COURSE OUTLINE

(1) GENERAL

SCHOOL	
ACADEMIC UNIT	**Interdisciplinary Graduate Programme in the BRAIN and MIND sciences**
LEVEL OF STUDIES	7
COURSE CODE	**B&M-R-116** SEMESTER **depending on availability**
COURSE TITLE	Physiological Mechanisms of Learning and Memory

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
laboratory exercises	6	9-27
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*	Special background, skills development
PREREQUISITE COURSES:	B&M -102 Introduction to Systems Neuroscience I. Perception B&M -102A Introduction to Systems Neuroscience II. Movement & Cognitive Functions B&M -105 Introduction to Molecular and Cellular Neuroscience
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	English
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

The Laboratory of Neurophysiology and Behavior of the Department of Biology, University of Crete, focuses its research efforts on understanding the cellular mechanisms underlying cognitive functions such as working memory and long-term memory, as well as the alterations that occur under pathological conditions, such as neuropsychiatric disorders. To this end, the following methodological approaches are employed: a) Behavioral tests assessing different cognitive processes related to memory and learning in mice. b) Electrophysiological recordings in slices of mouse cerebral cortex or hippocampus for the study of intrinsic and synaptic mechanisms, synaptic plasticity, and spontaneous activity. c) Histological techniques

for the study of dendritic spines and protein expression in neurons. d) Computational simulations to investigate the activity of neural networks.

Upon completion of the laboratory exercise, the student is able to:

- Apply knowledge acquired from compulsory and elective courses of the program to design experiments and propose the optimal methodology for analyzing experimental data in order to address the research questions examined during their laboratory exercise.
- Reproduce current knowledge and theories in the field of cellular mechanisms of different types of memory.
- Apply analytical approaches described in the literature.
- Design and develop new methods for analyzing experimental data.
- Critically evaluate original literature relevant to their research topic.
- Write a research paper presenting the research hypothesis, results, and their connection to the current literature.
- Collaborate effectively with the laboratory team and contribute responsibly to the research output of the lab.
- Communicate, to both specialized and non-specialized audiences, conclusions and knowledge—potentially derived from original research, self-study, or experience—with clarity and precision.

If the laboratory exercise constitutes a thesis project, the student is additionally able to:

- Fully address research questions in the field of the exercise.
- Formulate original and innovative research questions in the field of the cellular mechanisms of memory and learning.
- Approach research questions creatively and thoroughly within the framework of their work.
- Independently generate new knowledge.
- Formulate new hypotheses and design comprehensive approaches to test them.
- Defend their research results and their implications before a specialized audience.

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…*
	…….

- 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
- Working in an international environment

- Working in an interdisciplinary environment
- Production of new research ideas
- Project planning and management
- Showing social, professional and ethical responsibility and sensitivity to gender issues
- Criticism and self-criticism
- Production of free, creative and inductive thinking

(3) SYLLABUS

Training in research methods in the field of behavior and neurophysiology, applied to the study of memory and learning processes. In particular, within the framework of the exercise, the student will be trained in some of the following:

- Care and handling of mice.
- Conduct of behavioral tests related to memory and learning (e.g., novel object recognition, object recognition with temporal order, contextual fear conditioning, delayed alternation in maze arms, and others).
- Brain removal for electrophysiological recordings.
- Cardiovascular perfusion for brain fixation.
- Conduct of extracellular recordings of neuronal population activity in slices of cerebral cortex or hippocampus.
- Use of computer programs for the acquisition and signal analysis of extracellular recordings.
- Use of computer programs for the analysis of synaptic current signals and action potential signals from patch-clamp recordings.
- Observation of patch-clamp experiments in brain slices.
- Execution of Golgi-Cox staining.
- Recording and analysis of behavioral parameters.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of publisher databases/electronic repositories of scientific articles

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*	Activity	Semester workload
	Study and analysis of bibliography	50-150
	project	100-300
	essay writing	25-75
	non-directed study	50-150
	Course total	***225-675***

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.*	Evaluation Language: English The student's dedication to conducting the study, autonomy and independence, critical review and analysis of the literature, progress over time, and the quality of the report are evaluated. Evaluation criteria are outlined in the study guide and communicated to students at the beginning of the course.

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
Scientific articles published in reputable scientific journals relevant to the research interests of the Laboratory of Neurophysiology and Behavior, Department of Biology, University of Crete.