UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Molecular Medicine

2526-1-F0902D002

Aims

The course aims to provide students with the fundamental concepts of molecular and translational medicine, with a particular focus on related biotechnological applications.

Knowledge and understanding - At the end of the course, the student will have acquired knowledge and understanding of the molecular and cellular mechanisms underlying human pathologies, with particular attention to the structural and functional alterations of the extracellular matrix, storage pathologies, dysfunctions of cellular organelles and genetic and molecular defects affecting transporters, receptors and inhibitors. Furthermore, the student will understand the physiopathological processes related to organ pathologies (kidney, pancreas, and hemostasis), the mechanisms of the intestinal immune response and related pathologies, as well as the role of the microbiome in regulating the immune system. Likewise, the student will acquire knowledge and understanding of the molecular bases of oncogenesis, the role of the tumor microenvironment, the principles of leukemia pathogenesis, and models for studying drug resistance.

Applying knowledge and understanding: Upon completing the course, student will be able to recognize the pathogenetic mechanisms underlying various pathologies and assess their impact on responses to treatments. She/he will also be able to analyze the impact of molecular alterations on cellular and tissue functioning and recognize the usefulness and importance of using advanced biotechnological methods in the study and treatment of organ, immune, and oncological pathologies.

Making judgments -Through the critical discussion of molecular and experimental models, the student will integrate knowledge related to organ physiopathology, mucosal immunity, and oncogenesis, developing the ability to evaluate experimental data and recognize the clinical implications of molecular alterations.

Communication skills - At the end of the course, the student will have gained the ability to clearly explain, with appropriate terminology and scientific rigor, the topics covered during the course.

Learning skills - By the end of the course, students will have received the tools to continue learning and updating autonomously, thanks to constant reference to models, translational approaches, and scientific literature regarding

the covered topics.

Contents

Cellular and organelle pathology. Extra-cellular matrix pathology. Physiopathology and pathology: pathology of blood coagulation, of glicemic control, of the kidney. Molecular mechanisms of the diseases: molecular mechanisms and pathways (tumors and other relevant diseases). Advanced biotechnological techniques and in vitro and in vivo model to study pathogenetic processes at cellular and organism level. Molecular mechanism of Innate Immunity, immunity of Mucosal Districts and mechanisms of regulation of immunity response. Diseases of gut immunity system. Models to study the pathogenetic mechanism involved in neoplastic transformation, in tumor progression and in mechanisms of drug resistance.

Detailed program

CELLULAR AND MOLECULAR PATHOLOGY: Extracellular matrix pathology (amyloidosis, prion disease, collagenopathies, elastopathies, fibrosis). Intracellular accumulations (metabolic disorders-thesaurismosis, steatosis). Organelles pathology (lysosomal disease, mitochondrial diseaes). Cystic fibrosis. Hemoglobin diseases (sickle cell anemia, thalassemia). Membrane receptors pathologies (familial hypercholesterolemia). Alpha 1-antitrypsin deficiency. DISEASES OF ORGAN SYSTEMS. Red blood cells and bleeding disorders. The kidney (glomerulopathies and tubulopathies, polycystic kidney disease). Diabetes. PHYSIOPATHOLOGY OF IMMUNE SYSTEM AND PATHOLOGY OF IMMUNE RESPONSE: General characteristics of the immune responses of epithelial barriers. Immune System in the Gastrointestinal Tract. Innate and adaptive immunity of the gastrointestinal tract. Control of immunity in the gastrointestinal tract by regulatory T cells and cytokines. Role of the commensal microbiome in the regulation of the immune system. Diseases related to the immune responses of the intestine. GENERAL AND TRANSLATIONAL ONCOLOGY: Pathogenic mechanisms involved in neoplastic transformation and their effects on regulating cell populations and related models. The role of the microenvironment (stromal cells, soluble factors, extracellular matrix, and hypoxia) in tumor progression with related study models. Morphological aspects and molecular mechanisms of programmed cell death (p53, Bcl2 family, IAPs, caspases, death receptors). Models for the study of drug resistance. Metronomic chemotherapy as a new therapeutic approach in tumors. The fundamental principles of the pathogenesis of different types of leukemia are genetic and molecular factors that influence the development of the disease and resistance to therapies.

Prerequisites

Knowledge in the field of genetic and cell biology, biochemistry, human histology and anatomy.

Teaching form

Course with different teaching activities:
27 frontal lessons of 2 hours in attendance
4 frontal practical sessions of 2 hours in attendance
3 seminars of 2 hours in attendance

Textbook and teaching resource

1. Robbins e Cotran, LE BASI PATOLOGICHE DELLE MALATTIE, 10 edizione, Edra
2. Moncharmont, PATOLOGIA GENERALE, 2019, Edizioni IDELSON-GNOCCHI
3. Pardi e Di Fiore, PATOGENESI, 2023, PICCIN
4. Abate-Shen C., Politi K., Chodosh L.A., Olive K.P. MOUSE MODELS OF CANCER. A LABORATORY MANUAL. 2014, Cold Spring Harbor Laboratory Press.
5. Abul K. Abbas. IMMUNOLOGIA CELLULARE E MOLECOLARE IX Edizione Edra
6. Infection, Immune Homeostasis and Immune Privilege, Joan Stein-Streilein Editor Springer1.
7. Review and selected papers will be discussed and provided to the students during the course.

Semester

First Year, First Semester

Assessment method

No “in itinere” tests.
Oral discussion about different topics belonging to the classroom lessons (teachers’ choice) to evaluate scientific communication skills and the ability to establish scientific links among different topics.

Office hours

Available on request by email at:
cristina.bianchi@unimib.it
maria.foti@unimib.it
mariagrazia.cerrito@unimib.it
jolanda.sarno@unimib.it

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | QUALITY EDUCATION