COURSE LAYOUT

1. GENERAL

SCHOOL	**School of Animal Biosciences**		
DEPARTMENT	**Department of Animal Science**		
STUDY LEVEL	***Undergraduate - Compulsory***		
COURSE CODE	**3635**	**SEMESTER**	**1st**
COURSE TITLE	**PRINCIPLES OF CELLULAR AND MOLECULAR BIOLOGY**		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**ECTS**
Theory	3	6
Laboratory Practicals	3	

COURSE TYPE (Foundation course, General knowledge, Scientific area, Developing skills)	Foundation Course
PREREQUISITES	
LANGUAGE	Greek
IS THE COURSE OFFERED for ERASMUS STUDENTS?	No
COURSE WEB PAGE	https://mediasrv.aua.gr/eclass/courses/EZPY205/

2. LEARNING OUTCOMES

Learning Outcomes

This course is an introductory course aimed at understanding the basic concepts of molecular biology of the cell, incorporating the principles of cellular structure and function with the underlying molecular mechanisms. It includes a detailed examination of the basic structure and function of cells, with an emphasis on the biology of eukaryotic cells. The main properties and functions of each class of biomolecules (carbohydrates, lipids, proteins and nucleic acids) will also be described. Emphasis will be placed on cells as systems for receiving and transforming energy and processing molecular information, as well as on the relationship between their form and function. Students will be introduced to aspects of gene regulation, genomics, cell cycle control, protein synthesis, intracellular protein distribution, and protein degradation in eukaryotic cells. Many of these concepts will be discussed in the context of how damage to cellular processes leads to cancer. Students will be introduced to some basic concepts of genetics, taking into account the experimental elements on which they are based in order to understand the central position of genetics in the biological sciences. Finally, fundamental points of the functioning of the immune system will also be covered.
Laboratory exercises will allow students to reinforce the concepts covered in the lectures.
Upon successful completion of this module, students will be able to describe:

- The properties and functions of the main groups of biomolecules,
- The origin of life, from the abiotic world to multicellular organisms.
- The structure and functions of the cell membrane and the main organelles found in eukaryotic cells.
- The mechanisms of storage, flow and expression of genetic information
- The mechanisms of intra- and intercellular signaling in eukaryotic organisms.
- The mechanisms of physical and acquired immunity.

The basic principles of cancer biology
In addition, they will be able to:

- use scientific texts, reference books and a number of other sources to further develop their knowledge of topics related to the biological sciences through continuous independent learning.
- Conduct a series of laboratory exercises, as a result of the development of their practical scientific skills.

General Competences

- Adaptation to new situations
- Decision making
- Autonomous work
- Teamwork
- Work in an interdisciplinary environment
- Search, analyze and compose data, using the necessary technologies
- Promoting free, creative and inductive thinking

3. COURSE CONTENT

THEORY

• Introduction. Historical review. Prokaryotic and eukaryotic cell. Animal cell. Intercellular environment. Cell membrane. Cytoplasm. Subcellular organelles: endoplasmic reticulum, Golgi device, mitochondria, lysosomes, peroxidosomes, nucleus

• Cellular aging, cell apoptosis, cell necrosis. Cell autophagy, autophagosome biogenesis, autophago-lysosomes

• Cell cycle and division. Genetic recombination and meiosis

• Chemical composition of cells. Energy and chemical potential of the cell. Biophysical chemistry, thermodynamics and behavior of biological molecules

• Structure, properties and functions of proteins. Properties of cell membranes

• Membrane transport systems

• Macromolecules, biomolecules and information. Elements of biological chemistry of nucleic acids. DNA structures, RNA, etc. and their differences

• Structure and organization of genetic material (DNA, genome, chromosomes)

• Introduction to molecular biology of the cell. Organization of chromosomes in the nucleus and chromatin structures. Nucleosomes. Reproduction of genetic information, copying and repair of DNA

• Principles of gene expression. The transcription and its mechanism. RNA structure and maturation. Transfer setting. Genetic code, transcription, translation and regulation

• Epigenetic modification in the cell, methylation, histone modifications. Epigenetic code

• Cellular recognition and communication. Cellular and molecular organization of the immune system. Molecular and cellular biology of the cancer cell

LABORATORY

• Safety and hygiene principles in the laboratory. Acquaintance with molecular analysis laboratories.

• Development of bird embryos (chicken). Enzymatic tissue degradation. Isolation of fetal fibroblasts. Measurement of number and viability, cell culture and microscopy

• Isolation of DNA from avian embryo fibroblasts

• Isolated DNA analysis, electrophoresis, spectrophotometric analysis

• PCR, Introduction of DNA into plasmid, Transformation of competent cells

• Methods and techniques for studying and analyzing proteins

•Enzyme kinetics

4. TEACHING and LEARNING METHODS - Evaluation

TEACHING METHOD	Face to face (theory, laboratory)
USE OF INFORMATICS and COMMUNICATION TECHNOLOGIES	Powerpoint presentations, e-class platform
TEACHING ORGANISATION (Lectures, individual or group assignments, field trips, individual study et.c.)	

Activities	***Workload per semester***
Lectures	39
Laboratory exercises	39
Individual study	72
Total contact hours and training	**150**

STUDENTS EVALUATION	The language of evaluation is Greek I. Theory (50% of the total grade) Short Answer Questions and Multiple Choice Test II. Laboratory Experience (50% of the total grade) Short Answer Questions and Multiple Choice Test

5. BIBLIOGRAPHY

The material of each lecture will be available on the eclass platform.

Recommended Bibliography:

• Marmaras, Lambropoulou-Marmaras. Cell Biology, Molecular Approach. 2013. Typorama Publications, Patras. (in Greek)
• Darnell, Lodish, Berk, Zipursky, Matsudaira, Baltimore 2000. Molecular Cell Biology. WH. Freeman & Company, New York.
• Benjamin Lewin. Genes IX. 2013. Jones and Bartlett Publishers. London (Chapters 1-11, 24, 26, 29)

Indicative list of related scientific journals:

Nature Reviews-Molecular Cell Biology
Cell
Nucleic Acids Research
Nature -Cell Biology
Nature-Structural Biology
Nature
Current Opinion in Cell Biology
Gene