

1. language

Italian.

2. course contents

Coordinator: Prof. LATTANZI WANDA

Academic Year: 2022/2023

Year Course: I

Semester: I, II

UFC: 8

Modules and lecturers:

- EXPERIMENTAL BIOLOGY 1 (OPR116) - 4 cfu - ssd BIO/13

Prof. Wanda Lattanzi, Daniela Palacios Garcia

- EXPERIMENTAL BIOLOGY 2 (OPR110) - 4 cfu - ssd BIO/13

Prof. Ornella Parolini, Wanda Lattanzi, Daniela Palacios Garcia

3. bibliography

EXPERIMENTAL BIOLOGY I

Suggested texts to be chosen from:

- J. Iwasa e W. Marshall. *Biologia Cellulare e Molecolare di Karp - Concetti ed Esperimenti- VI Edizione – 2021. Editore: EdiSES*
- Bruce Alberts et al. *L'essenziale di biologia molecolare della cellula. Quinta Edizione – 2020. Editore: Zanichelli*

EXPERIMENTAL BIOLOGY II

- J. Iwasa e W. Marshall. *Biologia Cellulare e Molecolare di Karp - Concetti ed Esperimenti- ultima edizione disponibile – 2021. Editore: EdiSES*
- Bruce Alberts et al. *L'essenziale di biologia molecolare della cellula - ultima edizione disponibile – 2020. Editore: Zanichelli*

For the Genetics sections, one of the following books:

- Giorgio Binelli, Daniela Ghisotti, et al – *Genetica – ultima edizione disponibile – Editore EdiSES*
- D.P. Snustad e M.J. Simmons – *Principi di Genetica – ultima edizione disponibile – Editore EdiSES*

In addition, supplementary teaching materials in the form of scholarly articles and appropriate telematic sources will be provided to supplement, deepen and update the content covered in lectures.

4. learning objectives

The course aims at providing the student with the fundamental information and elements of the scientific method to understand the basics of cellular and molecular biology, together with notions of general and human genetics, with particular reference to their application in issues related to clinical dentistry.

Upon completion of the integrated course, the student must demonstrate that he/she has acquired the following objectives:

Knowledge and understanding - *adequate knowledge of the different levels of organization of living matter and fundamental biological structures, the structure and function of all cellular compartments, the fundamental mechanisms that regulate cell activity, the interactions between cells, the flow of genetic information, and the basis of transmission of genetic information.*

Applied knowledge and understanding - *demonstrated ability to adequately interpret and understand the mechanisms underlying the organization and functions of the cell and how this knowledge can be applied to the dentistry field.*

Making judgements - *capacity to navigate the discipline and acquisition of the necessary skills to understand and correctly describe and evaluate the cellular and molecular mechanisms underlying development and disease in dentistry, and the modern techniques for maintaining oral health status and dental therapies.*

Communication skills – *ability to communicate scientific and applied content clearly and unambiguously, using appropriate technical language correctly, and explaining his/her conclusions, as well as the knowledge and rationale behind them, to both specialist and non-specialist audiences.*

Learning skills – *capacity to autonomously update and expand their knowledge thorough the use of scientific texts and articles (PubMed).*

5. PREREQUISITES

It is required a basic school education and knowledge of basic science subjects: chemistry, physics, and mathematics.

6. teaching methods

The course is conducted entirely with oral lectures, delivered using multimedia systems, alternating with theoretical and practical classroom exercises. Lessons are based on interactive methods, integrating active learning activities such as problem-based learning, self-learning and case studies into standard teaching. The didactic methods used in this course are designed to enable the student to pursue the learning objectives by virtue of the following characteristics:

- Knowledge and comprehension skills - face-to-face teaching will systematically cover all the topics listed in the detailed syllabus below, focusing on the most relevant and essential aspects, so

as to provide students with the complete picture of the integrated topics and the correct study method to reinforce theoretical knowledge.

- *Applied knowledge and understanding* - the use of practical examples, classroom exercises and case studies enables students to learn the application potential of the topics covered.

- *Autonomy of judgement* - the active learning methods implemented in this course are designed to enable students to formulate concepts and ideas independently.

- *Communication skills* - the active learning methods and the constant interaction with the lecturer during the lectures will be conducted in such a way as to allow the student the progressive acquisition of communication skills aimed at exposing applied biology topics with the correct scientific terminology.

- *Ability to learn* - the use of supplementary teaching material, also in the form of articles from the international scientific literature, will enable the student to continue studying mostly self-directed or autonomously.

Where the COVID-19 emergency makes distance learning necessary, the course will be delivered via live streaming sessions on the telematic platforms available at the university (Microsoft Teams and Blackboard).

7. other informations

Lecturers will be available throughout the duration of the course, by appointment via e-mail (wanda.lattanzi@unicatt.it; ornella.parolini@unicatt.it; daniela.palacios@unicatt.it), to answer questions and support students during their training, including individual meetings.

NB: lecturers cannot answer questions of a technical/administrative nature, for which please contact the relevant offices.

8. methods for verifying learning and for evaluation

The examination consists of an oral test comprising questions on theoretical aspects related to the topics covered in the individual lectures and aimed at ascertaining the student's understanding and ability to present the content with propriety.

The ability to explore the subject matter in depth will be assessed by means of an indicative number of 3 questions per module relating to the course content. Each question will be awarded a maximum score of 10 points. These questions will be used to assess knowledge of the topics covered, their level of detail, expository ability and appropriateness of language.

The overall mark will be obtained by calculating the arithmetic mean of the marks obtained in each module. The minimum mark for passing the test is 18/30 in each module. Honours will be awarded, subject to the achievement of 30/30 in both modules, to students who have demonstrated a superior level of knowledge and in-depth study of the subjects with autonomy of study, appropriateness of language and excellent communication skills. There are no additional questions in cases of insufficient assessment.

The objective of the examination consists of verifying

- the level of knowledge of the topics listed in the syllabus and understanding of the role of the cellular and molecular processes studied (*Knowledge and Understanding*);

- the ability to link theoretical concepts to concrete biological problems (Applied knowledge and understanding);
- the ability to make cross-cutting connections on the topics covered. (Autonomy of judgement);
- the adequate command and ownership of language and correct technical/scientific terminology (Communicative ability);
- the ability to explore topics of biological/medical interest in depth (Ability to learn).

Where the continuation of the COVID-19 emergency makes it necessary to carry out teaching activities remotely, learning assessments will be based on remote interviews using the telematic platforms available at the university (Microsoft Teams and Blackboard).

9. program

Experimental Biology I

Organisation and composition of living matter

- general characteristics of the living matter, cell theory, prokaryotes, eukaryotes
- chemical composition of living matter, macromolecules of biological interest

Organisation of the prokaryotic and eukaryotic cell

- biological membranes: composition and structure, active and passive transport mechanisms
- endocytosis and exocytosis
- cell communication and signal transduction
- structure and functions of cell organelles: ribosomes, endoplasmic reticulum, Golgi apparatus, lysosomes, mitochondria, cytoskeleton
- structure of the nucleus, chromatin, structure of nucleosomes, levels of chromatin organisation, chromosomes and karyotype

Cell cycle, its regulation and cell reproduction

- mitosis, phases and their biological significance
- meiosis and its genetic consequences
- mechanisms of cell death

Experimental biology II

Organisation and expression of genetic information

- DNA, chromatin and chromosomes, DNA replication
- genes and DNA, genetic code, gene-protein relationship
- organisation of the genome (single sequence, medium and highly repetitive DNA)
- types of RNA and their biological significance
- transcription and maturation of the primary transcript
- translation of the genetic message, protein synthesis and protein sorting
- control of gene expression in prokaryotes: concept of inducible and repressible operons, overview of gene regulation in eukaryotes

Principles of general genetics

- Mendel's laws and segregation of alleles in gametes

- extension of Mendelian inheritance (codominance, incomplete dominance, multiple alleles, pleiotropy, epistasis)
- gene penetrance and expressiveness, polygenic traits, multifactorial inheritance
- association and recombination
- sex determination, sex-linked inheritance and X-chromosome inactivation
- gene mutations and chromosomal mutations
- extra-chromosomal inheritance
- recombinant DNA technology: tools, methodologies and biotechnological applications in biology and medicine

Elements of human genetics

- normal human karyotype, chromosome nomenclature, chromosome banding
- chromosome aberrations
- family trees
- application of Mendel's laws to human genetics
- autosomal dominant and autosomal recessive segregation
- X-linked recessive and dominant segregation
- mitochondrial inheritance
- Clinical correlates: genetic diseases of dental/maxillofacial interest

Introduction to stem cells and their applications in regenerative medicine

NB: the topics indicated in the syllabus can be found in the recommended texts (specific references on chapters and paragraphs will be provided in the lecture at the students' request) and in some cases in the supplementary material provided during the lectures.