



UNIVERSITY OF CRETE



**FORTH**

FOUNDATION FOR  
RESEARCH AND  
TECHNOLOGY-HELLAS



STUDY GUIDE FOR THE MASTER'S PROGRAM "BRAIN & MIND"

Academic Year 2024-2025

**STUDY GUIDE**  
**OF THE INTERDISCIPLINARY GRADUATE PROGRAM**  
**"BRAIN AND MIND"**

**HISTORY AND PROFILE OF THE "BRAIN AND MIND" GRADUATE PROGRAM**

The "Brain and Mind" (B&M) program is an inter-institutional, interdisciplinary graduate program organized and operated by the University of Crete (UoC) in collaboration with the Foundation for Research and Technology – Hellas (FORTH). Specifically, the B&M Interdisciplinary Graduate Program involves participation from the UoC Medical School, the Departments of Computer Science, Philosophy and Social Studies, Physics, and Psychology, as well as FORTH's Institutes of Computer Science, Applied & Computational Mathematics, and Molecular Biology & Biotechnology. The B&M **started its operation in 2003** [ministerial decision approving operation 88743/B7 (Government Gazette 1537/17–10–2003)]. Subsequently, it was reformed with the Ministerial Decision No. 209765/Z1/23.10.2014 (Government Gazette B' 3606/2014) replacing the previous Ministerial Decision and was re-established by Ministerial Decision No. 5025/26.04.2018 (Government Gazette B' 1659/2018) in replacement of the previous Ministerial Decision and in application of Law 4485/2017 (Official Gazette 114 A'). Recently, necessary modifications were made (Government Gazette 1079/15–02–2024) to align with the relevant provisions of Law 4957/2022. During its operation, in addition to the changes required by the respective laws, the curriculum was reformed so that it meets the modern needs of postgraduate education.

The B&M aims at a global, integrated, interdisciplinary approach to fundamental scientific questions about the brain and the emergence of thought, consciousness and behavior. **The aim of the program is to bridge the Basic, Computational and Social Neurosciences** to ensure (1) The enhancement of postgraduate education in Greece. (2) The promotion of cutting-edge research in scientific and technological fields. (3) The preparation of scientists for excellent careers in internationally competitive research centers or as high-ranking officials in public services and the productive sector.

Investigating the mechanisms of brain function and their relationship to behavior is an interdisciplinary research field requiring approaches from Biological, Social, and Physical Sciences. The B&M includes educational and research activities that combine approaches from three scientific fields, aligning with international educational practices: (1) Biological -Cellular & Systems- Neurosciences, (2) Computational Neurosciences, Neuroinformatics, and Artificial Intelligence, (3) Social & Cognitive Neurosciences. Through lectures by distinguished scientists from Greece and abroad, guidance in in-depth study of relevant literature, practical training in distinguished research labs of collaborating UoC Departments and FORTH Institutes, and training in writing scientific texts like theses, conference abstracts, and journal articles, the B&M offers training in new research and technological developments.

The B&M was the first graduate program in Europe to provide education in Biological, Computational, and Social Neurosciences for the study of the nervous system and its products, setting an example followed by other European postgraduate programs in Neurosciences. Research fields in the B&M include Developmental Psychology, Neuropsychology, Brain Imaging, Neuroanatomy, Electron Microscopy, Neuroendocrinology, Neuropharmacology, Neurophilosophy, Neurophysiology, Neural Networks, Robotics, Artificial Intelligence, Computational Neuroscience, and Computational Vision.

As an interdisciplinary program, the B&M provides necessary interdisciplinary background in Brain and Mind Sciences to graduates from various HEI Departments and **complements the knowledge of participants**. The program's success **adds value to the educational and research activities** at the UoC Medical School, the Departments of Computer Science, Philosophy & Social Studies, Psychology, and Physics, as well as the FORTH Institutes of Computer Science, Applied & Computational Mathematics, and Molecular Biology & Biotechnology, opening new horizons beyond the main interests of the collaborating Schools/Departments and Institutes.

The program complements the knowledge of Medical School graduates with new research and technological developments related to the functioning of the Central Nervous System, the computations it performs, and the mental processes it supports. It also extends the knowledge of Computer Science graduates by grounding their understanding of artificial intelligence in the structure and function of the brain and the properties of neural networks, while sensitizing them to behavioral issues studied by Psychology and Cognitive Neuroscience. Similarly, it sensitizes Philosophy School graduates to Computational Neuroscience and the neurobiological basis of thought, offering a comprehensive approach to the Brain/Mind problem, enabling graduates to pose ambitious research questions.

### LEARNING OUTCOMES OF THE "BRAIN AND MIND" GRADUATE PROGRAM

Graduates of the B&M are expected to:

- Understand the interdisciplinary nature of Brain and Mind Sciences and have a solid knowledge base extending from neural cells to neuron networks, brain region circuits, and their interactions in the emergence of thought and behavior.
- Have theoretical and practical knowledge in a wide range of modern neuroscientific methods, from exploring cellular processes at the neuron level to recording and analyzing neuronal population activity from different brain regions in animal models, imaging human brain activity, studying and analyzing behavior, modeling brain function at various scales, developing computational algorithms, tools, and systems simulating nervous system functions.
- Possess skills in mathematics, statistics, and programming, enabling them to measure, analyze, and visualize data and results.
- Be able to evaluate experimental approaches' suitability, choose the most appropriate methods for a given problem, and combine techniques wisely to address complex scientific questions.
- Critically analyze scientific knowledge and use existing research, databases, and tools to solve scientific problems.
- Communicate their findings proficiently and convincingly, both orally and in writing, engage with experts, and contribute to discussions on current issues in Brain and Mind Sciences.
- Acquire general skills such as time and conflict management, handling stressful situations, and social skills.

### COURSES - STRUCTURE OF "BRAIN AND MIND" GRADUATE PROGRAM

The B&M **links teaching with scientific research** in the Nervous System in three main ways: a) Immersing students in primary literature through elective mandatory courses in the second year, b) Engaging students in research labs (laboratory/theoretical exercises) for at least 12 months required for the awarding of a master's degree, c) Allowing students to undertake a "Diploma Thesis" to complete the required ECTS credits for the master's degree.

Attendance in the B&M is full-time and exclusive, lasting a minimum of 4 and a maximum of 8 semesters, starting in the winter semester. Each student must attend courses and specialized laboratory/theoretical exercises to accumulate at least 120 ECTS credits. Students are required to select elective mandatory courses and specialized laboratory/theoretical exercises at the beginning of each semester.

Courses, teaching, research activities, specialized laboratory/theoretical exercises, and other educational and research activities are defined as follows:

a) **Postgraduate courses** (Title, semester, ECTS credits) listed in the following tables. The assignment of teaching duties for the B&M postgraduate courses is made by the Program Studies Committee upon the recommendation of the Coordinating Committee, or the Director of the program, as specified by current legislation. Attendance at both the core mandatory course and the elective mandatory courses

selected by the students is compulsory, and no makeup is provided. Consistent absence from educational activities leads to the student's expulsion from the B&M after a decision by the Program Studies Committee.

The core mandatory course corresponds to 36 ECTS credits and is organized into 6 modules:

<b>MODULE</b>	<b>semester</b>	<b>ECTS</b>
Molecular and Cellular Neuroscience	fall	6
Systems Neuroscience I: Perception	fall	6
Systems Neuroscience II: Movement and Cognitive Functions	fall	6
Introduction to Psychology and the Social Neurosciences	spring	6
Philosophy of Science - Philosophy of Mind	spring	6
Computational Neurosciences	spring	6

At the end of each module, students' performance is evaluated by the instructor(s) on a scale of 1-10 (5-10: sufficient, 0-4: insufficient). Evaluation is done through exams or other methods determined by the module leader. In case of failure in any module(s) of the core course, students can retake exams in September. If they fail again in even one module, they are expelled from the B&M.

Elective mandatory courses reflect the research interests and scientific specialization of the instructors, aiming to delve into contemporary research questions and methods in Brain and Mind Sciences. Each student must successfully complete elective mandatory courses totaling at least 48 ECTS credits. The maximum number of elective mandatory courses a student can enroll in per semester is five (5). A course must be selected by at least three students to be offered. Undergraduate program courses recommended by the program as elective mandatory are not recognized for graduates of the respective departments. Courses from previous studies that a student may recognize as elective courses cannot exceed 12 ECTS (25% of required elective mandatory course credits).

Elective mandatory courses belong to three general directions:

1. Biological/Systems Neurosciences
2. Computational Neuroscience
3. Social and Cognitive Neurosciences

Available elective mandatory courses are presented in the indicative table below:

<b>COURSE</b>	<b>semester</b>	<b>ECTS</b>
<b>Biological/Systems Neurosciences</b>		
Introduction to Neuroanatomy	fall	3
Synaptic interactions in the cortex	fall	6
Introduction to experimental methods in neuroscience	fall	6
Introduction to Molecular Neurobiology	fall	6

Cerebral cortex: Perception and Movement	fall	9
Molecular Cellular Neuroendocrinology	spring	6
Cellular mechanisms of learning and memory	spring	6
Oculomotor Control	spring	9
Computational Neuroscience		
Introduction to Statistics and programming in Matlab	fall	3
Introduction to Artificial Intelligence	fall	9
Introduction to Human-Computer Interaction	fall	12
Autonomous Robotic Navigation	fall	12
Biomimetic Robotics	fall	12
Neural networks	spring	12
Neural networks and learning of hierarchical representation	spring	6
Introduction to signal processing with applications in the analysis of discrete and continuous neural signals	spring	6
Brain network analysis and modeling	spring	6
Principles of computational modeling in neural circuits	spring	6
Brain connectivity analysis using EEG/MEG	spring	6
Machine Learning	spring	12
Computational Vision	spring	12
Social and Cognitive Neurosciences		
Principles of Functional Imaging of Brain Mechanisms applied to fMRI Data	fall	9
Philosophy of Science	fall	6
Foundations of cognitive science and unified theories of cognitive systems	fall	6
Introduction to the Philosophy of Perception	spring	6
Naturalization and Normativity	spring	6
Research in Developmental Psychology	spring	4

At the end of each module, students' performance is evaluated by the instructor(s) on a scale of 1-10 (5-10: sufficient, 0-4: insufficient). Evaluation is done through exams or other methods determined by the course leader. Students who fail in three or more courses are expelled from the B&M.

b) At least 2 specialized laboratory or theoretical **rotations** [Titles are provided in the following table] during which the student actively participates in the activities (meetings, literature reviews, participation in a research program) of the research groups involved in the B&M. These rotations aim to familiarize the students with the research process and help them choose their future research topic, depending on the available research subjects, their interests, and their inclinations. The selection of rotation is made by the students in consultation with their advisor. Each rotation lasts at least 3 months, and their total duration is at least 12 months. One month (120 hours of work) corresponds to three (3) ECTS. Consequently, each

student must accumulate at least 36 ECTS from mandatory attendance (minimum of 12 months) of rotations. The performance of the student in each rotation is graded (on a scale of 0-10) by the rotation supervisors who submit a relevant report to the Program Studies Committee. In case of failure (0-6) in a rotation, the student must choose another one.

Available rotations are presented in the indicative table below:

<b>ROTATIONS</b>
Biological/Systemic Neurosciences
Neurophysiology of visual perception and attention
Immunohistochemistry and Electron Microscopy
Quantum Phenomena in Biological Systems
Motor and Cognitive Neurophysiology
Physiological Mechanisms of Learning and Memory
Neurogenetics and aging
Cellular biology and pathophysiology of the retina
Cortical circuit function in object recognition
Molecular Neurobiology
Computational Neuroscience
Computational Vision
Neural networks
Brain Circuits
Computational Neuroscience
Computational Neuroscience and Neuro-oncology
Robotics
Machine learning and statistical analysis of bio -medical data
Deep Machine Learning for 3D Computer Vision and Image Composition
Social and Cognitive Neurosciences
Contemporary Philosophy of Mind
Philosophy of Perception
Philosophy of Mind
Neuropsychological assessment
Philosophy of Science
Developmental psychology

c) Attendance and participation in research group seminars and literature review discussions or other scientific events of the B&M (e.g., annual progress presentations of PhD candidates, research seminars of B&M faculty and other invited speakers).

d) **Dissertation:** Instead of attending a six-month rotation and 2 elective mandatory courses (6 ECTS each) or 1 of 12 ECTS, and to accumulate 30 credits, the student may choose to undertake a dissertation. This includes at least one original question posed by the student and a thorough literature review of the question and the methodology to be used to answer it. The Program Studies Committee, after the candidate's application, which includes the title and summary of the dissertation and the proposed supervisor, appoints the supervisor and the two members of the three-member examination committee. In exceptional cases of loss, objective inability to perform supervision duties, or other significant reasons, the supervisor or a member of the Three-Member Examination Committee can be replaced by a decision of the Program Studies Committee. The dissertation is defended before the three-member examination committee. The student can write the dissertation in Greek or English. After completing the dissertation, the student submits copies to the supervisor and the other two members of the Three-Member Examination Committee. If there is a positive evaluation from the Three-Member Examination Committee, the date for the public defense/evaluation of the dissertation is set by the Program Studies Committee. The extent and depth of the oral examination during the defense depend on the presentation format of the dissertation. After the presentation - defense of the dissertation, the Examination Committee drafts and signs a report of the public presentation of the dissertation, including any observations or comments and the final grade. In case of a negative evaluation, the dissertation can be resubmitted within two months, after the student improves it according to the comments of the Three-Member Examination Committee. The final complete copy of the dissertation is submitted to the library of the University of Crete after acceptance.

e) **Comprehensive examinations:** After successfully passing the courses and completing the required rotation, each postgraduate student is orally examined on 3 research topics determined by a three-member Examination Committee in consultation with the student. The students must, within a month of completing their requirements, in collaboration with their advisor, propose, to the Director, members of the B&M for the composition of the Examination Committee. The Examination Committee cannot consist solely of the supervisors of the rotations the student completed during the studies. If the student has undertaken a dissertation, the dissertation supervisor cannot be part of the Examination Committee. The Director, considering the student's proposal and the availability of B&M members, proposes the composition of the Examination Committee to the Program Studies Committee. The comprehensive examinations must be completed within 6 months from the date of the composition of the Examination Committee. An extension is granted only in exceptional cases by decision of the Program Studies Committee. Failure to complete the examination within the specified time leads to the postgraduate student's dismissal from the B&M. The student's performance in the 3 research topics is graded separately on a scale of 0-10, and to be considered successful, they must score at least 7 in each topic. In case of failure, even in one of the three topics, the entire examination is repeated. In case of a second failure, even in one of the three topics, the student is dismissed from the B&M.

In summary, to be awarded a Master's Degree from the B&M, the student must:

- i) Have successfully attended the core course.
- ii) Have completed at least 2 rotations lasting 12 months or have completed one rotation and undertaken a dissertation.
- iii) Have accumulated at least **120 ECTS**.
- iv) Have successfully participated in the comprehensive examinations.

The final diploma grade is calculated by considering the average grade of the core course and the elective mandatory courses successfully completed by the student (multiplied by the weighting factor reflecting the ECTS credits of each course). For the dissertation a weighting factor of 12 ECTS is used.

The maximum duration of study in the Program cannot exceed twice the normal duration, i.e., 4 years.

A small number of students may be granted scholarships if the financial resources of the program allow. To this end, the candidates' performance in the courses and their research experience are taken into account.

Disciplinary offenses may lead to the postgraduate student's dismissal from the B&M after a decision by the Program Studies Committee.

The Master's Degree is awarded to the student in an official ceremony held at the Department/School, which provides administrative support to B&M at regular intervals.



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## USEFUL LINKS

### **Official Website of Student Affairs of the University of Crete**

<https://www.Merimna.uoc.gr/index.php/en/>

### **University of Crete Student Counseling Center**

<https://skf.uoc.gr/index.php/en/>

### **University of Crete student advocate**

<https://www.uoc.gr/studies-at-uni/tutor/synigoros.html>

### **Gender Equality Committee of the University of Crete**

<https://www.eif.uoc.gr/index.php/en/>

### **Interconnection and Career Structure of the University of Crete**

<https://career.uoc.gr/>