**COURSE OUTLINE**
**"RESEARCH METHODOLOGY - LABORATORY TRAINING IN MODERN TECHNIQUES"**

**GENERAL**

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|---|---|---|---|---|
| **SCHOOL** | LIFE SCIENCES | | | |
| **ACADEMIC UNIT** | DEPARTMENT OF MEDICINE | | | |
| **LEVEL OF STUDIES** | POSTGRADUATE, BASIC BIOMEDICAL SCIENCES (BBS) | | | |
| **COURSE CODE** | **BBE-104** | **SEMESTER** | **A** | |
| **COURSE TITLE** | RESEARCH METHODOLOGY - LABORATORY TRAINING IN MODERN TECHNIQUES | | | |
| **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 | | | 4 | 9 |
| Laboratory exercises-tutorial (analysis of techniques) | | | 2 | |
| Laboratory exercises (cell culture analysis) | | | 2 | |
| *Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).* | | | | |
| **COURSE TYPE** *general background, special background, specialised general knowledge, skills development* | Mandatory, general-specialist background course | | | |
| **PREREQUISITE COURSES:** | There are no prerequisite courses | | | |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | Greek | | | |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | | | | |
| **COURSE WEBSITE (URL)** | The lectures are offered to the students updated via e-mail | | | |

## 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*

Subject of the lesson:

In the first 2 semesters, workshops and laboratory courses are added, which as a whole has the title: "Research Methodology - Laboratory training in modern techniques". In the context of the course, modern laboratory techniques and methods that are necessary in Medical research will be presented in depth. The course consists of a mixture of cellular and molecular basic mechanisms with examples of modern technology and detection of large cellular biomolecules (DNA, RNA, Proteins) through prokaryotic and eukaryotic cell systems with an emphasis on mammalian cells and especially human cells.

This course is considered basic-specialist, because it deals with important areas of Biomedical fields (A. Genetics-Cytogenetics-Genetic Epidemiology, B. Stem cells-Gene-Cell therapy (Regenerative Medicine, C) Applied Biomedicine (Clinical Chemistry, Microbiology, Pharmacology) associated with the following:

- Culture of eukaryotic and prokaryotic cells
- Genetic Engineering Methods
- Protein Expression in Bacteria-Eukaryotic Cells
- Protein Analysis by Western Blot
- CRISPR-Cas9 technology
- Real-Time PCR method
- Monoclonal Antibodies
- Organisms - Models used in Biomedical research scientist
- Detection of nucleic acids (DNA, RNA) and proteins
- The cytoskeleton and cellular connections
- The Cell cycle
- Cell death
- The nucleus, the nuclear envelope and the circulation of molecules between the nucleus and the cytoplasm
- The organization of chromosomes
- Karyotype preparation and analysis
- The nuclear particles
- The role of siRNAs and microRNAS in gene regulation. association with diseases
- Animal models in human medicine
- Apoptosis and metabolic disorders.

Form and outcomes of teaching:

The course is taught in combination with the laboratory-tutorial exercises, which concern the above

Alongside the theory courses, selectable laboratory exercises (such as Cell Culture) are carried out with the aim of familiarizing students with techniques and methods widely used in biomedical research.

The learning objective of the research methodology-laboratory training in modern techniques and the exercises is for the student at the end of the educational program to be able to:

a) To know the modes of operation of basic cellular-molecular mechanisms and ways of managing large biomolecules (DNA, RNA, Proteins) and animal models (mice, rats).

b) To understand how the techniques of modern technology work and where they are based

c) To understand the molecular basis of some important diseases
d) To know about the animal models that he should choose and are suitable for an experimental program.

Training hours for each student: 100/exam
Education semester: A

ECTS: 9

General Skills
Search, analysis and synthesis of data and information, using the necessary technologies
Adaptation to new situations
Decision making
Autonomous work
Teamwork
Work in an international environment
Work in an interdisciplinary environment
Generating new research ideas
Respect for diversity and multiculturalism
Project planning and management Respect for the natural environment
Demonstrating social, professional and ethical responsibility and sensitivity to gender issues
Exercise criticism and self-criticism
Promotion of free, creative and inductive thinking
Search, analysis and synthesis of data and information, using the necessary technologies
Adaptation to new situations
Autonomous work
Teamwork
Work in an international environment
Work in an interdisciplinary environment
Generating new research ideas
Exercise criticism and self-criticism

[3] SUBJECT OF THE LESSON:

RESEARCH METHODOLOGY - LABORATORY TRAINING IN MODERN TECHNIQUES deals with a Selected Technology in the fields of Biomedicine. The course includes a theoretical and a practical part. The theoretical part includes the following chapters:
• Culture of eukaryotic and prokaryotic cells
• Genetic Engineering Methods
• Protein Expression in Bacteria-Eukaryotic Cells
• Protein Analysis by Western Blot
• CRISPR-Cas9 technology
• Real-Time PCR method
• Monoclonal Antibodies
• Organisms - Models used in biomedical science research

TOTAL: 26 HOURS

The laboratory part contains the Laboratories:
• Transformation of Bacteria:
Small and large scale bacterial transformation and plasmid isolation will be performed.

• Culture of eukaryotic cells

During the workshop the procedures will be presented thawing, culturing and freezing of eukaryotic cells.

• Electroporation and lipid transformation of eukaryotic cells

Transformation with a plasmid carrying the EGFP fluorescent protein will be performed. Observation and comparison of the two methods will follow in a fluorescence microscope

• DNA isolation

DNA isolation will be performed from the cultured cells.

• RNA Isolation and cDNA Generation

RNA will be isolated from the cells that cultured and cDNA formation.

• PCR and Real Time-PCR analysis

A. The isolated DNA will be templated by PCR to check the successful integration of the EGFP-carrying plasmid with specific primers.

B. At the same time, Real Time-PCR will be performed on the cDNA samples prepared in the previous laboratory and transcriptional analysis will be performed for two genes (reference and target).

Indirect immunofluorescence on cell samples which will be fixed and followed by observation of the samples under a fluorescence microscope.

• Protein analysis with Western Blot

Protein Isolation and Quantification and Western Blot Analysis

TOTAL: 26 HOURS OF LABORATORY EXERCISES

For all laboratory exercises, laboratory guides will be made for the students in which all laboratory protocols will be detailed.

[4] TEACHING AND LEARNING METHODS – ASSESSMENT

METHOD OF LESSON LECTURE

Lifelong education

The theoretical part of the course is taught through lectures (in the Lecture Halls, with direct physical presence and teacher-student interaction). Additionally, in the context of the workshops, students observe and familiarize themselves with advanced scientific research techniques.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

Presentation of slides (powerpoint slides) and video in the context of the course's delivery.

All slides and videos are posted on the University's website, asynchronous distance learning platform (e-course) and are freely accessible by students. The course slides are updated at least once a year (each academic year). Also, through the e-course, students have access to additional educational material (eg important relevant articles from the international literature).

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Communication with the students for practical issues, but also questions concerning the of the course material and their preparation for the exams, is done through the e-course platform but also through messages to the e-mail addresses of the teachers that are available. Notes, original scientific articles and historical scientific documents are sent to students' personal e-mails.

## TEACHING and LEARNING METHODS - EVALUATION

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|---|---|
| **DELIVERY**<br>*Face-to-face, Distance learning, etc.* | Lifelong education<br><br>The theoretical part of the course is taught through lectures (in the Lecture Halls, with direct physical presence and teacher-student interaction). Additionally, in the context of the workshops, students observe and familiarize themselves with advanced scientific research techniques. The laboratory part is carried out in the respective laboratories of the teaching professors and mainly in those of the Medical Department. |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY**<br>*Use of ICT in teaching, laboratory education, communication with students* | Presentation of slides (powerpoint slides) and video in the context of the course's delivery.<br>All slides and videos are posted on the University's website, asynchronous distance learning platform (e-course) and are freely accessible by students. The course slides are updated at least once a year (each academic year). Also, through the e-course, students have access to additional educational material (eg important relevant articles from the international literature). Communication with the students for practical issues, announcements, but also questions regarding a better understanding of the course material and their preparation for the exams, is done through the e-course platform (see Messages, Discussion Forum at http://ecourse.uoi.gr/course /view.php?id=209), but also through messages to the e-mail addresses of the teachers that are available. Notes, original scientific articles and historical scientific documents are sent to students' personal e-mails. |
| **TEACHING METHODS**<br>*The manner and methods of teaching are described in detail.*<br>*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.*<br><br>*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* | |
| **STUDENT PERFORMANCE EVALUATION**<br>*Description of the evaluation procedure*<br><br>*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* | Greek<br><br>Written final exam<br><br>The written exam includes:<br>Short answer questions |

| *Activity* | *Semester workload* |
|---|---|
| Lectures | 48 |
| Tutorials | 40 |
| Bibliography | 32 |
| Preparation | 30 |
| student study | 60 |
| Course total | 210 |
| | |

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|---|---|
| *examination of patient, art interpretation, other*<br><br>*Specifically-defined evaluation criteria are given, and if and where they are accessible to students.* | Questions of short development of a topic<br>Questions combining material from various chapters<br>Questions that require critical thinking/reasoning<br>Multiple choice or double choice questions<br>(The weight of the questions is weighted so that the average degree of difficulty of the set of questions is similar in each written exam) |

**ATTACHED BIBLIOGRAPHY**

*- Suggested bibliography:*

- A Molecular Approach, Volumes I & II (Book [33133232])

(The Cell: A Molecular Approach, Geoffrey M. COOPER & Robert E. HAUSMAN, Boston University, 5th Edition, 2009, SINAUER Associates, INC., MA/ASM Press Washington, D.C.), Academic Publications 2011, I. BASDRA & SIA .

*- Related academic journals:*

- Related current reviews