UNIVERSITY OF PATRAS
SCHOOL OF NATURAL SCIENCES
DEPARTMENT OF BIOLOGY

POSTGRADUATE PROGRAMME

Biological Sciences: Research and Applications

Specialization

Biological Technology

Concise Guide and Course Outline

Academic year 2021-2022

Patras, October 2021

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COURSE ORGANIZATION

The course programme consists of elective courses distributed in the 1st and 2nd semesters of studies [**Table 1** and **Table 2**], and the Postgraduate Research Dissertation during the 2nd and 3rd semester [**Table 2** and **Table 3**].

Table 1. Courses of the 1st semester of studies

Students may choose 5 courses from the elective courses listed below in order to complete 30 ECTS.	**Credits [ECTS]**
Structural Biology	6
Specific Topics in Developmental Biology	6
Specific Topics in Biotechnology	6
Topics in Applied Plant Physiology and Biotechnology	6
Molecular Genetics and Applications	6
Molecular Physiology and Neurobiology	6
Current Topics in Cell Biology	6
Current Topics in Molecular Biology	6
Total ECTS	**30**

Table 2. Courses of the 2nd semester of studies

Students may choose 4 courses from the elective courses listed below [20 ECTS], and the Postgraduate Research Dissertation [10 ECTS] in order to complete 30 ECTS	**Credits [ECTS]**
Cancer Biology - Biomarkers	5
Biochemistry of Oxidative Stress	5
Specific Topics in Evolution	5
Methodology in Biomedical Research	5
Microbial Biotechnology	5
Molecular & Cellular Immunobiology	5
Systems Biology	5
Postgraduate Research Dissertation	10
Total ECTS	**30**

Table 3. Courses of the 3rd semester of studies

Development, execution, presentation and evaluation of the Postgraduate Research Dissertation	**Credits [ECTS]**
Postgraduate Research Dissertation	30
Total ECTS	**30**

TEACHING PROGRAMME

Before the start of the course, a meeting will be held with the new postgraduate students in order to inform them about the research and educational work of the course. All courses are taking place in the Seminar Room of the Division of Genetics, Cell & Developmental Biology [2nd floor]. The exact day and time of each course of the 1st and 2nd semesters [**Table 4** and **Table 5**] will be announced by the lecturers before the start of the course.

Table 4. Timetable for teaching and examination of courses of the 1st semester

Course	Lecturers	Teaching dates
Structural Biology	Margiolaki I.	08.11.2021 - 04.02.2022
Specific Topics in Developmental Biology	Kazanis I.	08.11.2021 - 04.02.2022
Specific Topics In Biotechnology	Kasapa M.	08.11.2021 - 04.02.2022
Topics in Applied Plant Physiology and Biotechnology	Grammatikopoulos G., Petropoulou G.	08.11.2021 - 04.02.2022
Molecular Genetics and Applications	Vasilopoulos I., Kilias G., Stefanou G.	08.11.2021 - 04.02.2022
Molecular Physiology and Neurobiology	Kazanis I., Margariti M., Panagopoulos N.	08.11.2021 - 04.02.2022
Current Topics in Cell Biology	Katsoris P.	08.11.2021 - 04.02.2022
Current Topics in Molecular Biology	Kamilari M.	08.11.2021 - 04.02.2022
1st Semester Course Examinations: 14.02.2022 – 28.02.2022		

Table 5. Timetable for teaching and examination of courses of the 2nd semester

Course	Lecturers	Teaching dates
Cancer Biology - Biomarkers	Kallergi G.	07.03.2022 - 03.06.2022
Biochemistry of Oxidative Stress	Georgiou C.	07.03.2022 - 03.06.2022
Specific Topics in Evolution	Kornilios P.	07.03.2022 - 03.06.2022
Methodology in Biomedical Research	Dermon C.	07.03.2022 - 03.06.2022
Microbial Biotechnology	Aggelis G., Lianou A.	07.03.2022 - 03.06.2022
Molecular and Cellular Immunobiology	Rosmaraki E.	07.03.2022 - 03.06.2022
Systems Biology	Klapa M.	07.03.2022 - 03.06.2022
2nd Semester Course Examinations: 13.06.2022 – 24.06.2022		

In the beginning of the 2nd semester, all MSc students are asked to implement diploma thesis for completing their studies [duration 12 months], after consultation with a member of the teaching stuff [supervisor].

Description and Content of Courses_1st Semester

Structural Biology

Abstract: Protein production, crystallization and structural characterization via X-ray diffraction and crystallographic methods. The role of Structural Biology in Life Sciences.

Syllabus: Methods of protein production and crystallization. Introduction to X-ray diffraction and Crystallography: molecular and biochemical techniques for sample preparation, diffraction of electromagnetic radiation, crystal symmetries, space group and point groups, Fourier transformations, methods for solving the crystallographic phase problem [Patterson methods, direct methods, molecular replacement, isomorphous replacement, anomalous dispersion].

Specific Topics in Developmental Biology

Abstract: Molecular and cellular mechanisms of stem cell regulation. Manipulation and use of stem cells. Comparative analysis of systems of adult stem cells.

Syllabus: Embryonic stem cells. Induced pluripotent stem cells. Use of stem cells in the clinical practice. Systems of tissue-specific/adult stem cells: neural stem cells, muscle stem cells, intestinal stem cells, stem cells of the epidermis, hematopoiesis, mammary gland stem cells, adipose and bone stem cells, *in vitro* fertilization. Two essays.

Specific Topics in Biotechnology

Abstract: Modern biotechnology methods and cutting-edge technologies in the field. Ethical dilemmas that arise from the applications of Biotechnology. Demonstration of collection and computational analysis of Molecular Biotechnology experimental data.

Syllabus: Definitions and tools of Biotechnology. Applications of DNA recombination. Cloning and Sequencing of DNA and RNA. Genetic engineering. Genetic modification of cells by genome editing methods. Gene therapy. Stem cell biology and Biotechnology applications. Nanobiotechnology. Bioethical issues stemming from modern applications of Biotechnology. Bioinformatics and it's role in data analysis of

Biotechnology. Virtual lab: collection and *in silico* analysis of publicly available experimental data of Molecular Biotechnology.

Topics in Applied Plant Physiology and Biotechnology

Abstract: Contemporary methodological approaches in applied plant Physiology and Plant Biotechnology. From laboratory experimentation to plant function under stressful environmental conditions.

Syllabus: Contemporary methodology in Plant Physiology. Evaluation of abiotic stresses [light, temperature, water, oxidative, ionic/osmotic stress]. Evaluation of biotic stress [infection by microorganisms]. Allelopathy and plant protection. Detection of metabolites of economic interest. Soil pollution by heavy metals. Remediation of agro-industrial wastes using microalgae. Transgenic plants and nutrition. Plants resistant to weeds, insects, microorganisms.

Molecular Genetics and Applications

Abstract: Molecular mechanisms underlying genetic variation in populations, with emphasis on evolutionary genetic studies and biomedical translational research.

Syllabus: Population genetics and gene variation. Methods of identification of gene variation. Use of mitochondrial DNA in human evolutionary and population genetic studies. Phylogenetic trees and software analysis. Molecular Cytogenetics, FISH and applications in human syndromes. Molecular basis of human disease. Genetic toxicology. Genetic basis of drug metabolism. Transcriptomics and epigenomics, applications in elucidation of the biological mechanism of common diseases. Systems biology and synthetic biology.

Molecular Physiology and Neurobiology

Abstract: Cellular and molecular mechanisms of selected topics related to areas of particular interest in both Physiology and Neurobiology.

Syllabus: Neuronal networks and the functional organization of the brain. The synapsis and synaptic plasticity. Cellular and molecular mechanisms of learning and memory. Molecular basis of biological rhythms. Cellular and molecular basis of sleep

and awakening. The cellular and molecular basis of CNS diseases (for example, Parkinson's and Alzheimer's disease, epilepsy, Multiple Sclerosis, schizophrenia, depression). Oxidative stress molecular mechanisms and the endogenous anti-oxidative system. Cell death. Molecular mechanisms of atherogenesis and drug treatment. Neuro-endocrine-immune interactions (eg stress). High flow/big data methods and precision medicine. Literature review on current and evolving methodologies (for example, stem cells, optogenetics, robotics). Evolution and development of the central nervous system. Embryonic and adult neural stem cells. Regeneration of the nervous system.

Current Topics in Cell Biology

Abstract: Molecular and cellular mechanisms of the tumor growth. The role of angiogenesis.

Syllabus: Cancer biology. Benign and malignant tumor. Oncogenes. Signal transduction. Tumor growth and angiogenesis. Models for angiogenesis studies. Proteasome. Immune system and cancer. Journal Club.

Current Topics on Molecular Biology

Abstract: Modern methods of Molecular Biology. The different -omics techniques and tools available. The role and applications of Molecular Biology and Genomics in diseases.

Syllabus: Next Generation Sequencing platforms. Important applications and achievements. Modern DNA recombination techniques. Regulation, silencing and suppression of gene expression [knockout and knockdown]. Databases and the ability to retrieve and process information. Methodologies and commenting tools and softwares. Genomes and Genomics and flagship Genome projects. Microarrays and transcriptomics. Epigenomics. Application of Genomics in diseases. Gene therapy techniques.

Description and Content of Courses_2nd Semester

Cancer Biology - Biomarkers

Abstract: Description of therapeutic targets/biomarkers and signal transduction pathways in tumor cells. Introduction to new approaches in cancer research: liquid biopsy and innovative means in cancer diagnosis and prognosis.

Syllabus: Signal transduction pathways in cancer cells and therapeutic targets. Cytoskeleton in tumor cells. Biomarkers in breast and prostate cancer. ErbB receptor family in cancer therapy. Biomarkers of immune response and cancer (PD-L1/PD-1 axis). Introduction to liquid biopsy. Circulating tumor cells (CTCs) in breast cancer. Circulating tumor cells in lung, prostate, and colon Cancer. Exosomes and cancer. Micro RNAs as biomarkers in cancer biology.

Biochemistry of Oxidative Stress

Abstract: Biochemical mechanisms of antioxidant defense at the molecular and cellular level.

Syllabus: Definition of oxidative stress and its role on the physiological and abnormal processes of the organisms, free radicals and reactive oxygen species (ROS), biochemical pathways of ROS generation, Fenton/Haber-Weiss reactions in relation to the pro-oxidant role of Fe and Cu and to the defense of the organisms from these transition metals, oxidative modification and degradation of lipids, proteins, carbohydrates and nucleic acids, mechanisms of enzymic and non-enzymic antioxidant defense, physiological free radical scavengers (vitamins C and E, carotenoids, etc).

Methodology in Biomedical Research

Abstract: Basic principles of ethics and integrity in biomedical research with emphasis in translational research in neurodegeneration and neuropsychiatric disorders.

Syllabus: Good practice of animal use and laboratory safety. Ethics in biological research. Experimental design and logic. Basic principles of research methodology in translation research using *in vitro* systems and animal models. Methods in

neurodegenerative diseases, neuropsychiatric disorders, imaging of neurochemical mechanisms of plasticity, development and function of brain circuits. Data analysis, meta-analysis. Critical discussion of research experimental protocols using animal and/or alternative models (e.g pathophysiologic mechanisms of Parkinson's disease, social and emotional behavioral disorders, epigenetic regulation, etc.).

Microbial Biotechnology

Abstract: Microbial processes and interactions of biotechnological interest: principles, description and applications in environmental and industrial biotechnology.

Syllabus: Mathematical models in the study of complex biological systems. Kinetic studies of pure cultures and mixed microbial populations. Production and storage of energy in microbial cells. Biosynthesis and accumulation of energy-storage products (lipids, polysaccharides, polyhydroxyalkanoic acids). Cell-to-cell communication and microbial interactions. Co-existence of microbial populations (substrate competition, synergism, symbiosis, antibiosis). Microorganisms as agents of biological control/biopreservation. Industrial and environmental applications of microbial technology. Development of biotechnological processes. Laboratory exercise (microbial fermentations in the laboratory). Industry visits. Journal Club. Projects.

Molecular & Cellular Immunobiology

Abstract: Molecular and cellular mechanisms of the immune system. The role of the immune system in health and disease.

Syllabus: Introduction to the immune system. Innate immunity. Antigen capture and presentation to lymphocytes. Antigen recognition in the adaptive immune system. T cell-mediated immunity. Effector mechanisms of T cell-mediated immunity. Humoral immune responses. Effector mechanisms of humoral immunity. Immunological tolerance and autoimmunity. Immune responses against tumors and transplants. Hypersensitivity. Congenital and acquired immunodeficiencies. Journal Club.

Systems Biology

Abstract: This course aims at presenting the experimental and computational methods used in the omic analyses in Systems Biology, indicating the significant new opportunities but also the relevant challenges in life science research, using also examples from recent literature.

Syllabus: Introduction to Systems Biology, the major shifts that Systems Biology brought in life sciences. Description of the multi-step procedure of omic analyses. Experimental methodologies/protocols for transcriptomics: DNA microarrays and RNASeq. Experimental methodologies/protocols for proteomics and metabolomics. Omic data normalization: need, methods & challenges. Data mining methods, multi-variate statistical analysis. Biomolecular networks: structure and characteristics. Databases of biomolecular networks. Examples of integrated omics analyses from recent literature.

COURSE OUTLINES_1st Semester

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	GBIO_BTEA13	**SEMESTER**	1st
COURSE TITLE	**STRUCTURAL BIOLOGY**		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**	
Lectures	2	6	
COURSE TYPE	Specialised general knowledge		
PREREQUISITE COURSES	NO. Formally, there are no prerequisite courses. Nevertheless, a good knowledge of Biochemistry is recommended.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
URL	https://eclass.upatras.gr/courses/BIO264/		

Learning outcomes

Upon course completion, students will have acquired knowledge in biochemistry, and will have understood fundamental principles related to cell process at molecular level via studying:

- The structures and functionalities of proteins (enzymes).
- The crystallographic methods necessary for the structural determination of biological macromolecules.

General Competences

Upon course completion, students be able to comprehend all methods related to the structural characterization of biological macromolecules, while also being capable of analyzing and presenting research data in the field of structural biology.

Teaching and Learning methods-Evaluation

DELIVERY	In person	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Support of educational procedure with use of the e-class electronic platform.	
TEACHING METHODS	**Activity**	**Semester workload**
	Lectures [12 weeks x 2 hours per week]	24
	Home study	126
	Course total [25 hours per one ECTS]	**150**
STUDENT PERFORMANCE	Written exams and Journal Club at the end of the semester.	

EVALUATION	Grading scale: 1-10. Passing grade: 5 Grading: 3 correspond to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A

Attached bibliography

- «Μία μη μαθηματική εισαγωγή στην κρυσταλλογραφία πρωτεϊνών», Ν. Γλυκός.
- «ΘΕΜΑΤΑ ΜΟΡΙΑΚΗΣ ΒΙΟΦΥΣΙΚΗΣ», ΧΑΜΟΔΡΑΚΑΣ Ι. ΣΤΑΥΡΟΣ, Κωδ. Πολιτείας: 4114-0086.
- «Introduction to Protein Structure», C. Branden & J. Tooze.

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	GBIO_BTEA11	**SEMESTER**	1st
COURSE TITLE	**SPECIFIC TOPICS IN DEVELOPMENTAL BIOLOGY**		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	2	6

COURSE TYPE	Specialised general knowledge
PREREQUISITE COURSES	NO. Formally, there are no prerequisite courses. Good knowledge of Cellular and Molecular Biology, as well as basic knowledge in anatomy and Developmental Biology is recommended
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
URL	https://eclass.upatras.gr/courses/BIO346/

Learning outcomes

During the course the basic concepts of the function and regulation of embryonic, induced and adult stem cells are presented and discussed. Focus is given on the description of anatomical, molecular and regulatory aspects of adult mammalian stem cell systems; on key experimental approaches and on the basic developmental processes (cell proliferation, cell fate choices, differentiation and migration).

General Competences

At the end of the course students are expected to have a good grasp on key elements of the organization and regulation of stem cell zones, of their contribution to tissue/ organ maintenance and regeneration and of the possible consequences of their dysregulation in the emergence of disease. They are also expected to have acquired the ability to plan basic experiments in order to investigate developmental processes.

Teaching and Learning methods-Evaluation

DELIVERY	Face to Face
USE OF INFORMATION AND	Support of educational procedure with use of the e-class

COMMUNICATIONS TECHNOLOGY	electronic platform and of online material.	
TEACHING METHODS	**Activity**	**Semester workload**
	Lectures (12 weeks x 2 hours per week)	24
	Home study	126
	Course total [25 hours per one ECTS]	**150**
STUDENT PERFORMANCE EVALUATION	Attendance and contribution (10%). Oral presentation of a topic (30%). Written assay and oral presentation (60%). Grading scale: 1-10. Passing grade: 5 Grading: 3 correspond to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A	

Attached bibliography

- «Principles of Development» Wolpert Lewis, Tickle Cheryll, Arias Martinez Alfonso, BROKEN HILL PUBLISHERS, 2020. ISBN: 9789925575046
- «Developmental Biology» Scott F. Gilbert, Michael J. F. Barresi. IMBB, Editions of the University of Crete. ISBN: 9789605245610E.
- I. Kazanis – Notes of Special Topics in Developmental Biology [https://eclass.upatras.gr/courses/BIO346/]

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	GBIO_BTEA12	**SEMESTER**	1st
COURSE TITLE	**SPECIFIC TOPICS IN BIOTECHNOLOGY**		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures		2	6
COURSE TYPE	Specialized general knowledge		
PREREQUISITE COURSES	NO. Formally, there are no prerequisite courses. Nevertheless, a good knowledge of Molecular Biology, Molecular Genetics and Cell Biology is recommended.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek. Although terms in English and international software packages, databases and publications are used.		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
URL			

Learning outcomes

Upon successful completion of the course the students will have acquired knowledge in special topics of Biotechnology. They will be familiar with modern techniques of genetic modification and genome editing of cells and organisms [e.g. stem cells] and their therapeutic uses [e.g. gene therapy]. During the lectures, nanobiotechnological applications and cutting-edge technologies [e.g. Next Generation Sequencing] of Biotechnology are presented. In addition, bioethical issues arising from the above Biotechnological applications are reported. Finally, students will learn to use Bioinformatics in order to collect publicly available biomedical data and analyze them.

General Competences

This course aims to provide knowledge in the uses of Biotechnology for biomedical purposes. Upon course completion students will have a solid understanding of fundamental principles related to the modern methods of DNA modification and their applications. Moreover, they will have learned about the contribution of Nanotechnology and Bioinformatics to Biotechnology. Therefore, they will be aware of the benefits coming from the genetic modification of organisms, as well as of the respective ethical issues and practical difficulties that arise. Finally, they will have the ability to carry out a small study on Biotechnology by collecting references and experimental data, analyzing them, extracting knowledge, drawing conclusions and presenting them.

Teaching and Learning methods-Evaluation

DELIVERY	In person	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Support of educational procedure with use of the e-class electronic platform.	
TEACHING METHODS	**Activity**	**Semester workload**
	Lectures [12 weeks x 2 hours per week]	24
	Home study	126
	Course total [25 hours per one ECTS]	**150**
STUDENT PERFORMANCE EVALUATION	Written exams at the end of the semester [60%]: Multiple choice questions. Journal Club [40%]: Students are asked to prepare and present a small bibliographic study under the supervision of the lecturer. Grading scale: 1-10. Passing grade: 5 Grading: 3 correspond to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A	

Attached bibliography

- Selection of recent scientific publications from international journals.
- **Dehlinger, C. A. Molecular Biotechnology. Jones & Bartlett Learning, LLC, an Ascend Learning Company. 2016.**

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	GBIO_BTEA6	**SEMESTER**	1st
COURSE TITLE	**TOPICS IN APPLIED PLANT PHYSIOLOGY AND BIOTECHNOLOGY**		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	2	6

COURSE TYPE	Specialised general knowledge
PREREQUISITE COURSES	NO. Formally, there are no prerequisite courses. Nevertheless, a good knowledge of Plant Physiology, as well as Biochemistry is recommended
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
URL	https://eclass.upatras.gr/courses/BIO390/

Learning outcomes

The course aims at understanding new methodologies used in the field of Applied Plant Physiology and their utilization in a wide range of applications. Issues related to the assessment of environmental stress in plants, plant protection and environmental rehabilitation are analyzed.

General Competences

At the end of the course, the student will have developed the following skills:

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Working independently
- Production of free, creative and inductive thinking

Teaching and Learning methods-Evaluation

DELIVERY	Face to Face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Support of educational procedure with use of the e-class electronic platform.	
TEACHING METHODS	**Activity**	**Semester workload**
	Lectures (12 weeks x 2 hours per week)	24
	Home study	70
	Study, preparation, presentation of a project	56
	Course total [25 hours per one ECTS]	**150**

STUDENT PERFORMANCE EVALUATION	Project presentation (at the semester's end) in course theory, accounting for the 100% of the Final Grade. Grading scale: 1-10. Passing grade: 5 Grading: 3 correspond to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A

Attached bibliography

- Plant stress physiology, G. Karabourniotis, G. Liakopoulos, D. Nikolopoulos [Embryo Press, 2016, *in greek*]
- Plant Biotechnology, P. Hatzopoulos [Embryo Press, 2016, *in greek*]
- Plant Biotechnology, S. Umesha [CRC Press 2019]
- Applied Photosynthesis, Mohammad Mahdi Najafpour (editor) [InTechOpen publisher 2016]
- G. Grammatikopoulos, G. Petropoulou – lecture notes [https://eclass.upatras.gr/courses/BIO390/]

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	GBIO_BTEA7	**SEMESTER**	1st
COURSE TITLE	**MOLECULAR GENETICS AND APPLICATIONS**		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**	
Lectures	2	6	
COURSE TYPE	Specialised general knowledge.		
PREREQUISITE COURSES	NO. Typically, there are no prerequisite courses. However, a good basic knowledge of Genetics, Molecular Biology and Evolution is recommended.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
URL	https://eclass.upatras.gr/courses/BIO393/		

Learning outcomes

Upon course completion, the students should be able to understand the basis of genetic variation in populations and have a thorough and up-to-date knowledge of applications in population studies and biomedical translational research.

General Competences

Students should be able to search, analyze and synthesize data and information, using the necessary technologies to study molecular mechanisms and markers of variation with applications in diagnosis of genetic syndromes, susceptibility to common disease, pharmacogenomics, gene editing and synthetic biology.

Teaching and Learning methods-Evaluation

DELIVERY	Face to Face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Support of educational procedure with use of the e-class electronic platform.	
TEACHING METHODS	**Activity**	**Semester workload**
	Lectures (12 weeks x 2 hours per week)	24
	Home study	126
	Course total [25 hours per one ECTS]	**150**
STUDENT PERFORMANCE EVALUATION	Written exams (70%) and Assignment (30%) at the end of the semester. Grading scale: 1-10. Passing grade: 5 Grading: 3 correspond to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A	

Attached bibliography

- P.J. Russell: iGenetics. A mendelian approach – [1st edition, 2009]
- A. Griffith, et al. Introduction to genetic analysis [11th edition, 2015]
- L. Hartwell, et al. Genetics: From genes to genomes [4th edition, 2013]

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	GBIO_BTEA9	**SEMESTER**	1st
COURSE TITLE	**MOLECULAR PHYSIOLOGY AND NEUROBIOLOGY**		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**	
Lectures	2	6	
COURSE TYPE	Specialised general knowledge		
PREREQUISITE COURSES	Animal Physiology		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
URL	https://eclass.upatras.gr/courses/BIO264/		

Learning outcomes

The course aims at enhancing the knowledge of postgraduate students on selected topics on the basic cellular and molecular mechanisms that underline animal physiology with a focus on Neurobiology.

General Competences

At the end of the course, students will be familiar with the key cellular and molecular mechanisms that underline several processes, with a focus on Neurobiology and on Pathophysiology. In addition, students will have developed analytical and presentation skills, and will have been shown how to work with primary research data in the fields of molecular physiology and of molecular neurobiology.		
Teaching and Learning methods-Evaluation		
DELIVERY	Face to Face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Support of educational procedure with use of the e-class electronic platform and with online material.	
TEACHING METHODS	**Activity**	**Semester workload**
	Lectures (12 weeks x 2 hours per week)	24
	Home study	126
	Course total [25 hours per one ECTS]	**150**
STUDENT PERFORMANCE EVALUATION	Written exams and Journal Club at the end of the semester. Grading scale: 1-10. Passing grade: 5 Grading: 3 correspond to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A	

Attached bibliography

- **1.** Kandel, E.R., Koester J.D. , Mack S.H. Principles of Neural Science, [6th Edition, 2021]. Selected chapters.
- **2.** Slack J. M. W.: «**Essential Developmental Biology**» [2001]. Selected chapters.
- **3**.Boron F.W. and Boulpaep L. E. : «Medical Physiology» [3rd Edition,2016]. Selected chapters
- 4. Purves D., Augustine D.J., Hall W.C., LaMntia A-S, McNamara J.O. and Williams S.M. : « Neuroscience» [3rd Edition, 2010]. Selected chapters
- 5. Selected papers from the International Bibliography

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	GBIO_BTEA10	**SEMESTER**	1st
COURSE TITLE	**CURRENT TOPICS IN CELL BIOLOGY**		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures		2	6
COURSE TYPE	Specialised general knowledge		
PREREQUISITE COURSES	NO. Formally, there are no prerequisite courses. Nevertheless, a good knowledge of Cellular and Molecular Biology, as well as Biochemistry is recommended		
LANGUAGE OF INSTRUCTION and	Greek		

EXAMINATIONS	
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
URL	

Learning outcomes

The course aims to the understanding of the function of molecular and cellular mechanisms that lead to the generation of cancer cells and tumors.

General Competences

At the end of the course, students will be familiar with the molecular and cellular mechanisms of carcinogenesis, as well as molecular approaches to its treatment.

Teaching and Learning methods-Evaluation

DELIVERY	Face to Face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Support of educational procedure with use of the e-class electronic platform.	
TEACHING METHODS	**Activity**	**Semester workload**
	Lectures (12 weeks x 2 hours per week)	24
	Home study	126
	Course total [25 hours per one ECTS]	**150**
STUDENT PERFORMANCE EVALUATION	Written exams and Journal Club at the end of the semester. Grading scale: 1-10. Passing grade: 5. Grading: 3 correspond to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A	

Attached bibliography

- H. Lodish *et al.* – Molecular Cell Biology [8th edition, 2019]

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	GBIO_BTEA8	**SEMESTER**	1st
COURSE TITLE	**CURRENT TOPICS IN MOLECULAR BIOLOGY**		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	2	6

COURSE TYPE	Specialised general knowledge
PREREQUISITE COURSES	NO. Formally, there are no prerequisite courses. Nevertheless, a good knowledge of Molecular Biology is recommended.
LANGUAGE OF	Greek

INSTRUCTION and EXAMINATIONS	
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
URL	

Learning outcomes

Upon successful completion of the course, students will have acquired knowledge and will have understood:

(a) the modern techniques of recombinant DNA and the principles of *in vivo* gene processing
(b) new generation sequencing technologies
(c) genomics, transcriptomics and proteomics
(d) online platforms, the use of online databases and software packages, and
(e) DNA sequence management and analysis, sequence alignment and analysis of protein information.

General Competences

Upon successful course completion, students will have comprehended the modern methodologies and techniques of Molecular Biology, and will be familiar with new generation sequencing technologies, databases and computational methods of molecular data analyses. Finally, they will have developed the ability of bibliographic review and presentation of research data in the field of Molecular Biology.

Teaching and Learning methods-Evaluation

DELIVERY	In person	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Support of educational procedure with use of the e-class electronic platform.	
TEACHING METHODS	**Activity**	**Semester workload**
	Lectures [12 weeks x 2 hours per week]	24
	Home study	126
	Course total [25 hours per one ECTS]	**150**
STUDENT PERFORMANCE EVALUATION	Written exams and Journal Club at the end of the semester. Grading scale: 1-10. Passing grade: 5 Grading: 3 correspond to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A	

Attached bibliography

- Genes. Lewin. Oxford University press. ISBN0-19-879280-8 Έκδοση στα ελληνικά: Ακαδημαϊκές εκδόσεις, ISBN 960-88412-0-8
- Molecular Biology of the Gene: Watson JD., Baker TA., Bell SP., Gann A., Levine M., Losick R. by Cold Spring Harbor Laboratory, 7th edition. ISBN-13: 978-0321762436
- Campbell Biology: Concepts & Connections. Taylor, Martha R., et al. 9th edition. Pearson, 2017. ISBN-13: 978-0134653402

COURSE OUTLINES_2nd Semester

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE		**SEMESTER**	2nd
COURSE TITLE	**CANCER BIOLOGY - BIOMARKERS**		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures		2	5
COURSE TYPE	Specialised general knowledge		
PREREQUISITE COURSES	Biochemistry and Cellular Biology		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
URL	https://eclass.upatras.gr/courses/BIO452/		

Learning outcomes

Upon successful completion of the course, the student will have acquired knowledge of the modern approach to cancer therapy and tumor biology. He/she will be taught all the signal transduction pathways maintaining cancer invasion and metastasis that are currently considered targets for the treatment of the disease. He/she will be informed about the most important biomarkers used for the characterization of various types of solid tumors such as breast, prostate, lung, etc.

General Competences

The course material aims to understand the signaling pathways that are activated in cancer cells during the metastatic process. Furthermore, the lectures will highlight all the new therapeutic approaches, based on targeting specific molecules and biomarkers in different types of cancer.

Teaching and Learning methods-Evaluation

DELIVERY	Face to Face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Support of educational procedure with use of the e-class electronic platform.	
TEACHING METHODS	**Activity**	**Semester workload**
	Lectures (12 weeks x 2 hours per week)	24
	Home study	101
	Course total [25 hours per one ECTS]	**125**
STUDENT PERFORMANCE	Journal Club at the end of the semester. Grant proposal	

EVALUATION	application in the field of cancer research. Grading scale: 1-10. Passing grade: 5 Grading: 3 correspond to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A

Attached bibliography

- Pubmed Publications
- Cancer Biomarkers in Body Fluids: Biomarkers in Circulation by Gabriel D. Dakubo (auth.)
- Predictive Biomarkers in Oncology: Applications in Precision Medicine by Sunil Badve & George Louis Kumar

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	GBIO_BTEB4	**SEMESTER**	2nd
COURSE TITLE	**BIOCHEMISTRY OF OXIDATIVE STRESS**		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	2	5

COURSE TYPE	Specialised general knowledge
PREREQUISITE COURSES	NO. Formally, there are no prerequisite courses. Nevertheless, a good knowledge of Cellular and Molecular Biology, as well as Biochemistry is recommended.
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
URL	

Learning outcomes

The course aims to understand the biochemical mechanisms of antioxidant defense at the molecular and cellular level.

General Competences

By the end of the course, students will have understood the molecular and cellular mechanisms of antioxidant defense, and their relationship to disease and nutrition.

Teaching and Learning methods-Evaluation

DELIVERY	Face to Face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Support of educational procedure with use of the e-class electronic platform.	
TEACHING METHODS	**Activity**	**Semester workload**
	Lectures (12 weeks x 2 hours	24

	per week)	24
	Home study	101
	Course total [25 hours per one ECTS]	**125**
STUDENT PERFORMANCE EVALUATION	Written exams and Journal Club at the end of the semester. Grading scale: 1-10. Passing grade: 5. Grading: 3 correspond to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A	

Attached bibliography

- Halliwell, B., Gutteridge, J. M. C. (2015). Free Radicals in Biology and Medicine, Oxford University Press, 5th edition, pp 904

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	GBIO_BTEB10	**SEMESTER**	2nd
COURSE TITLE	**METHODOLOGY IN BIOMEDICAL RESEARCH**		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	2	5

COURSE TYPE	Specialised general knowledge
PREREQUISITE COURSES	NO
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
URL	https://eclass.upatras.gr/courses/BIO343/

Learning outcomes

The course aims at understanding basic principles of methodology and bioethics in biomedical research, with emphasis on translational research in neurodegenerative diseases and neuropsychiatric disorders. Students will develop critical thinking about the experimental design, implementation, analysis and utilization of research data, based on *in vivo* and *in vitro* models.

General Competences

At the end of the course, students will have understood the basic principles of research protocol design and development, as well as the ethics and integrity in research.

Teaching and Learning methods- Evaluation

DELIVERY	Face to Face
USE OF INFORMATION AND COMMUNICATIONS	Support of educational procedure with use of the e-class electronic platform.

TECHNOLOGY		
TEACHING METHODS	**Activity**	**Semester workload**
	Lectures (12 weeks x 2 hours per week)	24
	Home study	101
	Course total [25 hours per one ECTS]	**125**
STUDENT PERFORMANCE EVALUATION	Presentation of a research proposal at the end of the semester. Grading scale: 1-10. Passing grade: 5. Grading: 3 correspond to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A	
Attached bibliography ▪ Review papers on recent research ▪ Supportive material in eclass platform		

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	GBIO_BTEB5	**SEMESTER**	2nd
COURSE TITLE	**MICROBIAL BIOTECHNOLOGY**		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**	
Lectures	2	5	
COURSE TYPE	Specialised general knowledge		
PREREQUISITE COURSES	Good knowledge of Cellular Biology, Microbiology, Biochemistry, Molecular Biology and Genetics is recommended		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
URL	https://eclass.upatras.gr/courses/BIO450/		
Learning outcomes			
Understanding of: 1) the structure of mathematical models used in the study of microbial processes of biotechnological interest, 2) the biochemical processes related to energy production in microbial cells, 3) microbial interactions, 4) topics of biological control/biopreservation, and 5) the transfer of fundamental biological knowledge to environmental and industrial biotechnology.			
General Competences			
Upon completion of the course, students should be able to comprehend microbial processes			

of biotechnological interest, while also being capable of analyzing and presenting research data in the field of Microbial Biotechnology.		
Teaching and Learning methods-Evaluation		
DELIVERY	Face to Face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Support of educational procedure with use of the e-class electronic platform.	
TEACHING METHODS	**Activity**	**Semester workload**
	Lectures (12 weeks x 2 hours per week)	24
	Home study	101
	Course total [25 hours per one ECTS]	**125**
STUDENT PERFORMANCE EVALUATION	Written exams and Journal Club/Projects at the end of the semester. Grading scale: 1-10. Passing grade: 5. Grading: 3 corresponds to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A	
Attached bibliography ▪ Microbiology and Microbial Technology (in Greek), 2nd edition 2017, George Aggelis, UNIBOOKS Publishers, Athens ▪ Selected scientific articles published in international journals		

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	GBIO_BTEB8	**SEMESTER**	2nd
COURSE TITLE	**MOLECULAR AND CELLULAR IMMUNOBIOLOGY**		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**	
Lectures	2	5	
COURSE TYPE	Specialised general knowledge		
PREREQUISITE COURSES	NO. Formally, there are no prerequisite courses. Nevertheless, a good knowledge of Cellular and Molecular Biology, as well as Biochemistry is recommended		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
URL	https://eclass.upatras.gr/courses/BIO451/		

Learning outcomes		
The course aims at understanding the organisation and function of the immune system at the molecular and cellular level, as well as the phenomena associated with normal and abnormal functions of the immune responses.		
General Competences		
By the end of the course, students will have understood the molecular and cellular mechanisms regulating the immune system, as well as the role of the immune system in health and disease.		
Teaching and Learning methods-Evaluation		
DELIVERY	Face to Face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Support of educational procedure with use of the e-class electronic platform.	
TEACHING METHODS	**Activity**	**Semester workload**
	Lectures (12 weeks x 2 hours per week)	24
	Home study	101
	Course total [25 hours per one ECTS]	**125**
STUDENT PERFORMANCE EVALUATION	Written exams and Journal Club at the end of the semester. Grading scale: 1-10. Passing grade: 5. Grading: 3 correspond to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A	
Attached bibliography ▪ A. K. Abbas *et al.* – Cellular & Molecular Immunology [9th edition, 2017] ▪ Janeway's Immunobiology [9th edition, 2016]		

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	GBIO_BTEB9	**SEMESTER**	2nd
COURSE TITLE	**SYSTEMS BIOLOGY**		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**	
Lectures	2	5	
COURSE TYPE	Specialised general knowledge		
PREREQUISITE COURSES	NO. Formally, there are no prerequisite courses. Nevertheless, a good knowledge of Genetics, Molecular biology, Biochemistry, Cell Biology is recommended. Knowledge of informatics and/or bioinformatics is preferable.		
LANGUAGE OF INSTRUCTION and	Greek		

EXAMINATIONS	
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
URL	https://eclass.upatras.gr/courses/BIO394/

Learning outcomes

The course aims at teaching the experimental and computational methodologies of omic analyses in Systems Biology, indicating the significant opportunities, but also the relevant challenges in life sciences research, using also examples from the recent literature.

General Competences

At the end of the class, the students will have learned the principles, the capabilities and the challenges of the technologies for high-throughput biomolecular analysis (omics) at the various levels of molecular cellular function. They will be taught about methods of big biological data management and computational analysis using multivariate statistical analysis, biological databases and graph/network theory.

Teaching and Learning methods-Evaluation

DELIVERY	Face to Face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Support of educational procedure with use of the e-class electronic platform.	
TEACHING METHODS	**Activity**	**Semester workload**
	Lectures (12 weeks x 2 hours per week)	24
	Home study	101
	Course total [25 hours per one ECTS]	**125**
STUDENT PERFORMANCE EVALUATION	Homeworks throughout the course (20%), written exams (40%) and oral presentation of a recent publication (40%) at the end of the semester. Grading scale: 1-10. Passing grade: 5. Grading: 3 correspond to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A	

Attached bibliography

- Class notes in eclass. Σημειώσεις/διαφάνειες μαθήματος στο eclass.
- Publications/videos provided in eclass.
- V. Helms. Principles of Computational Cell Biology: From Protein Complexes to Cellular Networks. Wiley-Blackwell, 2008.