DEGREE IN BIOMEDICAL LABORATORY TECHNIQUES

Course: Clinical Biochemistry and immunology
SSD**: BIOS-09/A, MEDS-02/B, MEDS-26/A**
Course coordinator: **Alessandra Rufini** e-mail **:** alessandra.rufini@unicamillus.org
Number of CFU: **6**

MODULO: **Biochimica di laboratorio / Laboratory Biochemistry**
SSD: **BIOS-09/A**
Professor: **Verena Damiani** e-mail : verena.damiani@unicamillus.org
Numero di CFU: **2**

MODULO: **Patologia Generale (Immunologia-Fisiopatologia) /General Pathology (Immunology-Physiopathology)**
SSD: **MEDS-02/B**
Professor: **Alessandra Rufini** e-mail : alessandra.rufini@unicamillus.org
Numero di CFU: **3**

MODULO: **Scienze Tecniche di Medicina di laboratorio / Technical sciences of laboratory medicine**
SSD: **MEDS-26/A**
Professor: **Felicia Carotenuto** e-mail **:** felicia.carotenuto@unicamillus.org
Numero di CFU: **1**

LEARNING OBJECTIVES
The student must learn the general characteristics of antigens, antibodies, cytokines and cells, tissues and organs of the immune system; the mechanisms of regulation of central and peripheral tolerance; the components and molecular mechanisms of innate and adaptive immune responses. Furthermore, the student must learn the causes of human diseases, interpreting the fundamental pathogenetic and pathophysiological mechanisms. The basic principles of the organization of the analysis laboratory are essential goals. Furthermore, the basis for quality in the laboratory will be provided and the UNI EN ISO 9001/15 Certification and Accreditation UNI EN ISO 15189 will be described.
In addition, the teaching aims to provide the theoretical and practical bases of the main techniques for manipulating cell cultures and their applications in the biomedical field. Therefore, the primary objectives will be the learning of the methods of preparation and maintenance of cell cultures, the control of the correct chemical-physical parameters in culture and the cryopreservation procedures of the cells, the main techniques of analysis of cellular response in vitro with particular reference to the immunofluorescence method. Students will also have to acquire knowledge on the main applications of cell cultures in the biomedical field, with specific attention to the field of regenerative medicine.
These objectives will be achieved through lectures and interactive educational activities designed to facilitate learning and improve the ability to deal with and resolve the main diagnostic questions from the clinical biochemistry laboratory, the main questions of immunology, physiopathology and of cell culture laboratory protocols employed in clinic and in research.

LEARNING OUTCOMES
Knowledge and understanding

At the end of the course, the student will have to recognize and autonomously understand the basic concepts of immunology, the molecular mechanisms of the activation of the immune response, and the pathogenetic and pathophysiological mechanisms of the most important human diseases. The student will also need to know and explain the organization of the clinical biochemistry laboratory, understand the techniques used in the laboratory and the quality processes applied.
In addition, the student must be able to:

- understand the meaning and the difference between "in vivo" and "in vitro" experiments
- know the principles on which the cell isolation protocols are based
- be able to describe the main differences between primary cultures and continuous lines
- know how to expand the adherent cell culture and the suspension cell culture
- describe a growth curve of a cell culture
- know the cell counting procedure
- know the methods of maintenance and control of the chemical-physical parameters of a cell culture
- know sterility conditions during cell manipulation
- detect the main problems of contamination of a cell culture
- know the cell cryopreservation methods and the usefulness of cell banks
- know the main cell analysis protocols
- know the main applications of cell cultures and their importance in the clinical field and in basic research

Applying knowledge and understanding
At the end of the course, the student will be able to use the acquired knowledge for an in-depth study of aspects relating to the specific field in which the student will devote himself to his professional activity.
The student must be able to apply his/her knowledge to analyze and understand the alterations of the cellular and immunological mechanisms underlying the human pathologies; must have the basics of laboratory quality notions to obtain a reliable data, to which the student will dedicate himself in his professional activity.

Communication skills
At the end of the course, the student must be able to use specific scientific terminology appropriately. The student must be able to communicate information, ideas, problems and solutions to expert and other interlocutors, in relation to cellular and molecular mechanisms of the activation of the immune response, to the pathogenetic and pathophysiological mechanisms of the most important human diseases and to the main laboratory techniques illustrated during the lessons.

Making Judgements
At the end of the course the student must be able to make general assessments related to the topics covered. The student must be able to use the acquired knowledge to identify and explain the cellular, molecular, immunological, and pathophysiological mechanisms that lead to a disease. The acquisition of autonomy of judgement will be acquired through the analysis of examples of damage and human diseases. In addition, the student must know the principles and techniques for determining the main biochemistry and cell culture study tests and the basics of laboratory quality. Finally, the student must be able to give its own interpretation of the laboratory protocols illustrated during the lessons.

PREREQUISITES

Although there are no preparatory courses, basic knowledge of cellular biology, histology, biochemistry, chemistry, anatomy and physiology is required.

COURSE SYLLABUS

BIOS-09/A **Laboratory Biochemistry:**

- Organization of clinical analysis laboratory;
- Biological, pre-analytical and analytical variability; specificity and sensitivity; discriminating value (ROC curve); predictive value and analytical reporting.
- Quality in the laboratory; the pre-analytical, analytical and post-analytical phase. UNI EN ISO 9001/15 certification and UNI EN ISO 15189 accreditation
- Separation techniques by centrifugation: sedimentation principles. Centrifuges and ultracentrifuges. Subcellular fractionation.
- Principles and applications of spectrophotometry, turbidimetry, nephelometry, fluorimetry, chemiluminescence.
- Principles and applications of radioimmunoassays.
- Principles and applications of chromatography, HPLC.
- Protein electrophoresis and Western blot. Nucleic acid electrophoresis.

MEDS-02/B **General pathology (Immunology-Physiopathology)**:

- General features of the immune response. Innate and acquired immunity. Cellular and tissue components of the immune system. Cytokines.
- Antigens and antibodies. Antigenic recognition and lymphocyte activation. Major Histocompatibility complex (MHC). Processing and presentation of antigen to T lymphocytes. Regulation of the immune response. Effector mechanisms of the cell-mediated and humoral immune responses. Immune tolerance.
- Immunopathogenic reactions: autoimmunity, hypersensitivity disorders, allergy.
- Hemostasis disorders.
- Hemodynamic disorders. Thrombosis, embolism. Infarction. Shock. Hypertension, atherosclerosis.
- Heart pathophysiology.
- Red blood cell disorders.
- Endocrine system pathophysiology. General mechanisms of hormonal hypofunction and hyperfunction.

MEDS-26/A **Technical sciences of laboratory medicine**:

- Cell cultures, examples, and fields of application.
- Primary cultures: isolation and preparation procedures.
- Subcultures of cells in suspension and in adhesion.
- Culture methods of continuous cell lines.
- Evolution of a cell line. Growth curve and duplication time.
- Cell passages in vitro. Cell adhesion.
- Maintenance of cultured cells. Cell culture media, solutions and containers for cell cultures. Control and maintenance of chemical-physical parameters.
- Cell counting. Cell storage methods, freezing and thawing. Cryopreservation and cellular banks.
- Work area and equipment for the cell culture laboratory.

- Prevention of cell contamination and sterility conditions.
- Principal techniques for analyzing cultured cells: cell viability, direct and indirect immunofluorescence.
- Applications of cell cultures in the biomedical field with particular focus on regenerative medicine.

COURSE STRUCTURE

The course consists of frontal lectures, divided in 20 hours of Laboratory Biochemistry, 30 hours of General Pathology and 10 hours of Technical sciences of laboratory medicine. The lecturers will include teaching tools such as presentations organised in PowerPoint files with explanatory diagrams, illustrations, and images to describe the topics. Films and animations will be used to supplement the processes described in class. There may be ongoing tests for the different modules. Attendance is mandatory.

COURSE GRADE DETERMINATION

The final evaluation will take place on the exam dates scheduled by the University and published on the website, in written and/or oral form.

The examination consists of a written test of Laboratory Biochemistry a: 15/30 questions (multiple choice); each correct question is assigned a maximum score of 2; each answer not given or wrong is assigned a value of 0.

The oral test for General Pathology and the oral test for Laboratory Medicine Technical Sciences consist of interviews to give the student the opportunity to demonstrate his/her preparation by discussing the course topics, to discuss issues relating to immunology and pathology and to show that he/she has acquired the ability to make connections and express himself/herself in an appropriate scientific language.

The final assessment will be the result of a weighted average between the results of the General Pathology test, the Laboratory Biochemistry test and the Laboratory Medicine Technical Sciences test.

The exam will be overall evaluated according to the following criteria:

Unsuitable: Major deficiencies in subject knowledge and understanding; limited capacity for analysis and synthesis, frequent generalisations.

18-20: just sufficient knowledge and understanding of the topics with possible imperfections; ability to analyze synthesis and independent judgment sufficient.

21-23: knowledge and understanding of routine topics; correct analysis and synthesis skills with coherent logical argumentation.

24-26: good knowledge and understanding of the topics; good analytical and synthesis skills with rigorously expressed arguments.

27-29: complete knowledge and understanding of the topics; remarkable skills of analysis, synthesis. Good autonomy of judgment.

30-30L: excellent level of knowledge and understanding of the topics. Remarkable capacity for analysis and synthesis and independent judgement. Arguments expressed in an original way.

OPTIONAL ACTIVITIES

In addition to the teaching activity, it will be given to the student the opportunity to participate in any ECM courses relevant to the topics covered. The ECM topics will be not subject of examination. It is mandatory a frequency of 100% to achieve proficiency.

READING MATERIALS

BIOS-09/A Laboratory Biochemistry:

-Slides and didactic materials provided by the teacher.

MEDS-02/B General Pathology (Immunology-Physiopathology):

-Slides and didactic materials provided by the teacher.

-Textbooks:

Le basi dell'immunologia; 5° Edizione; Abbas AK, Lichtman AH, Pillai S; Edra; ISBN: 9788821442551; 2017

Robbins, Fondamenti di Patologia e di Fisiopatologia; 9° Edizione; Kumar V, Abbass AK, Aster JC; Edra; ISBN: 9788821440458; 2013

MEDS-26/A Technical sciences of laboratory medicine:

-Didactic materials provided by the teacher.