

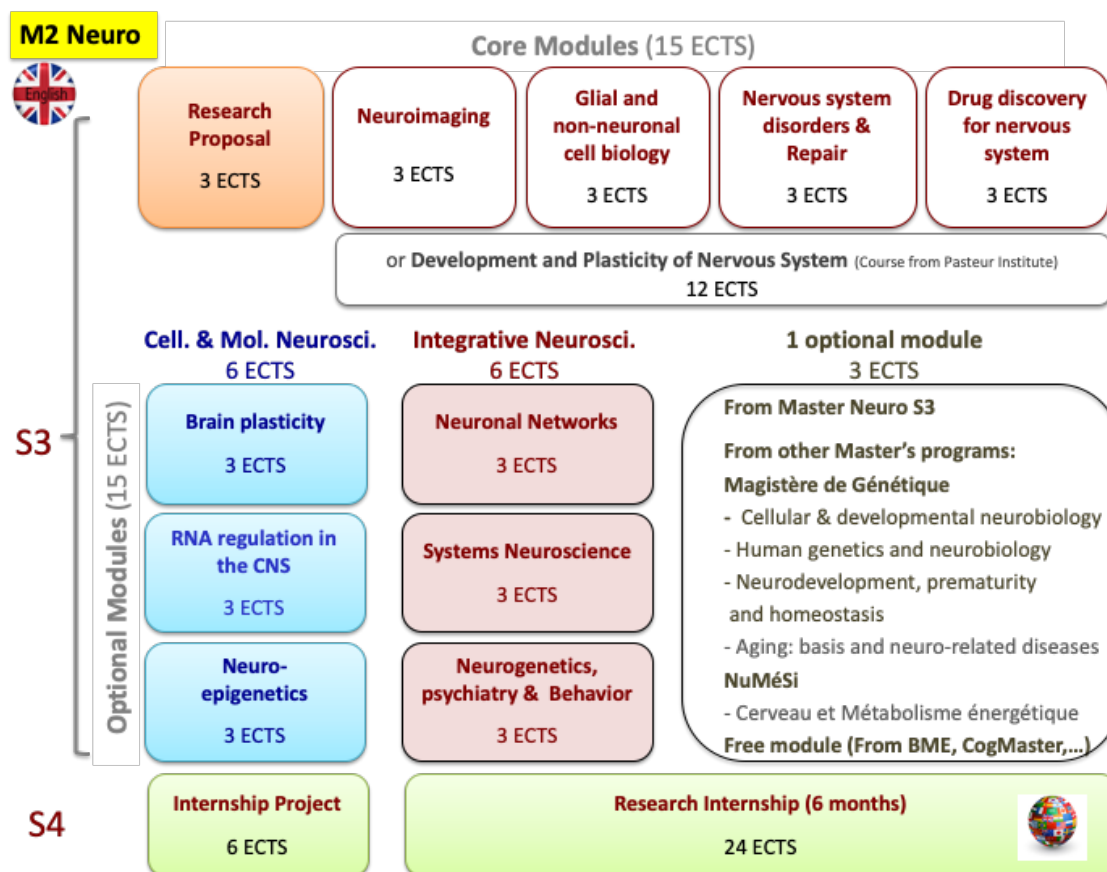
MASTER'S PROGRAM IN NEUROSCIENCE

Second year M2

List of modules at a glance

Courses are taught in **English**. In addition to core modules (15 ECTS), each student has to validate 6 ECTS in **cellular and molecular neuroscience**, and 6 ECTS in **integrative neuroscience**. Optional modules are offered in each specialization.

Specific optional modules (3 ECTS) from other Master's programs are also offered (see below). Keep in mind that the timetable compatibility between different Master's programs and the number of places available per module are subject to change each academic year.



S3: Semester 3; **S4:** Semester 4; **ECTS:** European Credit Transfer and Accumulation System

MASTER NEURO M2

COURSE OUTLINE



Course Title: Research proposal

Course(s) supervisor(s):

Title: Prof. Université Paris Cité

First name: Mehrnaz

LAST NAME: JAFARIAN-TEHRANI

Title: PR Université Paris Cité

First name: Isabelle

LAST NAME: CAILLE

Total number of hours: few practical sessions, mainly personal and team working

Number of ECTS: 3

Semester: Semester 3 (M2)

Description: To be able to write and defend a research proposal over 3 years based on a scientific publication, and fictive collaborations through interactions with the scientific community, researchers and engineers in research labs or technical facilities. The student has to write a proposal according to the instructions given at the beginning of the semester and finally be able to defend the proposal in front of a Jury.

Exact location: Campus Saint-Germain-des-Prés, UFR Basic and Biomedical Sciences, 45 rue des Saints-Pères, 75006 Paris

Mandatory course

Prerequisites/skills needed: M1 Neuroscience (UE Methodologies in Neuroscience S1 and S2)

Key words: Research project; experimental design; scientific report; scientific collaboration

Teaching methods and activities: personal/team working (to be proactive and interactive with researchers/engineers)

Assessment: written report and defense

MASTER NEURO M2

COURSE OUTLINE



Course Title: Neuroimaging

Course(s) supervisor(s):

Title: MCU Université Paris Cité

First name: Clément

LAST NAME: RICARD

Total number of hours: 24h

Number of ECTS: 3

Semester: Semester 3 (M2)

Description: Give an overview of the different neuroimaging techniques and approaches from the researcher, clinician and industrial point of view.

Exact location: Campus Saint-Germain-des-Prés, UFR Basic and Biomedical Sciences, 45 rue des Saints-Pères, 75006 Paris

Mandatory course

Prerequisites/skills needed: Knowledge in neuroanatomy (attending the M1 « Neuroanatomie fonctionnelle » course is not mandatory but recommended).

Key words: Neuroimaging, Optics, MRI, CT-Scan, Ultrasound, Nuclear imaging

Teaching methods and activities: lectures (CM) Practical sessions (TD)

Assessment: continuous assessment and exam

MASTER NEURO M2

COURSE OUTLINE



Course Title: Glial and non-neuronal cell biology

Course(s) supervisor(s):

Title: PR Université Paris Cité

First name: Charbel

LAST NAME: MASSAAD

Title: MCU Université Paris Cité

First name: Delphine

LAST NAME: MEFFRE

Total number of hours: 24h

Number of ECTS: 3

Semester: Semester 3 (M2)

Description: The aim of this teaching unit is to learn the recent advances in glial biology and glial and non-glial cell interactions. Besides the main courses, tutorials will guide the students to perform innovative academic project based on the topics developed during the main lectures.

Exact location: Campus Saint-Germain-des-Prés, UFR Basic and Biomedical Sciences, 45 rue des Saints-Pères, 75006 Paris

Mandatory course

Prerequisites/skills needed: cellular and molecular neurobiology, electrophysiology

Key words: schwann cell, astrocyte, oligodendrocyte, microglia, endothelial cell, neurovascular unit, cell interaction, neuron-glia interaction

Teaching methods and activities: lectures (CM) Practical sessions (TD)

Assessment: continuous assessment and exam

MASTER NEURO M2

COURSE OUTLINE



Course Title: Drug Discovery for Nervous system

Course(s) supervisor(s):

Title: CR CNRS

First name: Nicolas

LAST NAME: MARIE

Total number of hours: 24h

Number of ECTS: 3

Semester: Semester 3 (M2)

Description: Neuropharmacology is the study and understanding of the actions of chemical agents on neurobiological processes in nervous system. Students will discover the recent advances in neuropharmacology and some aspects of the development of drugs for the nervous system regarding medical specialties.

Exact location: Campus Saint-Germain-des-Prés, UFR Basic and Biomedical Sciences, 45 rue des Saints-Pères, 75006 Paris

Mandatory course

Prerequisites/skills needed: Strong background in physiology and neuropharmacology

Key words: Optopharmacology, drug development, biased ligands, drug delivery

Teaching methods and activities: lectures (CM) Practical sessions (TD)

Assessment: continuous assessment and exam

MASTER NEURO M2

COURSE OUTLINE



Course Title: Nervous system disorders and repair

Course(s) supervisor(s):

Title: PR Université Paris Cité

First name: Mehrnaz

LAST NAME: JAFARIAN-TEHRANI

Title: MCU Université Paris Cité

First name: Aude

LAST NAME: MARZO

Total number of hours: 24h

Number of ECTS: 3

Semester: Semester 3 (M2)

Description: Recent advances in the pathophysiology of nervous system disorders including neurodegenerative diseases, psychiatric disorders, movement disorders, pathologies of myelin, brain and spinal cord injuries and cerebrovascular diseases. Some aspects of nervous system repair are taught related to neuroprotection, physical exercise and brain stimulation.

Exact location: Campus Saint-Germain-des-Prés, UFR Basic and Biomedical Sciences, 45 rue des Saints-Pères, 75006 Paris

Mandatory course

Prerequisites/skills needed: Neurobiology, neuroanatomy

Key words: CNS disorders, Psychiatric disorders, Parkinson, Alzheimer, Huntington, Prion diseases, cerebrovascular diseases, stroke, brain injury, spinal cord injury, multiple sclerosis, movement disorders ALS, SMA

Teaching methods and activities: lectures (CM) Practical sessions (TD)

Assessment: continuous assessment and exam

MASTER NEURO M2

COURSE OUTLINE



Course Title: Brain Plasticity

Course(s) supervisor(s):

Title: PR Université Paris Cité

First name: Isabelle

LAST NAME: CAILLE

Title: DR INSERM

First name: Thierry

LAST NAME: GALLI

Total number of hours: 24h

Number of ECTS: 3

Semester: Semester 3 (M2)

Description: This class is based on controversies in the wide field of Brain Plasticity. The first theme we tackled was the existence of adult neurogenesis in the human brain. In subsequent years, we delved into the pros and cons of a revolutionary technique: brain organoids. The themes will evolve in the future. The modus operandi is first to listen (via zoom or in person) to about 8 experts of the field then to form two groups of students, who will defend two opposite views during a debate they took time to prepare collectively.

This class is meant to encourage active participation, critical thinking, analytical skills and the ability to articulate a point of view on a cutting-edge topic in the field of brain plasticity.

Exact location: Campus Saint-Germain-des-Prés, UFR Basic and Biomedical Sciences, 45 rue des Saints-Pères, 75006 Paris

Optional course

Prerequisites/skills needed: Knowledge in cellular and molecular neurobiology, will to actively participate

Key words: controversy-based teaching, adult neurogenesis, brain organoids, brain plasticity

Teaching methods and activities: lectures (CM) Practical sessions (TD)

conferences, debate preparation by students, debate

Assessment: continuous assessment (debate) and written exam

MASTER NEURO M2

COURSE OUTLINE



Course Title: RNA regulation in the CNS

Course(s) supervisor(s):

Title: MCU Université Paris Cité

First name: Laure

LAST NAME: WEILL

Total number of hours: 24h

Number of ECTS: 3

Semester: Semester 3 (M2) ☒

Description: The course provides an in-depth knowledge on RNA metabolism and RNA regulation and its role in neurobiology: brain development and cell differentiation, plasticity and how RNA dysregulation can lead to different neuropathology.

Exact location: Campus Saint-Germain-des-Prés, UFR Basic and Biomedical Sciences, 45 rue des Saints-Pères, 75006 Paris

Optional course ☒

Prerequisites/skills needed: Molecular Biology

Key words: Ribonucleopathy (splicing disease), RNA localization, local translation, non coding RNA, mRNA bodies

Teaching methods and activities: lectures (CM) ☒ Practical sessions (TD) ☒

Assessment: continuous assessment and exam

MASTER NEURO M2

COURSE OUTLINE



Course Title: Epigenetic, development and brain integrity

Course(s) supervisor(s):

Title: DR CNRS

First name: Valérie

LAST NAME: MEZGER

Title: PR Université Paris Cité

First name: Délara

LAST NAME: SABERAN-DJONEIDI

Title: MCU Université Paris Cité

First name: Véronique

LAST NAME: DUBREUIL

Total number of hours: 24h

Number of ECTS: 3

Semester: Semester 3 (M2)

Description: The course aims at providing in-depth research-based knowledge about the epigenetic processes that govern behaviors and brain functions. The student will appreciate how basic epigenetic mechanisms tightly regulate brain development, neural cell differentiation and brain integrity, and how the perturbation of normal epigenetic processes lead to a wide spectrum of neurodevelopmental and neuropsychiatric disorders. Moreover, special focus will be put on the impact of environmental insults on the neural epigenome and neural cell fate during development and in a lifetime manner, to the protective responses, which underlies the proper brain functions.

Exact location: Campus Saint-Germain-des-Prés, UFR Basic and Biomedical Sciences, 45 rue des Saints-Pères, 75006 Paris

Optional course (maximum 16 students)

Prerequisites/skills needed: brain development, molecular and cellular biology

Key words: Epigenome, neurodevelopment, brain integrity, NGS, cohort analysis, neurodegenerescence

Teaching methods and activities: lectures (CM) Practical sessions (TD)

Assessment: continuous assessment and exam

MASTER NEURO M2

COURSE OUTLINE



Course Title: Neuronal Networks

Course(s) supervisor(s):

Title: MCU Université Paris Cité

First name: Aude

LAST NAME: MARZO

Total number of hours: 24h

Number of ECTS: 3

Semester: Semester 3 (M2)

Description: “Neuronal Networks” aims at exploring relationship between neurons, mainly through synapses and synchronous neuronal activation, as found in ensembles (or engrams). A strong focus is put on the large panel of synaptic plasticity, described in various systems (cortical, cochlear, spinal, hippocampal), supporting many functions (association, coordination, memory).

Exact location: Campus Saint-Germain-des-Prés, UFR Basic and Biomedical Sciences, 45 rue des Saints-Pères, 75006 Paris

Optional course

Prerequisites/skills needed: Master 1 in Neuroscience ; good understanding of cellular electrophysiology

Key words: synaptic plasticity; dendritic integration; learning and memory

Teaching methods and activities: lectures (CM) Practical sessions (TD)

Assessment: continuous assessment and exam

MASTER NEURO M2

COURSE OUTLINE



Course Title: Systems and integrative Neuroscience

Course(s) supervisor(s):

Title: DR CNRS

First name: Mathieu

LAST NAME: BERANECK

Total number of hours: 24h

Number of ECTS: 3

Semester: Semester 3 (M2)

Description: the goal of the *Systems and Integrative Neuroscience* course is to provide the student the basic knowledge regarding the methodologies and approaches used to study functional neural systems. The course brings together teachers and researchers who are studying different functions on various species. They all work to understand how functions emerge by studying their respective systems at different levels with a so-called integrative approach. For each system we will consider the role of the electrophysiological properties of the neurons, of the properties that emerge from neural networks and microcircuits, and relate these properties to quantified behaviours through modeling.

Exact location: Campus Saint-Germain-des-Prés, UFR Basic and Biomedical Sciences, 45 rue des Saints-Pères, 75006 Paris

Optional course

Prerequisites/skills needed: Master 1 in Neuroscience; basic knowledge regarding sensory and motor systems; basic knowledge about cellular electrophysiology

Key words: multisensory integration; sensory systems; motor systems; sensorimotor; balance; orientation & navigation; basal ganglia-thalamus-cortical loop; cerebellum; oculomotor systems; electrophysiological intrinsic properties and synaptic properties; microcircuits; models of action selection; models of learning; statistical models; principle of maximum likelihood; bayesian models; initial theories; memory & learning; Hebb theory and experimental demonstrations

Teaching methods and activities: lectures (CM) Practical sessions (TD)

Assessment: continuous assessment and exam

MASTER NEURO M2

COURSE OUTLINE



Course Title: Neurogenetics, psychiatry and behavior

Course(s) supervisor(s):

Title: CR INSERM

First name: Nicolas

LAST NAME: RAMOZ

Total number of hours: 24h

Number of ECTS: 3

Semester: Semester 3 (M2)

Description: This course aims to explain the interface between basic research in neuroscience, through different strategies, especially molecular biology of genetics, epigenetics and pharmacogenetics, and clinical research to understand behavior and psychiatric disorders. It also aims to present clinical research in order to show its contribution to the understanding of psychiatric diseases and the interest of developing translational research. In the end, this course aims to show by practical examples the interest of neuropsychiatric domains in the understanding of normal and pathological behaviors.

Exact location: Campus Saint-Germain-des-Prés, UFR Basic and Biomedical Sciences, 45 rue des Saints-Pères, 75006 Paris

Optional course

Prerequisites/skills needed: M1 in science with a good understanding in fundamental neuroscience, genetics or molecular biology or M1 in health with the medical practice in neuroscience, psychiatry or pharmacology.

Key words: addiction, brain molecular biology, Epigenetics, Genetics, human behavior, psychopharmacogenetics, translational psychiatry

Teaching methods and activities: lectures (CM) Practical sessions (TD)

Assessment: continuous assessment and exam

MASTER NEURO M2

COURSE OUTLINE



Course Title: Internship project and Research Internship

Course(s) supervisor(s):

Title: PR Université Paris Cité

First name: Mehrnaz

LAST NAME: JAFARIAN-TEHRANI

Title: PR Université Paris Cité

First name: Isabelle

LAST NAME: CAILLE

Title: PR Université Paris Cité

First name: Nicolas

LAST NAME: GUEROUT

Total number of hours: 5 to 6-month internship

Number of ECTS: 6 ECTS (Internship project) + 24 ECTS (Research internship)

Semester: Semester 4 (M2)

Description: An overall five to six-month internship is required to validate the M2 level. Before starting the internship, students have to present and defend their internship project (6 ECTS) at the beginning of semester 4. They have to contact their internship supervisor during semester 3 and spend time with the host research team in order to understand their research project.

Exact location: Research teams in France or abroad, but mainly research teams affiliated to the Paris University (see Master Neuro internship offers).

Mandatory course

Prerequisites/skills needed: Master Neuro S3

Key words: Research teams, Europe, International, CNRS, INSERM, IPNP, Neurodiderot, Cochin, Necker, BFA, Institut Imagine, Campus Saint-Germain des Prés, Institut Pasteur

Teaching methods and activities: Experimental work attending the neuroscience seminars

Assessment: written report and defense