UNIVERSITY OF CRETE

FOUNDATION FOR RESEARCH AND TECHNOLOGY-HELLAS

INTERDISCIPLINARY GRADUATE PROGRAMME IN THE SCIENCES

BRAIN & MIND

# STUDY GUIDE

# FOR THE MASTER'S PROGRAM IN "BRAIN & MIND SCIENCES"

Academic Year 2025-2026

**STUDY GUIDE**

**OF THE INTERDISCIPLINARY GRADUATE PROGRAM in**

**"BRAIN AND MIND Sciences"**

## HISTORY AND PROFILE OF THE "BRAIN AND MIND Sciences" GRADUATE PROGRAM

The MSc in "Brain and Mind Sciences" (MSc B&M) 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 MSc B&M 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 MSc 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 MSc 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 MSc 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 MSc B&M offers training in new research and technological developments.

The MSc 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 MSc 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 MSc 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 Sciences" GRADUATE PROGRAM

Graduates of the MSc 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 Sciences" GRADUATE PROGRAM

The MSc 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 MSc 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 MSc B&M postgraduate courses is made by the Program Committee upon the recommendation of the Steering 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 MSc B&M after a decision by the Program Committee.

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

| MODULE | semester | ECTS |
|---|---|---|
| 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 MSc 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:

| COURSE | semester | ECTS |
|---|---|---|
| Biological/Systems Neurosciences | | |
| 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 MSc 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 MSc 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 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:

| **ROTATIONS** |
|---|
| 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 MSc B&M (e.g., annual progress presentations of PhD candidates, research seminars of MSc 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 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 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 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 MSc 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 MSc B&M members, proposes the composition of the Examination Committee to the Program 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 Committee. Failure to complete the examination within the specified time leads to the postgraduate student's dismissal from the MSc 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 MSc B&M.

In summary, to be awarded a Master's Degree from the MSc 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 MSc 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 MSc B&M at regular intervals.

## FACULTY OF "BRAIN AND MIND Sciences" GRADUATE PROGRAM

**Antypa Despina**, Postdoctoral Fellow, University of Crete & ICS-FORTH, e-mail address

**Argyros Antonis**, Professor of Computer Science, Computer Science Department, University of Crete & ICS-FORTH, e-mail address

**Athanasiou Grigoris**, Assistant Professor of Theoretical Physics, Dept. of Physics, University of Crete, e-mail address

**Charalampopoulos Ioannis**, Professor of Pharmacology, School of Medicine, University of Crete & IMBB-FORTH e-mail address

**Chavlis Spiros**, Postdoctoral Fellow IMBB-FORTH e-mail address

**Dalezios Yannis**, Associate Professor of Physiology, School of Medicine, University of Crete, e-mail address

**Dermitzaki Eirini**, Tenure scientist-EDIP, School of Medicine, University of Crete, e-mail address

**Economou Elias**, Assistant Professor of Cognitive Psychology, Dept. of Psychology, University of Crete, e-mail address

**Frankish Keith**, Honorary Professor, Department of Philosophy, The University of Sheffield, UK, e-mail address

**Froudarakis Emmanouil**, Assistant Professor of Physiology-Neurophysiology, School of Medicine, University of Crete & IMBB-FORTH, e-mail address

**Gelepithis A. M. Petros**, Ex University Professor, AI & Cognitive Science. Ex Academic Visitor Faculty of Philosophy, University of Oxford. Adjunct Faculty Member, Brain & Mind Sciences, University of Crete, e-mail address

**Gregoriou G. Georgia**, Professor of Physiology, School of Medicine, University of Crete, & IACM-FORTH, e-mail address

**Hourdakis Emmanouil**, Postdoctoral Fellow ICS-FORTH, e-mail address

**Kavroulakis Eleftherios**, Postdoctoral Fellow, School of Medicine, University of Crete, e-mail address

**Kapsetaki Marianna**, Neurosurgery Resident, e-mail address
**Kokkinaki Theano**, Professor of Developmental Psychology, Dept. of Psychology, School of Social Sciences, University of Crete, e-mail address

**Kominis Iannis**, Associate Professor, Department of Physics, University of Crete, e-mail address

**Komodakis Nikos**, Assistant Professor, Computer Science Department, University of Crete & IACM-FORTH, e-mail address

**Maniadakis Mihalis**, Postdoctoral Researher, ICS-FORTH, e-mail address

**Maris Thomas,** Professor of Medical Physics, School of Medicine, University of Crete, e-mail address

**Moschovakis Adonis**, Professor Emeritus of Physiology, School of Medicine, University of Crete & IACM-FORTH, e-mail address

**Mastrotheodoros Stefanos**, Assistant Professor of Developmental Psychology, Dept of Psychology, University of Crete, e-mail address

**Papadopouli Maria**, Professor, Computer Science Department, University of Crete & ICS-FORTH, e-mail address

**Papoutsi Athanasia**, Staff Scientist, IMBB-FORTH, e-mail address

**Plainis Sotiris**, Research Fellow, Vardinoyiannion Eye Institute of Crete (VEIC), Faculty of Medicine, University of Crete, e-mail address

**Poirazi Panayiota,** Research Director, IMBB-FORTH, e-mail address

**Raos Vassilis,** Professor of Physiology, School of Medicine, University of Crete & IACM-FORTH, e-mail address

**Roussos Anastasios**, Principal Researcher, Institute of Computer Science, FORTH, e-mail address

**Sakkalis Vangelis,** Principal Investigator, Institute of Computer Science, FORTH, e-mail address

**Sapountzis Panos,** Postdoctoral Fellow School of Medicine, University of Crete & IACM-FORTH, e-mail address

**Savaki Helen,** Professor Emerita of Physiology, School of Medicine, University of Crete and IACM-FORTH, e-mail address

**Sidiropoulou Kyriaki**, Associate of Neurophysiology, Dept. of Biology, School of Natural Sciences, University of Crete & IMBB-FORTH, e-mail address

**Simos Panagiotis,** Professor of Developmental Neuropsychology, School of Medicine, University of Crete, & ICS- FORTH, e-mail address

**Stephanidis Constantine,** Professor of Computer Science, University of Crete, & ICS-FORTH, e-mail address

**Tavernarakis Nektarios,** Professor of Systems Biology, School of Medicine, University of Crete & IMBB-FORTH, e-mail address

**Theodorou Panos,** Professor of Philosophy, Dept. of Philosophy and Social Studies, University of Crete, e-mail address

**Trahanias Panos,** Professor of Computer Sciences, University of Crete & ICS-FORTH, e-mail address

**Tsakiris Dimitris,** Research Scientist, ICS-FORTH, e-mail address

**Tsamardinos Ioannis**, Professor, Computer Science Department, University of Crete & IACM-FORTH e-mail address

**Tsilimbaris Miltiadis,** Professor of Ophthalmology, School of Medicine, University of Crete, e-mail address

**Tsinorema Stavroula,** Professor of Philosophy, Dept. of Philosophy and Social Studies, University of Crete, e-mail address

**Vassiliou Fotini,** Postdoctoral fellow Dept. of Philosophy and Social Studies, University of Crete, e-mail address

**Venieri Maria,** Associate Professor of Philosophy, Dept. of Philosophy and Social Studies, University of Crete, e-mail address

**Venihaki Maria**, Associate Professor in Clinical Chemistry, School of Medicine, University of Crete e-mail address

## 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/