COURSE OUTLINE

(1) GENERAL

SCHOOL	Health Sciences		
ACADEMIC UNIT	Department of Biological Applications & Technology		
LEVEL OF STUDIES	*Undergraduate*		
COURSE CODE	BEE810	**SEMESTER**	8th
COURSE TITLE	Molecular Neurobiology		

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	3
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*	Elective Course (Specialised general knowledge / Skills Development)
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	

(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*

During the past decade, a significant progress has been made in understanding the genetic and molecular basis of the development and function of the nervous system. This progress includes the identification of genes which determine with remarkable precision the mechanisms by which the neuronal cells acquire their properties, extend their axons to the appropriate targets, and form synaptic connections. The shaping of the nervous system depends on the highly regulated spatial and temporal expression of specific genes during development. This process is coordinated by strict, genetically defined molecular programs as well as by epigenetic mechanisms.

In the context of this course, after a brief introduction into the basic structure and the cellular organization of the nervous system, the students are learning the funamental principles of birth, migration and differentiation of neurons, the multifaceted actions of neurotrophins and other neurotrophic factors, the formation of synaptic contacts and the organization of the neuronal networks as well as the mechanisms of neuronal remodeling. They also hear about the current challenges in neural stem cell biology as well as the molecular mechanisms underlying the regenerative capacity of the nervous system.

After the course, the students (*according to the descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning*):

a) should have a deep understanding of the genetic and molecular processes that underpin the development and the regeneration of the nervous system,

b) will have become acquainted with the scientific strategies and experimental methodologies through which these mechanisms are determined, and

c) will be able to comprehend the value of interdisciplinary approaches in Science

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
- Working independently
- Team work
- Criticism and self-criticism
- Production of free, creative and inductive thinking

(3) SYLLABUS

1. Induction and Patterning of the Nervous System

Inductive signals control neural cell differentiation. Neural induction involves inhibition of BMP signals. Distinct morphogenetic proteins are shaping the neural plate along its dorsoventral axis. The rostrocaudal axis of the neural tube is patterned in several stages. The actions of homeotic proteins.

2. Generation and Survival of Nerve Cells

The molecular basis of neurogenesis. The role of *pro-neural* genes. Secreted factors direct the differentiation of neural crest cells into neurons and glia. Neuronal fate in the mammalian cortex is influenced by the timing of cell differentiation. The phenotype of a neuron is controlled by signals emanating from the neuronal target. Control of neuronal survival by neurotrophic factors. The multifaceted role of neurotrophins. Signal transduction by the neurotophic factor receptors.

3. Guidance of Axons to their Targets

Specific molecular cues guide the axons to their targets. The extracellular milieu provides a complex set of commands to the developing axon. Growth cones, integrins, netrins, ephrins, semapahorins. Molecules of distinct protein families interact to guide axons to their destinations.

4. Formation of Synapses and the Fine-tuning of Synaptic Connections

Dynamic interactions of neuronal cells with their targets. The role of neurotrophic factors. Synaptic regression. The recognition of synaptic targets is highly specific. Development of neural circuits and postnatal neuronal activity. Sychronous presynaptic activity enhances the release of neurotrophic factors from their target neurons. Neuronal competition and refinement of synaptic connections.

5. Regeneration of the Nervous System

Regenerative capacity of the nervous system. New neural connections can reform following nerve injury. Axonal regeneration and functional restoration. Biology of the neural stem cell.

Functional replacement of neuronal cells. Molecular mechanisms of aging. Alzheimer's Dementia.

6. Cellular and Molecular Mechanisms of Learning and Memory: Implicit and explicit memory. Elementary forms of learning: habituation, sensitization, and classical conditioning. Genetic analyses of long-term memory storage in Drosophila. The cAMP-PKA-CREB pathway. Long-term storage of explicit memory in mammals. Genetic interference with long-term potentiation is reflected in the properties of place cells in the hippocampus. Learning and changes in the somatotopic map of the brain.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face, in the lecture halls and the Lecturer's office
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of powerpoint presentations for teaching, posts for the lectures in E-course, announcements at the Department's website, direct communication with students through e-mail
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*	
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.*	*Language of evaluation*: Greek Method of evaluation: Written test (100%)

Activity	***Semester workload***
Lectures	48
Study and analysis of bibliography	27
Course total	75

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

Kandel ER, Schwartz HH, Jessell TM ***Principles of Neural Science*****, Βασικές Αρχές Νευροεπιστημών (4η αγγλική έκδοση, 1η ελληνική έκδοση), Τόμος 3**, 2006, Ιατρικές Εκδόσεις Π.Χ. Πασχαλίδης ISBN 978-960-48928-7-7