

## Degree in Biomedical Laboratory Techniques

### Course: Clinical Biochemistry and immunology

SSD: BIO/12, MED/04, MED/46

CFU : 6

Coordinator: **Monica Benvenuto**

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MODULE : **Laboratory Biochemistry**

SSD: BIO/12

CFU: 2

Professor: **Massimo Pieri**

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

SSD: MED/04

CFU: 3

Professor: **Monica Benvenuto**

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MODULE : **Technical sciences of laboratory medicine**

SSD: MED/46

CFU: 1

Professor: **Felicia Carotenuto**

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## PREREQUISITES

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

## LEARNING OBJECTIVES

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

### 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 and understand the techniques used in the laboratory.

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 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. The student must be able to 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. In addition, the student must 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

**These expected learning outcomes are measurable with the final assessment**

## **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: autoimmunity, hypersensitivity disorders, allergy.

#### Physiopathology

- 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.

### **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 reference to the field of regenerative medicine.

## COURSE STRUCTURE

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

**MED/04:** The course 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 course is structured in 10 hours of frontal teaching, divided into lessons of 2 hours according to the academic calendar. The frontal teaching will include theoretical lessons and interactive teaching on the topics covered.

## COURSE GRADE DETERMINATION

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

Written test: 15/30 questions (multiple choice); for each correct answer a maximum score of 1 is assigned; each incorrect answer is assigned a value of 0.

The oral exam consists of an interview lasting about 20 minutes per student. The knowledge and ability to understand, the ability to apply knowledge and understanding, the autonomy of judgment, and the communication skills of the student will weigh in the final score as follows 30%, 30%, 30% and 10%, respectively.

### **The evaluation criteria are as follows:**

Not suitable: Poor or lacking knowledge and understanding of the topics; limited capacity for analysis and synthesis, frequent generalizations of the requested contents; inability to use technical language.

18-20: Just sufficient knowledge and understanding of the topics, with obvious imperfections; just sufficient capacity for analysis, synthesis and autonomy of judgment; poor ability to use technical language.

21-23: Sufficient knowledge and understanding of the topics; sufficient ability to analyze and synthesize with the ability to reason with logic and coherence the required contents; sufficient ability to use technical language.

24-26: Fair knowledge and understanding of the topics; discrete ability to analyze and synthesize with the ability to rigorously argue the required contents; good ability to use technical language.



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27-29: Good knowledge and understanding of the required contents; good ability to analyze and synthesize with the ability to rigorously argue the required contents; good usability

30-30L: Excellent level of knowledge and understanding of the required content with an excellent ability to analyze and synthesize with the ability to argue the required content in a rigorous, innovative and original way; excellent ability to use technical language

### **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**

#### 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.

-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, Abbas AK, Aster JC; Edra; ISBN: 9788821440458 ; 2013

#### MED/46 Technical sciences of laboratory medicine:

-Didactic materials provided by the teacher.

### **PROFESSORS AVAILABILITY**

Office hours are scheduled by appointment, calling or writing the following addresses :

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