Degree Course in Biomedical Laboratory Techniques

Integrated Teaching: General and Clinical Pathology
SSD: MEDS-02/A, MEDS-02/B, MEDS-26/A
Integrated Teaching Coordinator: **Cristina Capuano**   e-mail: cristina.capuano@unicamillus.org
CFU number: 7

MODULE: General and Cellular Pathology
SSD: MEDS-02/A
Teachear: Cristina Capuano   e-mail: cristina.capuano@unicamillus.org
CFU number: 2

MODULE: Clinical Pathology and Immunohematology
SSD: MEDS-02/B
Teacher: Silvia Consalvi   e-mail: silvia.consalvi@unicamillus.org
CFU number: 3

MODULO: Technical Sciences of Laboratory Medicine
SSD: MEDS-26/A
Teacher: Mariadomenica Divona   e-mail: mariadomenica.divona@unicamillus.org
CFU number: 2

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 of knowledge and understanding of the pathogenetic mechanisms of diseases and the analytical procedures used in laboratory diagnosis.

- The General and Cellular Pathology module will give the student 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 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 molecular biology, flow cytometry, and cytogenetics's main techniques for diagnosing and monitoring 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.
- 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 oncohematology 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 limits of diagnostic methodologies in the field of oncohaematology

Applying knowledge and understanding
At the end of the integrated teaching, the student will be able to :
- use the acquired knowledge for the 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 discussed during the course
- 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 to improve clinical outcomes at significantly reduced costs
- know and explain the main diagnostic approaches in oncohaematology

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:
- independently use the acquired knowledge and skills
- independently identify and explain the molecular and cellular mechanisms underlying different human pathologies
- independently evaluate and interpret data, by applying the different diagnostic techniques according to the pathology under investigation
- recognize the impact 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 (MEDS-02/A) (Prof. C. Capuano)

Etiology. Health and Diseases: definitions. Concepts of etiology, pathogenesis, and pathophysiology. Etiologically-based classified diseases: intrinsic, extrinsic, and multifactorial diseases (examples).

Cellular Pathology. Cellular responses to stress and damaging stimuli. Cellular adaptations of growth and differentiation: hyperplasia, hypertrophy, atrophy, metaplasia. Reversible and irreversible cell injury. Mechanisms of cell damage. Irreversible cell damage. Necrosis, types of necrosis. Apoptosis: causes, mechanisms, and examples of apoptosis.

Inflammation. Acute Inflammation: stimuli, vascular changes, and cellular events. Exudate classification. Chemical mediators of inflammation. Outcomes of acute inflammatory response. Chronic Inflammation: causes and morphological features. Interstitial and granulomatous inflammation. Pathogenesis of granuloma. Systemic effects of inflammation: leukocytosis, acute phase proteins, ESR, fever, type of fever, and septic shock.

Mechanisms of tissue repair. Regeneration. Pathogenesis of healing and fibrosis. Wound Healing.

Neoplasia. Biological and clinical classification criteria. Biological characteristics: proliferation, invasion, angiogenesis. Oncogenes and oncosuppressors.

CLINICAL PATHOLOGY AND IMMUNOHEMATOLOGY (MEDS-02/B) (Prof. S. Consalvi)

Introduction to clinical pathology and laboratory tests. Definition, limits, and purposes of Laboratory Medicine. The report, reference intervals. Pre-analytical, analytical, and post-analytical phases. Sensitivity, specificity, accuracy, and precision of laboratory tests.

The Blood. Formed elements of blood. Blood count and related disorders. Micro, normal, and macrocytic anemias. Hemostatic process, hemorrhagic and thrombotic diatheses. The laboratory in the evaluation of hemostatic function. Blood groups. Transfusion medicine.

Markers of inflammation.

Immunological diagnosis of autoimmune diseases.

The Liver. Evaluation of hepatic biosynthetic and detoxifying functions and structural integrity enzymes. Jaundice.

The Kidney. Pathophysiological evaluation of the kidney and urinary system. Tests for the evaluation of renal function at the glomerular and tubular levels. Urine test.

Laboratory diagnosis of Diabetes. Prediabetes, Type I/II Diabetes, Gestational Diabetes. Glycemic blood. Glycemic curve.

Laboratory diagnosis of Dyslipoproteinemias. Lipemia, triglycerides, and cholesterol.

TECHNICAL SCIENCES OF LABORATORY MEDICINES (MEDS-26/A) (Prof. M. Divona)

Introduction to integrated oncohaematology diagnostics. Diagnosis and classification of leukemia. Cytofluorimetric techniques. Molecular biology. Traditional cytogenetics. Fluorescent in situ hybridization (FISH).

Separation of mononuclear cells. Isolation from bone marrow aspirate and peripheral blood (Ficoll). Cell counting by using cell counting chambers

Nucleic Acid extraction. Automatic extraction. Home Made Tecniques.

RT-PCR: basic principles and technical aspects. PCR application in oncohaematology. Real-time PCR basis and application for the monitoring of minimal residual disease.

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:

- 20 hours of lectures for the General and Cellular Pathology module
- 30 hours of lectures for the Clinical Pathology and Immunohematology module
- 20 hours of lectures for the Technical Sciences of Laboratory Medicines module

The integrated teaching includes lectures focused on the covered topics and interactive discussions. During lectures, slides containing issues from the program will be shown to guide students in their study and learning. To achieve the learning objectives, practical examples (in the form of clinical cases) will stimulate and encourage critical discussion of the topic. At the beginning of each lecture, the learning objectives and outcomes will be stated; at the end of the lecture, the lecturer will summarize the key points of the discussed topics to meet the learning outcomes.

COURSE GRADE DETERMINATION

The exam for integrated teaching consists of a written and oral exam.

Written Exam:

- General and Cellular Pathology module: 30 multiple-choice questions
- Clinical Pathology and Immunohematology module: 30 multiple-choice questions
- Technical Sciences of Laboratory Medicines module: 30 multiple-choice questions

For each correct answer (SBA, single Best Answer), 1 point will be assigned. No penalty for unanswered questions or incorrect answers will be assigned. To pass the exam, the student must have obtained at least a score of 18/30 in each module.

Oral exam: the student will be asked to discuss program topics, demonstrating knowledge and skills described in the learning outcomes. Specifically, reasoning, independent judgment, and communication skills will be evaluated following the indications of Dublin descriptors.

The grade will be expressed in a mark out of thirty, obtained from the average (according to the CFU) between the marks of the oral individual modules. The exam includes the entire integrated teaching and it is not allowed to sit the exam for each module.

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 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
Teachers can suggest websites for learning or exercising. To further clarify, the Teachers are available to meet the students through appointments taken by e-mail.

READING MATERIALS
Textbooks for General and Cellular Pathology module:
- Maier JAM: Patologia generale e fisiopatologia, II edizione, McGraw-Hill, 2014
- V.Kumar, A.K. Abbas, J.C. Aster, A.T. Deyrup- Robbins Elementi di Patologia e Fisiopatologia, IV edizione Edra
- Damjanov, Pathology for the Health Professions, 5th Edition, Elsevier; ISBN: 9780323357210; 2016.

Learning materials and suggested specific readings will be provided by the teacher and available on the university's WebApp

Textbooks for Clinical Pathology and Immunohematology module:
- Medicina di laboratorio. Logica e patologia clinica. Elio Gulletta, Italo Antonozzi – Piccin 2019.
- Medicina di laboratorio. La diagnosi di malattia nel laboratorio clinico. Michael Laposata – Piccin 2020.

Learning materials and suggested specific readings will be provided by the teacher and available on the university's WebApp

Technical Sciences of Laboratory Medicines module
Learning materials and suggested specific readings will be provided by the teacher and available on the university's WebApp

COORDINATOR AVAILABILITY
Office hours by appointment, by e-mail:
Professor **Cristina Capuano**
E-mail: **cristina.capuano@unicamillus.org**