

## Degree Course in Biomedical Laboratory Techniques

### Integrated Teaching: General and Clinical Pathology

SSD: MED/04, MED/05, MED/46

CFU: 7

Integrated Teaching Coordinator: [Cristina Capuano](#)

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### MODULE: General and Cellular Pathology

SSD: MED/04

CFU: 2

Teacher: [Cristina Capuano](#)

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### MODULE: Clinical Pathology and Immunohematology

SSD: MED/05

CFU: 3

Teacher: [Anna Claudia Romeo](#)

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### MODULE: Technical Sciences of Laboratory Medicine

SSD: MED/46

CFU: 2

Teacher: [Maria Domenica Divona](#)

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## PREREQUISITES

Basic knowledge of Biology, Molecular Biology and Genetics, Anatomy, Physiology, General and Applied Biochemistry, Physics and Statistics, Immunology, and Microbiology is required.

## LEARNING OBJECTIVES

The integrated teaching of General and Clinical Pathology aims to provide the student with the fundamentals for knowledge and understanding of the pathogenetic mechanisms of diseases and the analytical procedures used in laboratory diagnosis.

- The General and Cellular Pathology module will provide the student with the main notions of the molecular and cellular mechanisms underlying homeostatic alterations, the response to cell and tissue damage, and the molecular basis of neoplastic transformation and progression.
- The Clinical Pathology and Immunohaematology module will provide the student with the fundamentals of the main laboratory methods applicable to the qualitative and quantitative analysis of pathogenetic determinants and significant biological processes in medicine. Acquisition of the ability to correctly apply the methodologies to detect clinical, functional, and laboratory findings, interpreting them critically also from a physiopathological point of view, for the purposes of diagnosis and prognosis; ability to assess cost/benefit ratios in the choice of diagnostic procedures, taking into account the requirements of both correct clinical methodology and the principles of evidence-based medicine
- The Technical Sciences of Laboratory Medicine module will provide notions of the main techniques of molecular biology, flow cytometry, and cytogenetics for the diagnosis and monitoring of blood diseases and the relevance of laboratory activities for integrated clinical management of the hematological patient.

By the end of the integrated teaching, the student will have acquired the ability to address the main questions of general and cellular pathology and the basic elements in the clinical diagnosis of the main diseases. By applying the experimental method, the student will be able to analyze and correctly interpret experimental data both in the field of health care and in research and to cooperate in clinical reasoning.

## 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 integrated teaching, the student must be able to :

- Know and understand the molecular and cellular mechanisms underlying homeostatic alterations
- Know and explain the cellular and tissue damage response
- Know and explain the molecular basis of neoplastic transformation and progression
- Understand the main processes in clinical pathology; especially the hematological profile, focusing on the concept of blood transfusion, hemodialysis, transplantation, and GvHD
- Know the pre-analytical, analytical, and post-analytical principles of laboratory techniques.
- Know the standard values of routine blood and urine tests and be able to differentiate physiological and pathological features.
- Recognize the most appropriate indications and diagnostic steps according to the clinical features and interpret laboratory and diagnostic tests as appropriate
- Know and explain the main diagnostic approaches in oncohaematology
- Know and explain the pre-analytical phase in the oncohaematology laboratory
- Know and explain the various techniques of nucleic acid extraction
- Know and explain the techniques for the separation of mononuclear cells
- Know and explain the techniques for cytogenetic analysis
- Know and explain standard and innovative methodologies for the rapid diagnosis of acute leukemia
- Know and explain the principles of PCR-Realtime, the types of probes used
- Know and explain the advantages and disadvantages of diagnostic methodologies in the field of oncohaematology.

### **Ability to apply knowledge and understanding**

At the end of the integrated teaching, the student will be able to :

- Know and explain the main diagnostic approaches in oncohaematology
- Use the knowledge acquired for the autonomous in-depth study of aspects related to the specific field to which the student will devote his/her professional activity
- Apply his/her knowledge to analyzing and understanding the pathogenetic mechanisms underlying diseases
- Apply theoretical knowledge to the clinical and laboratory environment, recognizing the general diagnostic aspects of biochemical, hematological and infectious diseases.
- Understand and comply with laboratory safety rules and procedures, in particular the constant use of aseptic technique and the correct management of biological risks.
- Know the practical aspects of transfusion techniques and how to perform them.
- Evaluate the indications and practical utility of key biochemical values. Provide a differential diagnosis based on specific clinical data.
- Cooperate with other healthcare providers in making decisions regarding diagnosis, treatment, and monitoring of patient's conditions in order to improve clinical outcomes at significantly reduced costs.
- Use the acquired laboratory knowledge for independent investigation of aspects related to the field of oncohaematological diagnostics.

### **Communication skills**

At the end of the integrated teaching, the student must be able to communicate the covered topics by using scientific and technical terminology as appropriate

### **Making Judgements**

At the end of the integrated teaching, the student must be able to:

- Make general assessments related to the topics covered
- Use the acquired knowledge to autonomously identify and explain the molecular and cellular mechanisms underlying different human pathologies
- Achieve autonomy in the evaluation and interpretation of data, by applying the different diagnostic techniques according to the pathology under investigation
- Recognize the importance of in-depth knowledge of the topics consistent with adequate health

education

### Learning skills

At the end of the integrated teaching, the student will be able to:

- Acquire the appropriate learning methods for in-depth study
- Improve skills in the field of general and clinical pathology by consulting scientific literature, databases, and specialized websites by grasping the fundamental and relevant aspects of his/her professional context

### COURSE SYLLABUS

#### GENERAL AND CELLULAR PATHOLOGY (MED/04)

- BASIC CONCEPTS OF HEALTH AND DISEASE
- CELLULAR HOMEOSTASIS ALTERATION
  - Cellular adaptation: Atrophy, Hypertrophy, Hyperplasia, Metaplasia
  - Damage and cell death: Necrosis, Apoptosis
  - Cellular Aging
- INFLAMMATION
  - Causes and general features of inflammation
  - Acute Inflammation: vasculo-haematic changes, cellular phase. Inflammatory Exudates. Soluble mediators of inflammation. Outcomes of inflammatory response.
  - Chronic Inflammation: morphologic features (acute vs chronic). Impact of macrophages on chronic inflammation. Chronic Interstitial and granulomatous inflammation. Examples of chronic inflammation diseases.
  - Systemic effects of inflammation: leukocytosis, acute phase protein, reactive protein C, erythrocyte sedimentation velocity, fever, septic shock
- MECHANISMS OF TISSUE DAMAGE REPAIR
  - Regeneration
  - Repair: Scarring and Fibrosis
  - Wound healing: pathologic aspects
- ETHIOPATHOGENETIC CLASSIFICATION OF THE DISEASES
  - Extrinsic agents (physical, chemical, biological)
  - Intrinsic agents (genetic and malformation diseases)
  - Multifactorial diseases
  - Hints of Immunopathology
- TUMORS
  - Biological and clinical classification criteria
  - Biological features: proliferation, invasion, angiogenesis
  - Metastatisation
  - Carcinogenesis, oncogenes and oncosuppressors, tumour marker concept

#### CLINICAL PATHOLOGY AND IMMUNOHEMATOLOGY (MED/05)

- Definition, limits, and aims of Laboratory Medicine.
- Appropriateness in the choice of laboratory investigations
- Pre-analytical, analytical and post-analytical variability, sensitivity and specificity.
- The report, reference intervals.
- Functional evaluation of organs and tissues and general pathophysiological states
  - THE BLOOD: Clinical biochemistry of haemostasis. Functional evaluation of the biochemical mechanisms underlying haemostasis (vascular phase, coagulation, and fibrinolysis). Qualitative-quantitative clinical biochemistry of blood elements. Evaluation of erythrocyte functionality (haemoglobins, iron metabolism, the study of erythrocyte enzymes, and biochemical approach to the study of anaemias). Functional biochemical study of leucocyte populations under normal and pathological conditions. Hints of transfusion medicine
  - THE KIDNEY. Pathophysiological evaluation of the kidney and urinary system. Tests for assessing the renal function at the glomerular and tubular level; endocrine functions of the kidney



- THE LIVER: Biochemical evaluation of the biosynthetic (interpretative criteria of the serum protein and individual protein assay) and detoxifying liver functions and structural integrity indexes. Clinical biochemical study of the major functional and structural alterations. Clinical biochemical contribution to the differential diagnosis in the course of jaundice.
- THE PANCREAS: Functional evaluation (exocrine and endocrine) and structural integrity of the pancreas
- THE THYROID: Pathophysiological evaluation of the thyroid gland and laboratory diagnosis of thyroid diseases: contribution of evaluation of hypothalamus/pituitary axis
- SYSTEMIC DISEASES: Clinical biochemical approach to the study of certain systemic diseases: autoimmune and rheumatological diseases, celiac disease, diabetes mellitus, dyslipidemia
- PREGNANCY: Clinical biochemical evaluation of pregnancy and fetal function; major biochemical changes in pregnancy, under normal and pathological conditions; the amniotic fluid biochemistry

#### TECHNICAL SCIENCES OF LABORATORY MEDICINE (MED/46)

- INTRODUCTION TO INTEGRATED ONCOHEMATOLOGICAL DIAGNOSTICS
  - Flow cytometry techniques
  - Molecular biology
  - Conventional cytogenetics
  - Fluorescent in situ hybridization (FISH)
- ISOLATION OF MONONUCLEAR CELLS FROM BONE MARROW ASPIRATE AND PERIPHERAL BLOOD (Ficoll)
- CELL COUNT BY MEANS OF CELL COUNTING CHAMBERS
- NUCLEIC ACID EXTRACTION TECHNIQUES
  - Automatic Extractor
  - Home Made Techniques
- RT-PCR: BASIC PRINCIPLES AND TECHNICAL ASPECTS
  - PCR application in oncohaematology
  - Real-time PCR: basic principles and technical aspects
  - Application of real-time PCR in the monitoring of minimal residual disease
- Q-LAMP : BASIC PRINCIPLES AND TECHNICAL ASPECTS
  - Application of Q-LAMP in the rapid diagnosis of Acute Promyelocytic Leukemia
  
- ELECTROPHORETIC TECHNIQUES
  - Agarose gel electrophoresis
  - Capillary electrophoresis
- CASE REPORT IN THE VALIDATION OF ANALYTICAL DATA.

#### **COURSE STRUCTURE**

The integrated teaching comprises 70 hours of lectures with mandatory attendance (75%). According to the academic calendar, lessons (2 or 3 hours) will be structured as follows:

- General and Cellular Pathology (MED/04): 20 hours of lectures based on theoretical lessons focused on program topics, and interactive discussions about clinical focus. The teaching materials will be organized in PowerPoint slides supported, when applicable, by didactic videos
- Clinical Pathology and Immunohematology (MED/05): 30 hours of lectures based on theoretical lessons interactive discussions of the covered topics and cooperative learning. Presentations organized in PowerPoint files with explanatory diagrams, illustrations, and images will be used as teaching tools
- Technical Sciences of Laboratory Medicine (MED/46): 20 hours of lectures including theoretical lessons with interactive discussion and supported the projection of videos on the topics covered. The beginning of each lesson will be preceded by a summary of the previous lesson in order to verify the correct understanding by the students.

#### **COURSE GRADE DETERMINATION**

The exam for integrated teaching is structured in a written and oral test. Taking into account the learning objectives, the examining committee will assess the student's ability to apply the acquired knowledge, and if the acquired skills are adequate for the problem-solving of the specific disciplinary areas. The student's

learning, judgment ability, and communication skills will also be evaluated. In the evaluation, knowledge, and understanding have a weight of 50%, knowledge and understanding of 20%, and autonomy of judgment of 30%

**WRITTEN TEST:**

- Clinical Pathology and Immunohematology (MED/05): 30 multiple-choice questions
- Technical Sciences of Laboratory Medicine (MED/46): 30 multiple-choice questions

The exam is passed with 18 correct answers out of 30. 1 point will be assigned for each correct answer, no penalty will be assigned to unanswered questions or incorrect answers. To proceed with the oral exam, the student must have obtained at least a score of 18/30 on the written test of each module

**ORAL EXAM:**

- General and Cellular Pathology (MED/04): it will be focused on questions related to program topics. It will evaluate the student's preparation, the ability to argue and reason on the contents as well as the the ability to explain by using the appropriate scientific terminology

The final assessment will be the result of a weighted average of the results of the tests of each module and the exam can be passed with a score of 18/30. The exam is unique for the entire integrated teaching and it is not possible to take the exam for the individual modules

The exam will be assessed according to the following criteria :

**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 enough 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.

**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 ability to use technical language.

**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 ACTIVITY**

- General and Cellular Pathology (MED/04): not planned
- Clinical Pathology and Immunohematology (MED/05): not planned
- Technical Sciences of Laboratory Medicine (MED/46): not planned

**READING MATERIALS**

General and Cellular Pathology (MED/04):

- Textbook: Ivan Damjanov MD PhD, Pathology for the Health Professions, 5th Edition, Elsevier; ISBN: 9780323357210; 2016.
- Slides and didactic materials will be provided by the teacher



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Clinical Pathology and Immunohematology (MED/05):

- Textbook: Laposata's Laboratory Medicine Diagnosis of Disease in Clinical Laboratory 3rd Edition LANGEC Mc Graw Hill 2018
- Slides and didactic materials will be provided by the teacher

Technical Sciences of Laboratory Medicine (MED/46):

Slides and didactic materials will be provided by the teacher.

**COORDINATOR AVAILABILITY**

Office hours by appointment, by e-mail:

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