

Degree Course in Dentistry and Dental Prosthetics 2021/2022

Integrated Course: Molecular Biology and Clinical Pathology

CFU Number: 6

Coordinator of integrated course: Prof. Costanza Montagna; email: costanza.montagna@unicamillus.org

Module: Molecular Biology

SSD: BIO/11

CFU Number: 2

Professor's name: Prof. Costanza Montagna Costanza.montagna@unicamillus.org

Module: Clinical Molecular Biology

SSD: BIO/12

CFU Number: 2

Professor's name: Prof. Lusia Pieroni luisa.pieroni@unicamillus.org

Module: Clinical Pathology

SSD: MED/05

CFU Number: 2

Professor's name: Prof. Anna Claudia Romeo annaclaudia.romeo@unicamillus.org

PREREQUISITES

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

LEARNING OBJECTIVES

To acquire learn basic knowledge on fundamental processes of molecular biology and their regulation, necessary to understand:

- The pathogenic mechanisms of diseases
- Molecular mechanisms involved in the therapeutic intervention
- Biotechnology applications of medical relevance, including the principal methods for the study of nucleic acids and of their application for diagnostic and research purpose
- Clinical laboratory organization, clinical biomarker significance, sample variability
- Tests allowing determination of DNA, RNA, proteins and metabolites diagnostic and prognostic biomarkers of specific disease currently use in clinical practice
- Basic elements of clinical laboratory procedures application, data analysis and interpretation both in research and clinical practice.

LEARNING OUTCOMES

Knowledges and comprehension skills

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 skills

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 judgments

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 up-to-date their knowledge and skills by consulting scientific literature, databases and specialized websites, capturing the fundamental and relevant aspects for their professional context.

COURSE SYLLABUS

Molecular Biology Module

- 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.
- Genome editing and gene therapy concepts, development, and application of CRISPR/Cas9 technique. Fundamentals of protein synthesis: translation initiation, elongation, and termination; post-translational modifications.

Clinical Molecular Biology Module

- Introduction to clinical molecular biology and molecular biomarkers. Laboratory organization. Sample variability: biological, preanalytical, analytical, and postanalytical. Diagnostic sensitivity and sensibility. Structure and function DNA, RNA, proteins and metabolites.
- Procedures for preparation of nucleic acids and proteins and metabolites from biological samples.
- PCR, Gene sequencing (NGS, Exome Sequencing, RFLP).
- Introduction to omics sciences: trascrittomics, proteomics and metabolomics and their clinical application. Microarray. Proteome analysis of different matrix (saliva, plasma, serum), LC-MS and metabolites

Clinical Pathology Module

- 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
- 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
- Electrolytes, blood gases, calcium, magnesium, phosphorus
- Determination of plasma proteins and acute phase markers
- Principles of the immunological diagnosis of autoimmune diseases.

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), divided into 2-hours lessons basing on the academic calendar. 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 final exam will consist of a written test followed by an oral exam. The written test will consist of 30 questions with multiple-choice and open-ended answers (10 questions for molecular biology, 10 for clinical molecular biology and 10 for clinical pathology); for each correct answer, 1 point will be assigned. For every wrong or missing answer, 0 points will be assigned. The final score of the written test will be given by the sum of the scores of each correct answer. To access the oral exam the student must score at least 18 points. During the oral exam, the examining commission will assess the student's ability to correctly present knowledge acquired during the integrated course, and the ability to apply knowledge in the medical field.

Ability to making judgments, communication skills and learning skills will be also evaluated, as indicated in the Dublin descriptors.

OPTIONAL ACTIVITIES

In addition to the frontal teaching activity, students will be able to take advantage of 1 hours of reception by Prof.Montagna (every second week) and 1 hour by Prof.Pieroni (every second week), and 1 hour by Prof.Romeo (every second week), students are received by appointment by writing via email.

READING MATERIALS

Molecular Biology

- WATSON James D , BAKER Tania A , BELL Stephen P , GANN Alexander , LEVINE Michael , LOSICK Richard Molecular Biology of the Gene (7th ed) COLD SPRING HARBOR LABORATORY PRESS
- Michael M. Cox, Jennifer Doudna, Michael O'Donnell. Molecular Biology: Principles and Practice; W H Freeman & Co; 2 edition (16 March 2015)

Clinical Molecular Biology

- Michael M. Cox, Jennifer Doudna, Michael O'Donnell. Molecular Biology: Principles and Practice; W H Freeman & Co; 2 edition (16 March 2015)
- *Teaching material provided by the teacher during the lessons*

Clinical Pathology

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