UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

# COURSE SYLLABUS

# Pathology and Immunology 1

**2021-2-H4101D255-H4101D173M**

## Aims

To introduce the student to the knowledge of etio-pathogenesis of human diseases, the students will be able to understand the fundamental pathophysiological mechanisms of diseases. Topics for in-depth knowledge on the molecular mechanisms underlying the pathogenesis of diseases and the identification of potential diagnostic and therapeutic targets will be developed and on immune responce.

## Contents

**GENERAL PATHOLOGY**

- **Molecular Pathology**

- **Cellular Pathology**

**IMMUNOLOGY AND IMMUNO-PATHOLOGY**

## Detailed program

- **General Pathology.** Etiology. Pathogenesis. Homeostasis and disease. Onset and course of diseases. Acute and chronic diseases. Physiological and pathological predisposing factors.

- **Causes of diseases I. Extrinsic causes of disease.** Physical: radiation, electricity, atmospheric pressure, heat. Chemicals: Toxic substances of natural origin, organic solvents, metals, drugs. Biological: bacteria, viruses, protozoa, fungi, metazoans. Virulence. Pathogenicity. Transmission of infections. Spread of infectious agents.

- **Intrinsic causes of disease I.** Classification of genetic diseases. Monogenic diseases. Genotype-phenotype correlations. Molecular pathology: mutations from gain and loss of function. Examples of diseases.

- **Intrinsic causes of disease II.** Exceptions to Mendelian heredity: triplet diseases and mitochondrial diseases. Examples of diseases.

- **Intrinsic causes of disease III.** Defects from genomic imprinting and pathological implications. Examples of diseases.

- **Intrinsic causes of disease IV.** Oligogenic and multifactorial inheritance.

- **Cell response to damage. Reversible damage.** Activation of protective mechanisms: expression of inducible stress genes. Adaptation. Hypertrophy, Hyperplasia, Hypotrophy, Hypoplasia, Metaplasia, Dysplasia. Hypoxia damage. Damage from ischemia. Damage from ischemia / reperfusion.

- **Cell response to damage. Irreversible damage.** Cell death: necrosis and apoptosis. Neoplastic transformation.

- **Tissue response to damage. Inflammation I.** Cardinal signs of inflammation. Patway of inflammation. Cells involved in inflammation. Cell migration: Chemotaxis, adhesion molecules. Chemical mediators of inflammation: histamine, serotonin, interleukins and cytokines, prostaglandins, leukotrienes, permeability factors and proteases.

- **Complement.** Activation, classical way and alternative way. Opsonization. Membrane attachment complex (MAC).

- **Inflammation II.** Acute inflammation: I. serosa, I. serofibrinosa, I. catarrhal, I. purulent, I. hemorrhagic. Chronic inflammation. Granuloma.

- **Tissue repair.** Tissue cleansing. Granulation tissue. Evolution: *Restitutio ad integrum*, Cicatrizzazione. Wound Repair

- **Acute inflammation. Burns**

- **Chronic inflammation.**

- **Arteriosclerosis and Atherosclerosis**

- **Systemic effects of inflammation.** Acute phase proteins. Fever: general information, temperature measurement. Physiopathology of thermo-regulation: thermogenesis: basal metabolism, regulation of thermogenesis, thermodispersion. Alterations of body temperature. Non-febrile hyperthermia: sun-stroke, heat-stroke. Febrile hyperthermia: pathogenesis of fever, exogenous pyrogens and endogenous pyrogens, course of fever. types of fever.

- **Immune response.** General properties of the immune system. Innate immunity and acquired immunity. Cells of the immune system. Soluble mediators. Antigens. The immune response. Inflammation. Defense mechanisms against intra- and extra-cellular pathogens. Humoral immunity. Cell-mediated immunity.

- **Cells, tissues and organs of the immune system.** Cells of innate immunity, phagocytes: Neutrophils, Basophils, Eosinophils, Monocytes and Macrophages; Platelets, Natural Killer Cells. Cells of acquired immunity:

Antigen Presenting cells; T lymphocytes - differentiation, activation and functions, B lymphocytes - differentiation, activation and functions. Primary lymphoid organs and tissues: Bone marrow; Thymus. Secondary lymphoid organs and tissues: Lymph nodes, Spleen, Lymphoid tissue of the mucous membranes (MALT). Leukocyte traffic.

- **Antibodies and antibody response**. Structure and functions. Antigen-Antibody Interaction. Fc receptor. Antibody response. Generation of antibody diversity. The cooperation of cells in the antibody response.

- **Major Histocompatibility Complex I and II** (MHC I and MHC II) and Antigen Presentation. T Cell Receptor: structure and functions. MHC I and II: gene organization and expression; structure and function; interaction with the antigen. Antigen presentation. Costimulatory molecules. Cell-mediated cytotoxicity.

- **Regulation of the immune response.** Role of antigens, antibodies, lymphocytes, NK cells. Idiotypical modulation. Neuroendocrine modulation. Genetic control.

- **Tolerance.** Experimental induction of tolerance. Thymic tolerance to self antigens. Selection and Development of T Cells. Peripheral tolerance to self antigens. Privileged sites. Role of T cells and Dendritics. Tolerance of B Cells to self antigens.

- **Hypersensitivity reactions. Type I hypersensitivity reactions.** IgE. Allergens. Role of Cellue T, Mastcellulas and Basophils. Genetics of allergies. Type II hypersensitivity reactions. Mechanism of damage. Reactions against blood cells. ABO system. Reactions against tissue antigens.

- **Delayed hypersensitivity reactions. Type III hypersensitivity reactions**. Immune complex diseases. Formation, persistence and deposition of complexes in tissues. Hypersensitivity reactions Type IV. Contact hypersensitivity. Cellular reactions. Granulomas.

- **Autoimmunity.** Genetic factors. Etiology and Pathogenesis of autoimmune diseases.

- **Immune response in infectious diseases**. Immunity to viruses, bacteria and fungi. Evasion of immune defenses. LPS action mechanism.

- **Immunodeficiency** - Primary

- **Immunodeficiency** - Acquired

- **Transplant immunology**. Immunological barriers to transplantation. Histocompatibility antigens. Rejection. Role of lymphocytes in rejection. Prevention of rejection. Principles of immunosuppressive therapy.

- **Molecular medicine and personalized medicine.**

- **Molecular pathology.** Molecular pathology of proteins. Enzymatic defects. Alteration of hemostasis: hemophilia, von Willenbrant disease, Glanzmann thrombo-asthenia. Pathology of cell receptors, ion channels: cystic fibrosis; of signal transduction mechanisms. Pathology of connective tissue. A1anti-trypsin deficiency.

- **Cellular pathology.** Steatosis, Amyloidosis, turbid swelling and vacuolar degeneration. Tesaurismosi. Lipidosis. Gangliosidosis. Glycogen storage disease. Mucopolysaccharidosis. Mucolipidosis.

## Prerequisites

Knowledge of the introductory courses indicated in the regulation of the degree course

## Teaching form

Lectures and exercises

During the COVID-19 outbreak, the lectures will be recorded and delivered syncronized with the timetable

## Textbook and teaching resource

- Robbins e Cotran: Le Basi Patologiche delle Malattie. Edizione. Elsevier

- Pontieri-Russo-Frati: Patologia Generale. Edizione. Piccin.

- Abbas A.K.: Fondamenti di Immunologia. Funzioni e alterazioni del Sistema Immunitario. Piccin

## Semester

II semester II year

## Assessment method

The evaluation will be carried out through a multiple choice test focused on the topics of Immunology and immuno-pathology (60 questions) and an oral examination. The interview will evaluate the degree of knowledge achieved by the student. Questions will be asked about all the fundamental part of the program.

During the COVID-19 outbreak, the multiple choice test will be delivered remotly using the PROCTORING platform control

During the COVID-19 outbreak, the interview will be done remotly using the webex platform

## Office hours

By appointment