Medicine and Surgery degree course

Integrated course : Laboratory Medicine   **8 ECTS**

SDS **BIO/12, MED/05, MED/07, VET/06, MED/16**

(Clinical Pathology; Clinical Biochemistry and Clinical Molecular Biology; Microbiology and Clinical Microbiology; Clinical Parasitology;)

Module: **Clinical Biochemistry and Clinical Molecular Biology**
SSD: **BIO/12**
Number of CFU: **2**
Name professor**: Luisa Pieroni** luisa.pieroni@unicamillus.org
 https://www.unicamillus.org/it/personnel/pieroni-luisa/
Module: **Clinical Pathology**
SSD: **MED/05**
Number of CFU: **2**
Name professors: **Giovanni Barillari** - giovanni.barillari@unicamillus.org
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             Silvia Consalvi - silvia.consalvi@unicamillus.org
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Module: **Microbiology and Clinical Microbiology**
SSD: **MED/07**
Number of CFU: **2**
Name professors: **Carlo Federico Perno** - carlofederico.perno@unicamillus.org
https://www.unicamillus.org/wp-content/uploads/docenti/P/Perno/Perno-cv-ita.pdf
             Cristina Russo - cristina.russo@opbg.net

Module: **Clinical Parasitology**
SSD: **VET/06**
Number of CFU: **1**
Name professor: **Lorenza Putignani** lorenza.putignani@unicamillus.org
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PREREQUISITES
To understand the topics of this course, basic knowledge of chemistry, organic chemistry and biochemistry, as well as, of anatomy, physiology and general pathology is required.
Finally, knowledge of medical microbiology and the basics of immunology are an essential criterion.

LEARNING OBJECTIVES:
The integrated teaching of Laboratory Medicine is aimed at introducing the student to the logic and tools underlying the execution of the diagnostic tests of the Clinical Biochemistry, Clinical Pathology, Clinical Microbiology, Clinical Parasitology. At the end of the integrated teaching, the

student will be able to apply diagnostic tests in the clinical practice, and to interpret and evaluate their results.

LEARNING OUTCOMES

The learning outcomes expected from the integrated teaching of Laboratory Medicine are consistent with the provisions from the Bologna Process and are found within the Dublin descriptors as follows:

Knowledge and understanding:

At the end of the course, the student will demonstrate knowledge and understanding of: the basic principles to interpret laboratory data; sources of pre-analytical and analytical variation; principles of quality control; diagnostic databases and reference values; methodologies for dosing common enzyme markers and their diagnostic value, and also their use as organ biomarkers; water and electrolytes homeostasis; methods and principles for electrolytes dosing in clinical samples; methods and principles for evaluating blood gases; the impact of the acid-base equilibria in the development of pathologies, the main methods and applications of molecular biology and clinical diagnostics, the new developments of omics sciences and their potential clinical application.

The student must: have learned the logic of the clinical use of laboratory tests, the interpretation of their results and their integration into clinical reasoning; knowing how to frame the biological marker in the context of evidence-based medicine; know the methodologies used for counting/ identifying the blood cells and investigating the most common erythocyte, platelet and leukocyte pathologies; have a notion of the mechanisms underlying the haemostatic and fibrinolytic process, as well as the main laboratory investigations used to define the patient's hemorrhagic or thrombotic risk; know the diagnostic tests useful for evaluating the immune response or the presence of an inflammatory state in the patient, and their main clinical indications; have knowledge of laboratory investigations relating to the most common acute or chronic liver diseases; know the most frequently used methodologies to assess kidney function and know how to interpret the results of the macroscopic, microscopic and chemical-physical examination of the urine sample; understand the results of diagnostic tests aimed at determining the level of glucose or the concentration of lipids in the blood, know the reasons behind their pathological changes, and knowing how to correlate the obtained data with the risk of vascular damage ; know the markers employed to highlight the presence of a tumor or monitor its stage of progression; have notions about the typing of blood cells, and the laboratory investigations preparatory to transfusions; being able to identify the conditions in which to apply therapeutic drug monitoring and understanding the results; know the characteristics and applications of laboratory investigations aimed at ascertaining the presence and nature of a voluptuous intoxication; being able to identify and apply laboratory tests useful for monitoring the health status of individuals who perform sporting activities at different levels, disclosing any health risk factors resulting from overexertion and/or trauma.

Upon completion of the module of Clinical Microbiology, students should be able to: 1) know the relevance of an appropriate diagnosis of infections; 2) define the pre-analytical tools essential for a proper collection, storing, transport and assessment of the biological samples to be tested for research, direct or indirect, of microbes ; 3) appreciate the importance of using new and updated technologies for an adequate diagnosis; 4) know the major microorganisms cause of infections in different organs and apparatuses, their interaction with the human body, and how to diagnose them.

At the end of the Clinical Parasitology module, the student will know the main parasites that can infect humans, as well as the techniques used in the diagnosis of parasitic diseases and the correlation between pathogen, clinical course of the disease and treatment.

Applying knowledge and understanding:

The general objective of the integrated course of Laboratory Medicine is the critical learning of the method of dosing biomarkers which are present in human body fluids, as well as their use in the diagnosis of pathological conditions . At the end of the integrated teaching, the student will be able to evaluate the results of a laboratory medicine test, critically using the reference value databases. Starting from the knowledge of the laboratory test and its result, the student will be able to learn how to: determine the presence of a disease or the predisposition to it; confirm the diagnosis already hypothesized through other instrumental methods and/or clinical semeiotics; define the prognosis of the disease; choose the appropriate therapy and monitor its effects.

Communication skills:

At the end of the integrated teaching, the student will be able to explain the laboratory analysis of the patient's specimen by dividing its various phases into logical steps. Ultimately, the student will be able to correlate specific biomarkers, and/or the presence of microbes, with the presence, or with the risk of developing, a disease.

Making judgements:

At the end of the integrated teaching, the student will be able to provide evaluations of the results obtained in a clinical laboratory, and understand the factors which influence laboratory tests.

Learning skills:

At the end of the integrated teaching, the student will acquire skills useful to deepen and expand their knowledge in the field of laboratory medicine, also through the consultation of scientific literature, databases, and specialized websites.

INTEGRATED TEACHING SYLLABUS

Clinical biochemistry and clinical molecular biochemistry

- Definition, limits and aims of Laboratory Medicine and its disciplines: clinical biochemistry and molecular diagnostics, appropriateness of laboratory medicine and diagnostic process
- General organization of the analysis laboratory from the request for analysis to the report: laboratory sectors, use of the laboratory, sources of variability, reference intervals, critical values in the pre-analytical and analytical phases, intra- and inter-individual biological variability, concepts of diagnostic sensitivity and specificity and their applications. Internal and external quality control, interpretation of results. POCT
- Types and collection of clinical sample
- Main analytical techniques and instrumentation in the analysis laboratory and most common analytes.
- Balance of body fluids and electrolytes. Acid-base balance. Conditions associated with abnormal electrolyte composition or acid-base balance
- Molecular Biomarkers: characteristics, definition and interpretation of molecular biomarkers.
- Plasma proteins and enzymes as biomarkers of tissue and organ damage.
- Methods of preparation and analysis of proteins in clinical diagnostics (e.g., protein

electrophoresis, immuno-detection and immunoassays of proteins protein arrays, LC-MS, etc)
- Analytical techniques to discriminate, identify and amplify nucleic acids and examples of clinical application: agarose gel electrophoresis, PCR, gene sequencing (Sanger method), hybridization (southern blot, northern blot, in situ hybridization, etc. .), recombinant DNA and microarray, molecular diagnostic tests (genetic and oncological diseases)
- Genome editing and concept of gene therapy in clinical application
- Introduction to omics sciences and the holistic approach, concepts of Genome, Transcriptome and Proteome
- Human Genome Project and genome annotations
- Next Generation Sequencing and clinical applications of gene sequencing
- Transcriptomics, RNA sequencing
- Proteome analysis and clinical applications

Clinical Pathology

- Clinical value of the laboratory
- Injury and function markers
- Blood count test
- Markers of inflammation and immune reactions
- Coagulation and pathologies of the coagulation system
- Diagnostics of anemias
- Liver function tests and jaundice
- Glycemia
- Lipemia
- Renal function tests and urinalysis
- Immunohematology and transfusion medicine.

Clinical Microbiology

- Principles of medical microbiology and immunology
- Basic principles of microbiological diagnosis.
- Knowledge of laboratory tests used for the purpose of microbiological diagnosis.
- Definition of sample appropriateness and pre-analytical protocols
- Biological specimens suitable for microbiological diagnosis: Collection and storage of biological specimens for diagnostic purposes; Interpretation of microbiological test results.
- Elements of Microbiological Diagnostics: direct and indirect testing, microbial isolation, Principles, purpose and interpretation of antibiotic susceptibility testing
- Elements of Virological Diagnostics: direct and indirect tests, viral isolation. Meaning and proper
- Fungal Identification Methods and Strategies
- Main etiological agents and modern diagnostics in central nervous system infections, with emphasis on the diagnostic aspect on CSF. Samples used, methods of collection, storage. Interpretation of results.
- Main etiologic agents and modern diagnostics of upper and lower respiratory tract infections. Samples used, mode of sampling, preservation. Interpretation of results.

- Main etiological agents and modern diagnostics of gastrointestinal infections and Food Toxins: Samples used, sampling methods, storage. Interpretation of results
- Main etiologic agents and modern diagnostics of urinary tract infections: specimens used, collection methods, storage. Interpretation of results
- Infections in pregnancy : diagnosis of maternal-fetal infection. Main etiologic agents and modern diagnostics ; spécimens used, mode of collection, storage. Interpretation of results.
- Sexually transmitted infections ; main etiologic agents and modern diagnostics ; specimens collection and storage. Interpretation of results
- Diagnosis of HIV and hepatitis virus infection.
- Hospital infections : main etiological agents and modern diagnostics; microbiological control of hospital infections
- Systemic infections and sepsis - State of the art, values and limitations of Hemoculture. The new frontiers of molecular diagnosis of sepsis
- Pathologies, diagnosis and treatment of diseases caused by Tuberculous and NON-Tuberculous Mycobacteria
- Infections in the immunocompromised patient : pathogenic and opportunistic etiologic agents, the importance of quantitative molecular diagnostic strategy. Selection of biological specimens addressed for diagnosis and follow-up. Interpretation of results

Clinical Parasitology

- Concepts of ecology applied to parasitism;
- General clinical parasitology principles regarding transmission routes, zoonosis, anthropozoonosis;
- Medically important Parasites belonging to Nematodes and Cestodes. Laboratory diagnosis of parasitic diseases, clinical symptoms and treatment

COURSE STRUCTURE
The course is divided into lectures, and seminars, embedded in the programmed course dates, the latter dedicated to deepen some specific topics of each different module, that deserve particular attention, update, and/or definition. During the course the teacher will dedicate the lessons to specific topics and arguments, present in the programme, that require more attention, update in respect to what is present in the advised textbooks. <u>Therefore, it is underlined that the topics and matters to be brought at the exams is entirely the one described in the programme, independent of whether it has been discussed at lessons.</u> The teachers use didactic tools such as powerpoint presentation with explanatory diagrams, illustrations and images to describe the pathologies. Attendance is mandatory.

COURSE GRADE DETERMINATION

The exam consists in a written exam with multiple-choice questions. A point will be assigned for each correct answer. No penalties for wrong answers will be assigned

In peculiar conditions (i.e. result of the written exams on the edge of sufficiency, or desire of the student to improve the mark taken at the written exam, etc) there will be an oral exam, following the written one, in which the student is given the opportunity to show his preparation discussing the course topics, and his elaboration skills on the thematics dealt demonstrating the acquisition of expressive capacity with a suitable scientific language. Hence, the whole examination will be evaluated as it follows:

➢ Insufficient: severe poor knowledge of the subject, very limited skill in the analysis of specific items.

➢ 18-20: knowledge of the subjects of sufficient quality characterized by frequent imperfections. Analysis and reasoning skills of sufficient quality.

➢ 21-23: standard knowledge of the specific subject; analysis and reasoning skill of acceptable quality.

➢ 24-26: good knowledge of the subjects and good analysis and reasoning skills; arguments are expressed in a rigorous way.

➢ 27-29: very good knowledge of the specific scientific subjects, valid analysis and reasoning skills, significant skill in making judgements.

➢ 30-30L: outstanding knowledge of the specific knowledge of the scientific tasks. Exceptional analysis, reasoning and making judgments skills.

RECOMMENDED TEXTBOOKS

- **Clinical Pathology**:
  Laposata M, McCaffrey P. *Clinical Laboratory Methods: Atlas of Commonly Performed Tests*. Mc Graw Hill 2022

- **Clinical Biochemistry and Clinical Molecular Biology**:
- Michael J. Murphy & Rajeev Srivastava & Kevin Deans "Clinical Biochemistry", Sixth Edition , Elsevier
- Michael M. Cox, Jennifer Doudna, Michael O'Donnell. "Molecular Biology: Principles and Practice"; W H Freeman & Co; 2 edition

or
- Nader Rifai, Rossa W.K. Chiu. Ian Young, Carey-Ann D.Burnham, Carl T. Wittwer "Tietz Textbook of Laboratory Medicine." (7th Edition). Elsevier Health Sciences (US), Available from: VitalSource Bookshelf
- Materiale didattico integrativo fornito dal docente sottoforma di articoli scientifici e fonti telematiche appropriate, per completare approfondire ed aggiornare i contenuti trattati a lezione.

- **Clinical Microbiology**
  Oxford handbook - "Infectious diseases and microbiology" – E Torok, E. Moran, F Cooke Second edition

  Clinical Microbiology, Murray, Rosenthal, Pfaller, 8 Edition,

  For consultation :

Wolters Kluwer – "Color atlas and textbook of Diagnostic Microbiology" – GW Procop, DL Church, GS Hall, WM Janda, EW Konemar, PC Schreckenberger, GL Wood – Seventh Edition

Harrison's Principle of Internal Medicine, latest edition (eventualmente per consultazione)

Textbooks for parasitology can be the same as those proposed for Clinical Microbiology