

Degree Course in Dentistry and Dental Prosthetics 2022/2023

Integrated Course: Molecular biology and clinical pathology

CFU Number: 6

Course coordinator: Prof. Luisa Pieroni; e-mail: luisa.pieroni@unicamillus.org

Module: Molecular biology

SSD: BIO/11

CFU Number: 2

Professor: Prof. Emiliano Maiani; e-mail: emiliano.maiani@unicamillus.org

Module: Clinical pathology

SSD: MED/05

CFU Number: 2

Professor: Prof. Silvia Consalvi; e-mail: silvia.consalvi@unicamillus.org

Module: Clinical molecular biology

SSD: BIO/12

CFU Number: 2

Professor: Prof. Luisa Pieroni; e-mail: luisa.pieroni@unicamillus.org

PREREQUISITES

Student must be aware of fundamental concepts of the Biology and Genetics, Physiology, Biochemistry and Pathology courses.

LEARNING OBJECTIVES

The integrated teaching of Molecular Biology and Clinical Pathology will provide the student with the fundamentals of Molecular Biology and Pathology and will allow the student to translate the basic knowledge acquired into clinical diagnostic applications. The main methodologies used in molecular, biochemical, and cellular diagnostics will be presented, and the conceptual approaches according to which they have been developed will be explained.

Different types of tests based on the determination of DNA, RNA, proteins, or metabolites will be introduced and discussed to identify specific pathophysiological states and the main disease markers that measurable in a clinical laboratory will be studied.

At the end of the course the student will have acquired the basic elements in the clinical diagnosis of the main pathologies, will be able to use laboratory procedures by applying the experimental method, analyze and correctly interpret experimental data both in the healthcare field and in research and cooperate in clinical reasoning.

LEARNING OUTCOMES

The learning outcomes expected from the integrated teaching Molecular Biology and Clinical Pathology 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 this teaching, the student will acquire:

- Knowledge of the molecular basis of biological processes of eucaryotic cells and microorganisms.
- Knowledge of the molecular regulation mechanisms of genome replication and expression.
- Knowledge of the structure and function of nucleic acids and proteins.
- Knowledge of the fundamental molecular techniques and applications for diagnostic and study purpose.
- Knowledge of specific diagnostic test, and interval references.
- Knowledge of appropriate test for specific pathology.

Applying knowledge and understanding

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

- Understand the molecular basis of human diseases.
- Understand medical approaches to molecular medicine and translational research.
- Understand application of molecular techniques for diagnostic and research purpose.
- Understand test significance (reference values) and proper application in specific pathological conditions.
- Apply proper test to develop a diagnostic hypothesis, define prognosis and plan a therapeutic intervention.
- Apply the acquired knowledge in the specific field of the professional activity.
- Develop teamwork skills to make diagnosis, to choose therapeutic strategies and to follow up patient, to obtain the best possible clinical and cost-effective result.

Communication skills

At the end of this teaching, the student will be expected to:

- communicate scientific contents in a clear and unambiguous way, using appropriate technical language.

Making judgements

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

- carry out assessments of the topics covered.
- autonomously interpret the data pertaining the topics covered by the course.

Learning skills

At the end of the course the student must be able to deepen and keep their knowledge and skills up-to-date by consulting scientific literature, databases and specialist websites, grasping the fundamental and relevant aspects for their professional context.

COURSE SYLLABUS

Molecular biology

- Structure and replication of DNA.
- Genome and exome.
- Genome organization: viruses, bacteria, eucaryotic cells.
- Genome alteration and mechanisms of evolution.
- Mechanisms of DNA repair.
- Control of gene expression: promoters and enhancers.
- Structure and function of various RNA species; mrna processing.
- Protein synthesis: translation initiation, elongation, and termination; post-translational modifications.
- Procedures for preparation of nucleic acids and proteins and metabolites from biological samples. Electrophoresis procedures, SDS-PAGE Northern and Western Blot.

Clinical molecular biology

- Introduction to clinical molecular biology and molecular biomarkers.
- Clinical Laboratory organization: use of the laboratory, interpretation of results, source of variation, specimen collection.
- Nucleic Acids and proteins analytical techniques and their clinical application (i.e.PCR, Gene sequencing, Hybridization, Microarray).
- Genome editing and gene therapy concepts.
- Development, and application of CRISPR/Cas9 technique.
- Introduction to omics sciences: genomics, metagenomics, epigenomics, transcriptomics, proteomics and their clinical application.

Clinical pathology

- Introduction to clinical pathology and evaluation of laboratory tests.
- Complete blood count and related disorders.
- The laboratory in the evaluation of the haemostatic function.
- Outline of transfusion medicine.
- Inflammation biomarkers.
- Principles of the immunological diagnosis of autoimmune diseases.
- Biochemical indicators of liver function and damage, jaundice.
- Parameters of function and renal damage.
- The laboratory in the diagnostic evaluation of diabetes.
- Laboratory diagnosis of dyslipoproteinemias.

COURSE STRUCTURE

The course is structured in 60 hours of frontal teaching (20 hours Molecular Biology, 20 hours Clinical Molecular Biology, 20 hours Clinical Pathology). Lectures will include theoretical lessons on the topics of the program, interactive discussion and cooperative learning. Teaching tools such as presentations organized in powerpoint files with explanatory diagrams, illustrations and images will be used.

COURSE GRADE DETERMINATION

The exam is unique for the entire integrated course, it is not possible to take exam tests for the individual modules.

The exam consists of a written test with multiple choice questions and open-ended answers that will cover all the teachings (10 question each). No penalty will be assigned to unanswered question or wrong answer. At least 50% of the answer of each teaching should be correct to pass the exam. The final exam grade will be calculated 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 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

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 contents with an excellent ability to analyze and synthesize with the ability to argue the required contents in a rigorous, innovative and original way; excellent ability to use technical language

OPTIONAL ACTIVITIES

In addition to the frontal teaching activity, students will be able to take advantage of reception by Prof. Maiani, Prof. Pieroni and Prof. Consalvi by appointment using email.

READING MATERIALS

Molecular Biology

- Bruce Alberts et al., *Molecular Biology of the Cell*, VII ed., WW Norton & Co.. In alternativa:
- Michael M. Cox, Jennifer Doudna, Michael O'Donnell. *Biologia Molecolare. Principi e tecniche*, Zanichelli 2013
- Teaching material provided by the teacher during the lessons

Clinical Molecular Biology

- Bruce Alberts et al., *Molecular Biology of the Cell*, VII ed., WW Norton & Co.

In alternativa:

- Michael M. Cox, Jennifer Doudna, Michael O'Donnell. *Biologia Molecolare. Principi e tecniche*, Zanichelli 2013

- Teaching material provided by the teacher during the lessons

Clinical Pathology

- Laposata's Laboratory Medicine Diagnosis of Disease in Clinical Laboratory 3rd Edition – LANGECC – Mc Graw Hill 2018
- Teaching material provided by the teacher during the lessons.