COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Sciences		
ACADEMIC UNIT	Physics		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**10ΕΛΕ51**	**SEMESTER**	**7**
COURSE TITLE	**Current issues on Cell Biology**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	
Laboratory practice	1	
		6

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General Knowledge
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (Teaching in Greek language, Exams in English language)
COURSE WEBSITE (URL)	https://eclass.uoa.gr/courses/BIOL216/

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

The course deals with the organization, structure and function of the cell, including biological membranes and cellular organelles. It examines the first step in the flow of genetic information and organization of DNA, and the later steps that end in protein synthesis. Students will study the post-translational modifications, the sorting and targeting of proteins and the mechanisms behind cellular polarity. Emphasis will be given in the structure and role of peroxisomes, lysosomes, mitochondria, chloroplasts, and cytoskeleton. Introduction in the concepts of intra-, extra- and inter-cellular communication, as well as in signal transduction. By the end of the lectures and the laboratory exercises, students are expected to be able to:

- describe the organization of a model cellular system
- identify the composition and function of intra- and extra-cellular structures
- describe the flow of genetic information from nucleic acids (encoding, storage - packaging and expression of genetic information) to biogenesis of mature, functional proteins (prokaryotic / eukaryotic ribosome and the mechanisms of protein synthesis)
- identify and describe the flow of energy in cells, and the mechanisms of cellular communication
- select, apply and interpret the results of conventional Cell Biology techniques, such as Electron Microscopy, Optical Microscopy and Staining.

Knowledge

At the end of the course students should:

- understand the concepts related to the structure of a model cellular system, such as building blocks, biological membranes, cytoskeleton, cellular organelles and extracellular matrix
- identify and explain the organization of the flow of genetic information and cellular organelles
- describe the mechanisms of protein synthesis and the organelles via which it is performed
- explain and describe processes of the modification and degradation of bio-molecules in a model cellular system, through mechanisms implicated in the lysosomal - proteasomal degradation, endocytosis and autophagy
- identify and understand the cell-cycle function
- explain and understand the processes of intra-/inter-cellular communication of a model animal cell system
- dissect and describe the mechanisms of production and cellular management of energy and heat
- identify the post-translational protein modifications, sorting and targeting processes, as well as cellular polarity
- apply the appropriate research methodology and techniques required to study the structure, organization and operation of a model cellular system

Skills

At the end of the course students should:

- be able to explain the processes of signal transduction and intra-/inter-cellular communication of a model animal cell system
- be able to handle scientific instruments with ease and reliability
- have the ability to implement and adapt a research protocol accordingly
- identify and classify the various cell types and cellular organelles

- develop the ability to examine cellular behavior, with respect to mechanisms governing cellular function and organization

Abilities

At the end of the course students should:

- combine techniques in order to successfully respond to biological questions about the animal cell
- interpret results, draw conclusions and make new assumptions regarding the structure and operation of an animal system
- be able to comment on the physiological or pathological organization, flow of information and function of the animal cell and to review the data
- develop competence to compare and evaluate data with respect to signaling cascades, energy metabolism and cellular response to signal-transduction mechanisms

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

The course aims at the following general competences

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Adapting to new situations
- Decision-making
- Working independently
- Team work
- Production of new research ideas
- Respect for the natural environment
- Production of free, creative and inductive thinking

(3) SYLLABUS

INTRODUCTION: STRUCTURAL ELEMENTS - CELLULAR ORGANIZATION (3 Hours): Origin and evolution of organisms. Structural elements - from bio-molecules to cells. Bonds of structural elements and bio-molecules. Cellular organization. Historical overview of Cell Biology. The status of Cell Biology among Biosciences. Dynamics of cellular structure and function. Structure and function of representative cell types. Ultra-structural analysis of cellular organization

BIOLOGICAL MEMBRANES - SEPARATIVE FUNCTIONAL DOUBLE LAYERS (3 Hours): Components of biological membranes. Fluidity and its regulation in organisms. Specialized methodology. Properties of biological membranes. Models describing the structure and function of biological membranes. Specialized membrane systems

FIRST STEP IN THE FLOW OF GENETIC INFORMATION: DNA ORGANIZATION LEVELS (3 Hours): Coding, storage - packaging and decoding of genetic information. Nucleus, nucleolus and chromosomal components. Nuclear envelope, nuclear skeleton and nuclear pores. Human Genome Project (HGP)

SECOND STEP IN THE FLOW OF GENETIC INFORMATION: PROTEIN SYNTHESIS (3 Hours): Protein

synthesis. The prokaryotic ribosome. The eukaryotic ribosome. Mechanisms of protein synthesis. Simultaneous translation of an mRNA transcript from multiple ribosomes

POST-TRANSLATIONAL MODIFICATION - PROTEIN SORTING, TARGETING AND CELLULAR POLARITY (3 Hours): Compartmentalization - Fundamental pathways of protein sorting. “Gated” transport of bio-molecules between cytosol and nucleus. Protein transport across membranes. Sorting, transport and protein targeting through vesicle-mediated processes

CELLULAR ORGANELLES PRODUCING AND CONVERTING ENERGY: MITOCHONDRIA AND CHLOROPLASTS (3 Hours): Morphology, molecular composition and function of mitochondria. Structure - function, relationship. Morphology, composition and function of chloroplasts. Origin and distribution of their molecular components. Structure and function semi-autonomy. Information flow - Transcription and translation

CELLULAR ORGANELLES FOR THE PROCESSING AND DEGRADATION OF BIO-MOLECULES: PEROXISOMES AND LYSOSOMES (3 Hours): Morphology and function of peroxisomes. Morphology and function of lysosomes. Participation of lysosomes in the processes of endocytosis (pinocytosis and phagocytosis) and autophagy. Contribution of lysosomes to cellular function

CELLULAR FIBRILS - CYTOSKELETON (6 Hours): Microfilaments. Actin participation in the cellular mechanisms of movement. Intermediate Filaments (IF). Characteristic types, intracellular organization and distribution of Intermediate Filaments. Microtubules, nucleation mechanisms. Microtubule Organizing Centers (MTOCs). The role of microtubules in mitosis. Cilia and flagella. The Actin-Myosin system. Proteins of thick and thin myofibrils. Interactions of myofibrils with extracellular matrix. Filaments and cellular shape. Microvilli

CELLULAR COMMUNICATION AND CONJUNCTION (3 Hours): Morphological manifestation of communication: Cellular junctions. Communication junctions. Occluding junctions. Anchoring junctions. Cellular adherence. Chemotaxis

EXTRACELLULAR MATRIX (3 Hours): Components, organization and function of extracellular matrix. Collagens and elastins. Glycosaminoglycans (GAGs) and proteoglycans (PGs). Extracellular matrix proteins for multiple binding. Basement membrane. Supra-molecular structure of extracellular components

CELL CYCLE - REPRODUCTION (3 Hours): Cell growth and division. Inter-phase. Cell-cycle regulation during inter-phase. Cell-cycle progression and the distinct restriction/check points. Regulation of cell-cycle check points. Mitosis and cytokinesis. Mechanisms controlling mitosis. Meiosis. Stages of the meiotic divisions I and II

PRINCIPLES OF SIGNAL TRANSMISSION (3 hours): role of protein phosphorylation in signal transduction. Classification of biological signals. Classification of signal transduction. Role of signal transduction in cell differentiation and development.

Laboratory Exercises:

1. Light Microscopy
2. Stainings
3. Mitosis-Meiosis
4. Blood types
5. Osmosis
6. Electron Microscopy
7. DNA isolation
8. *In silico* approaches

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>THEORY: FACE TO FACE

LABORATORY EXERCISES: FACE-TO-FACE AND USING SPECIALISED SCIENTIFIC INSTRUMENTS</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>In Teaching Theory:
- Presentations with multimedia content (images, animation, video)
- Preparation aids in digital format using the e-class platform

In the teaching of the Laboratory Exercises:
- Presentations with multimedia content (images, animation, video)
- Supporting material for preparation in digital format using the e-class platform

In communication with students:
- Supporting the learning process and informing students through the e-class platform (announcements, information, messages, documents, user groups, working groups, etc.)
- e-mails, messages, communications, notifications, messages, emails, group work groups, groups of users, etc.
- Use of doodles to plan various events such as registration of students and organization in working groups, participation in exams, etc.</td></tr>
<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>39 hours</td></tr>
<tr><td>Exercises</td><td>13 hours</td></tr>
<tr><td>Individual Study/ Study and Analysis of bibliography</td><td>78 hours</td></tr>
<tr><td>Preparation for evaluation</td><td>20 hours</td></tr>
<tr><td>Course Total</td><td>150 hours</td></tr>
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</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td><td>The evaluation process is conducted in Greek (there is the possibility of an examination in English for Erasmus students), with a final examination on the entire syllabus and includes:
Theory: (80% of the total grade/score of the course), Written Examination with Extended Response Questions and/or Multiple-Choice Questions
Laboratory exercises: (20% of the total course grade) oral examination of the student at the time of the exercise and a written examination with an Extended Response Question at the time of the exercise
The overall grade is the sum of the above individual assessments</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- *Suggested bibliography*

- «Biology of the Cell», Margaritis L. et al., 4th Edition LITSAS S.A. Athens, 2008 - ISBN: 960-372-077-1, Eudoxus: 25249
- «Biology of the Cell - Molecular Approach», Marmaras V. et al. 5th Edition, TYPORAMA, Patra, 2005, ISBN: 960-7620-13-5, Eudoxus: 6
- «The Cell: A molecular approach», Cooper G.M. and Hausman R.E., BASDRA & Co, Athens, 2013, ISBN: 978-618-5135-20-1, Eudoxus: 102123643

- *Related academic journals*:

- Journal of Cell Biology
- Nature Cell Biology
- Cell
- Nature Reviews Molecular Cell Biology
- Trends in Cell Biology
- Journal of Molecular Cell Biology
- Cell Biology and Toxicology
- European Journal of Cell Biology
- Cell Metabolism
- Cell Research
- Molecular Cell
- Cell Reports