th17 cell differentiation.

10: Interazioni microrganismi-ospite

Description: Pattern recognition receptor and Danger theory. PAMPs and DAMPs

11: The complement system
Description: Mecahnism of complement activation, functions of the complement

12: The inflammatory process
Description: Activation of inflammation, leukocyte recruitment, the role of inflammation in response to infection, from inflammation to the activation of adaptive immunity

13: Effector mechanisms of humoral immunity.
Description: T and B cell cooperation. Plasmacells. Isotype switch, hypermutation and affinity maturation. Kinetic of primary and secondary response

14: Effector nechanisms of cell-mediated immunity
Description: macrophage activation. Cytotoxic T lymphocytes and cell killing, effector mechanisms of t helper cells and NK cells

15: Immunological memory
Description: memory of T cells; memory of B cells

16: Vaccines
Description: active and passive vaccination, prophylactic vaccines, therapeutic vaccines, adjuvants

Prerequisites

Background: none
Specific prerequisites: none.
General prerequisites: Students can take the exams of the second year after passing the examinations of Introductory biology, General and inorganic chemistry, Mathematics, and Foreign Language.

Teaching form

All teaching activities are carried out in an expository (lecturing) mode.

The course includes 24 in-person frontal lectures, each lasting 2 hours, for a total of 48 hours.

The final two hours of the course are delivered in an interactive format. During these sessions, students engage in discussions, problem-solving activities, and group exercises.

The course is taught in Italian.

A 1-CFU module concerning the actin cytoskeleton of dendritic cells, its remodeling during maturation, and the processes of phagocytosis, pinocytosis and macropinocytosis in dendritic cells and macrophages, is co-taught with Dr. Metello Innocenti, expert in cell biology and cytoskeleton.

Textbook and teaching resource

The teaching materials consist of slide decks and recorded lectures available on the e-learning platform..

Recommended textbooks:
- Immunobiology from Janeway
- Cellular and Molecular Immunology from Abul Abbas e Andrew Lichtman

Semester

First semester

Assessment method

The final examination consists of an individual oral exam. No midterm tests are foreseen.

The exam includes two to five questions, depending on the student's level of preparation, covering all topics presented during the course.

The exam aims to assess:

- Knowledge and understanding of the mechanisms of innate and adaptive immunity;
- The ability to apply such knowledge to biological and pathological contexts;
- The ability to critically connect the various course topics;
- The use of appropriate scientific terminology and clarity in communication;
- Independent learning skills, including interdisciplinary integration.

Evaluation criteria include:

- Accuracy and completeness of answers;
- Logical connections between topics;
- Correct use of scientific language;
- Clarity and organization of discourse;
- Critical thinking and independent judgment.

The final grade, expressed in thirtieths, reflects the overall level of mastery demonstrated by the student with respect to the criteria above.

Office hours

Contact: on demand, upon request by mail to lecturer

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | QUALITY EDUCATION