

Degree in Biomedical Laboratory Techniques

Integrated course: Clinical Biochemistry and Immunology

SSD Integrated course: **BIO/12, MED/04, MED/46**

CFU: **6**

Course coordinator: **Monica Benvenuto** e-mail: monica.benvenuto@unicamillus.org

MODULE: **Laboratory Biochemistry**

SSD: **BIO/12**

CFU: **2**

Teacher: **Massimo Pieri** e-mail: massimo.pieri@unicamillus.org

MODULE: **General Pathology (Immunology-Physiopathology)**

SSD: **MED/04**

CFU: **3**

Teacher: **Monica Benvenuto** e-mail: monica.benvenuto@unicamillus.org

MODULE: **Technical sciences of laboratory medicine**

SSD: **MED/46**

CFU: **1**

Teacher: **Felicia Carotenuto** e-mail: felicia.carotenuto@unicamillus.org

ATTENDANCE MODE: MANDATORY WITH AT LEAST 75% OF FREQUENCY OF THE INTEGRATED COURSE

PREREQUISITES

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

LEARNING OBJECTIVES

The course of Clinical Biochemistry and Immunology aims to provide students with the basic notions of clinical biochemistry, immunology and physiopathology, also in the field of laboratory diagnosis. 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.

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.

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 ones diagnostic questions from the clinical biochemistry laboratory, the main questions of immunology, physiopathology and of laboratory protocols employed in clinic and in research.

LEARNING OUTCOMES

The expected learning outcomes are consistent with the general provisions of the Bologna Process and the specific provisions of Directive 2005/36/EC. They are found within the European Qualifications Framework (Dublin descriptors) as follows:

Knowledge and understanding

At the end of the course, the student will have to:

- Know, understand and explain the basic concepts of immunology and the molecular mechanisms of the activation of the immune response
- Know, understand and explain the pathogenetic and pathophysiological mechanisms of the most important human diseases
- Know and explain the organization of the clinical biochemistry laboratory and understand the techniques used in the laboratory
- Understand the meaning and the difference between "in vivo" and "in vitro" experiments
- Know the principles on which the cell isolation protocols are based
- 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
- Apply his/her knowledge to analyze and understand the alterations of the cellular and immunological mechanisms underlying the human pathologies
- 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

- Communicate information, ideas, problems and solutions to expert and others interlocutors, in relation to the 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
- Use the acquired knowledge to identify and explain the 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.
- Know the principles and techniques for determining the main biochemistry tests and the basics of laboratory quality and must be able to give its own interpretation of the laboratory protocols illustrated during the lessons.

COURSE SYLLABUS

BIO/12 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.

MED/04 General pathology (Immunology-Physiopathology):

Immunology

- General features of the immune response. Natural and acquired immunity. Cellular and tissue components of the immune system. Immune tolerance
- 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 immune response. Cytokines
- Immunopathogenic reactions

Physiopathology

- Hemostasis disorders
- Hemodynamic disorders. Thrombosis, embolism. Infarction. Shock. Hypertension, atherosclerosis
- Heart physiopathology
- Red blood cell disorders
- Liver physiopathology

- Kidney physiopathology
- Endocrine system physiopathology. General mechanisms of hormonal hypofunction and hyperfunction.

MED/46 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 reference to the field of regenerative medicine.

COURSE STRUCTURE

BIO/12: The module is structured in 20 hours of frontal teaching, divided into lessons of 2 or 3 hours according to the academic calendar. The lesson will include theoretical lessons with video projections on the topics covered.

MED/04: The module is structured in 30 hours of frontal teaching, divided into lessons of 2 hours according to the academic calendar. During the lessons will be shown slides containing topics of the program that will allow students to achieve the educational objectives.

MED/46: The module is structured in 10 hours of frontal teaching, divided into lessons of 2 hours based on the academic calendar. The frontal teaching will include theoretical lessons and interactive teaching on the topics covered.

COURSE GRADE DETERMINATION

The exam of the Integrated course of Clinical Biochemistry and Immunology consists of a test of LABORATORY BIOCHEMISTRY, a test of GENERAL PATHOLOGY (IMMUNOLOGY AND PHYSIOPATHOLOGY), and one of TECHNICAL SCIENCES OF BIOMEDICAL LABORATORY, whose marks form an integral part of the integrated teaching evaluation.

The student can take the test of LABORATORY BIOCHEMISTRY, GENERAL PATHOLOGY (IMMUNOLOGY AND PHYSIOPATHOLOGY) or TECHNICAL SCIENCES OF BIOMEDICAL LABORATORY in a single session or in different sessions of the current academic year according to the methods listed below.

The judgment will be expressed in a mark out of thirty, obtained from the weighted average according to the CFU between the marks of the individual modules.

- For the module Laboratory Biochemistry (BIO/12), the verification of the preparation of the students will take place with a written exam followed by an oral exam. The written test will consist of questions with multiple choice answers. To access the oral exam the student must have totaled at least a minimum of 18/30 points. During the oral exam the Examining Commission will assess the student's knowledge and the skills learned during the course. In the evaluation, knowledge and understanding skills have a weight equal to 40%, applied knowledge and understanding skills of 40% and autonomy of judgment of 20%.

- For the module General Pathology (Immunology-Physiopathology) (MED/04), the exam consists of an oral test. The student will have to answer questions in order to demonstrate the acquisition of the knowledge and skills described in the educational objectives.

The exam mark, expressed in 30/30, is established according to the following criteria:

- o Not allow to pass the test: important shortcomings and/or inaccuracy in the knowledge and understanding of the topics; limited analysis and synthesis skills, frequent generalizations
- o 18-20: Just enough knowledge and understanding of the topics
- o 21-23: Knowledge and discreet understanding of the topics
- o 24-26: Good knowledge and understanding of the topics
- o 27-29: Full knowledge and understanding of the topics
- o 30-30L: Excellent level of knowledge and understanding of the topics.

In the evaluation, knowledge and understanding skills have a weight equal to 40%, applied knowledge and understanding skills of 40% and autonomy of judgment of 20%.

- For the module Technical sciences of laboratory medicine (MED/46), the verification of the preparation of the students will take place with a written exam followed by an oral exam. The written test will consist of 8 questions with multiple choice answers and 2 open questions, for each correct answer three points will be awarded. The final score of the written test will be given by the sum of the partial scores assigned to each question answered correctly. To access the oral exam the student must have totaled at least a minimum of 18 points. During the written test the examining commission will assess the student's ability to apply the knowledge and will ensure that the skills are adequate to solve the main questions of biomedical laboratory techniques for cell cultures. During the eventual oral examination the Evaluation Committee will verify the student's knowledge on the topics covered during the lessons.

In the evaluation, knowledge and understanding skills have a weight equal to 40%, applied knowledge and understanding skills of 40% and autonomy of judgment of 20%.

OPTIONAL ACTIVITIES

BIO/12: 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.

MED/04 and MED/46: Not planned.

READING MATERIALS

BIO/12 Laboratory Biochemistry:

-Slides and didactic materials provided by the teacher.

MED/04 General Pathology (Immunology-Physiopathology):

-Slides and didactic materials provided by the teacher.

-Textbook:

Abul Abbas, Andrew H. Lichtman, Shiv Pillai, Basic Immunology, 6th Edition, Elsevier; ISBN: 9780323549431; 2019



Ivan Damjanov MD PhD, Pathology for the Health Professions, 5th Edition, Elsevier; ISBN : 9780323357210; 2016.

MED/46 Technical sciences of laboratory medicine:

-Didactic materials provided by the teacher.

COURSE COORDINATOR AVAILABILITY

Office hours by appointment, by e-mail:

Prof. Monica Benvenuto

e-mail: monica.benvenuto@unicamillus.org