UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

# COURSE SYLLABUS

# Applied Immunology

**2425-1-F0802Q055**

## Aims

The aim of the course is to provide knowledge of the functioning of the immune system in different pathological contexts and at specific moments in the life of an individual.

Specifically, particular attention will be paid to the dysfunctions of the immune system that lead to chronic pathological contexts, such as auto-inflammatory diseases, tumors, autoimmune diseases and some diseases associated with infection, such as COVID19, in which the immune system is dysfunctional.

The course will provide the very latest knowledge relating to neuroimmunology and immune system dysfunctions in neuropathological contexts.

We will also discuss how dysfunctional immunological responses can be manipulated through the development of targeted therapies.

The basis for understanding the changes that accompany the immune system during the aging of individuals will be provided and recent theories in this field such as 'tissue tolerance' will be explained. Moreover, the immunological changes that occur during pregnancy, a particular stage of life, will also be discussed

Speaking of immunometabolism, it will also be understood how some cellular processes support immune functions and how their alteration can lead to pathologies.

The general objective is the acquisition of in-depth knowledge of the immune system in various pathological and non-pathological contexts.

## Contents

**Synthetic contents**

- Current methodologies for the advanced study of immunology and rare populations of immune cells: scRNAseq, multiplexed imaging, spatial transcriptomics
- Rare populations of immune cells: subpopulations of DCs and neutrophils, unconventional T cells.
- New theories on inflammation and new concepts of inflammation.
- Alterations in the mechanisms of resolving the inflammatory process and chronic inflammation.
- Examples of chronic inflammations.
- Tumor immunology and immunotherapies.
- Neuroimmunology (AD, Parkinson's, MS).
- Immunity during pregnancy.
- Immunity during aging and aging of the immune system.
- Tissue resistance and tolerance.
- Theory of "trained immunity".
- Immunometabolism

## Detailed program

**Lectures program**

Lesson 1: Introduction to the course

Lesson 2: scRNAseq, spatial transcriptomics

Lesson 3: Multiplexed imaging

Lesson 4: Subpopulations of neutrophils and DCs

Lesson 5: Unconventional T cells

Lesson 6: New theories on inflammation and new concepts of inflammation

Lesson 7: Alterations in the mechanisms of resolving the inflammatory process and chronic inflammation

Lesson 8: Examples of chronic inflammations

Lesson 9: Tumor immunology I

Lesson 10: Tumor immunology II

Lesson 11: Immunotherapies and new generations of vaccines

Lesson 12: Neuroinflammation and neuroimmunology

Lesson 13: Neuroinflammation in neurodegenerative diseases: AD, PD, MS

Lesson 14: Immunity and tolerance during pregnancy

Lesson 15: Immunity during aging and aging of the immune system

Lesson 16: Theory of "trained immunity"

Lesson 17: Concepts of tissue resistance and tolerance

Lesson 18: Immunometabolism

Lesson 19: Student presentations of scientific articles and class discussion

Lesson 20: Student presentations of scientific articles and class discussion

Lesson 21: Student presentations of scientific articles and class discussion

## Prerequisites

The knowledge of the basic mechanisms of functioning of the immune system is required.

## Teaching form

All lessons will be held in person.
A video recording will be provided for each lesson.
The following will be conducted:

18 lessons of 2 hours each in a didactic mode, where the concepts related to the topics will be explained.
6 lessons of 2 hours each in an integrative mode, where a group of students will present a scientific article related to one of the course topics and another group will ask questions and moderate a scientific discussion involving the entire class.

## Textbook and teaching resource

Slides from the instructor, original articles provided by the instructor (in English), review articles for further study provided by the instructor (in English).
For those who need to review the basic concepts of immunology, the following reference texts are recommended: ImmunoBiology, The Immune System in Health and Disease by Janeway, Travers (latest English edition or the latest edition of the Italian translation, Piccin).

## Semester

First semester

## Assessment method

Students will be assessed through an oral exam, which will consist of a discussion on the topics covered in the lessons.
For students who choose to participate in the scientific seminars (discussion of the scientific article or moderation of

the discussion on scientific articles), these seminars will count as their interim assessment.

## Office hours

Reception hours ON APPOINTMENT to be requested by email:

VENERDI 9:30-11:30

## Sustainable Development Goals