iMIND

International Master In Neurodegenerative Diseases

PARIS

2025-2026

SCIENCES SORBONNE UNIVERSITÉ

Paris Brain Institute ICM

Search, find, cure, for you, with you

iMIND
International Master In Neurodegenerative Diseases

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SCIENCES SORBONNE UNIVERSITÉ

bip MASTER biologie intégrative et physiologie

ICM Paris Brain Institute Search, find, cure, for you, with you

iMIND
International Master In Neurodegenerative Diseases

Specialized and selective track of the **Master Neuroscience** (year 2), developed with the **Paris Brain Institute**

The first masters programme to focus specifically on neurodegenerative disorders

Recruits students who wish to understand the functioning of the brain in normal and pathological conditions

Coursework (30 ECTS), Msc second year, first semester

Main specific courses (4 x 6 ECTS)

- Novel Technologies applied to Human Neuropathologies
- Developing a Research Project
- Hot Topics: Transdisciplinary Approaches in Neurodegenerative and Psychiatric Diseases
- Glial Pathologies and Neurodegenerative Diseases

Specialization coursework (6 ECTS)

Brain to Market Summer School (6 ECTS) **OR** 1 module from each series of specialized short courses (2 x 3 ECTS) **OR** 1 module from one of the specialized short courses & the course "Neurodegenerative diseases and abnormal movements 1: clinical and therapeutic aspects" from EPHE (2 x 3 ECTS)

Specialized short courses:

Series 1
- Hippocampus: from cells to physiology and human pathology
- Spatial navigation and memory

Series 2
- New Methods for Behavioral and Cognitive Explorations
- Neuron-glia interactions
- Neuropsychiatry genetics
- Cerebellum : From Cells and Circuits to Motor and Cognitive Behaviors

- **Research**-oriented programme (medical, scientific, R&D…), entirely taught in **English**
- **Involvement of numerous researchers and technological platforms from the Paris Brain Institute**, as well as other neuroscience institutes in Paris (NeuroSU, Collège de France, Pasteur Institute, etc.).
- **Flexibility** allowed regarding course choices *(access to Neurosciences master modules)*

Up to 5 scholarships (1200 €/month) offered to international students for the first semester upon selection

Master's thesis (30 ECTS), Msc second year, second semester

The master's thesis is a 5 to 6 months internship that can be done in France or abroad.

iMIND is designed to teach the latest scientific advances in the field of neurodegenerative diseases and to stimulate scientific curiosity, creativity, autonomous and team work, as well as critical thinking.

Prerequisites: first year of Msc (M1) level in neurosciences, biology or equivalent

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HOT TOPICS: TRANSDISCIPLINARY APPROACHES TO NEURODEGENERATIVE AND PSYCHIATRIC DISEASES

Students will develop a research project under the supervision of an expert tutor in the field, **a cross between research and library project**.

Project topics will cover **the latest advances in neurosciences**, specifically regarding neurodegenerative or psychiatric pathologies as well as cutting-edge technologies.

Students will be exposed to notions of fundamental, translational and clinical research by attending **conferences at the Paris Brain Institute,** where they will participate to discussions with the international scientists presenting.

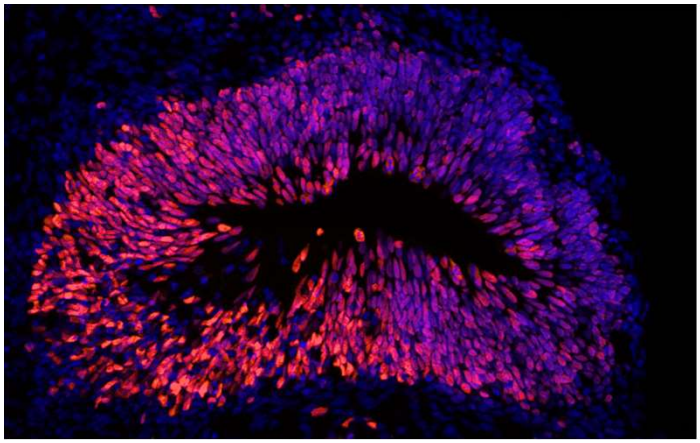
➔ Exposure to the multidisciplinary aspects of neurodegenerative and psychiatric diseases research

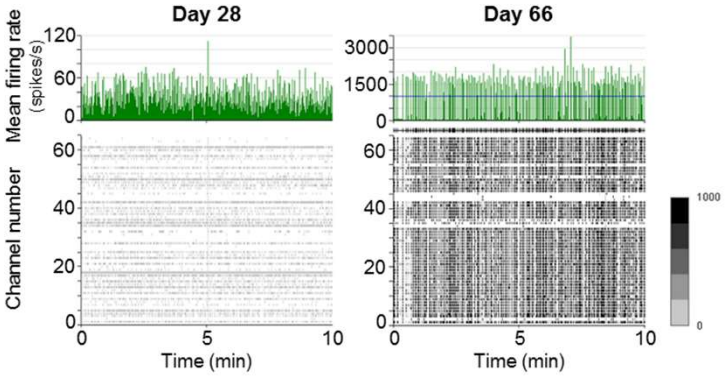
➔ Participation in discussions with international experts *via* the **Paris Brain Institute conference series** which is integrated into the programme

➔ **Tutorship with scientists from the Paris Brain Institute and the Neuroscience Paris Seine Institute** to develop a research project

- ✓ Critically analyse the scientific literature
- ✓ Master approaches and tools to study neurodegenerative and psychiatric diseases
- ✓ Evaluate the validity of these approaches and tools
- ✓ Suggest experimental approaches to answer scientific issues
- ✓ Elaborate and organise the interpretation of research data
- ✓ Present in a clear summarized manner

6 ECTS
iMIND students





NOVEL TECHNOLOGIES APPLIED TO HUMAN NEUROPATHOLOGIES

Overview of the **latest methodological approaches** used to study in an integrative way the molecular and cellular mechanisms associated with neuronal function and dysfunction

Focus on four main domains: **Omics, stem cell research, imaging and electrophysiology**

Applications to advance research on **diverse brain disorders** including: Parkinson's disease, ALS, Alzheimer's disease, MS, cancer, neurodevelopmental and psychiatric disorders

- **Theoretical bases** underlying the main techniques addressed in this course.
- **Technical demonstrations** at the cutting-edge facilities of the Paris Brain Institute (electrophysiology, Calcium imaging, spatial transcriptomics, research and development…).
- **Talks from expert scientists** covering their latest research on neurodegenerative diseases (Parkinson's Disease, Alzheimer's Disease, ALS, MS), as well as other human pathologies (neurodevelopmental diseases, epilepsy, addiction, cancer).
- **Talks from junior scientists** discussing their research projects as well as their professional experience and training.
- **Workshop on ethical considerations** regarding these new methodological approaches.

✓ Understand the most recent approaches to study cellular and molecular mechanisms underlying human diseases

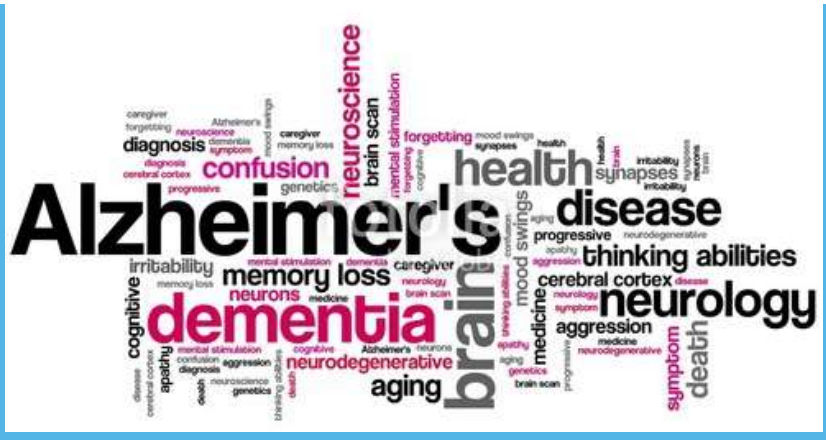
✓ Gain knowledge on the scientific advances in these fields

✓ Acquire the methodological understanding (advantages and drawbacks of different approaches) to answer a specific scientific issue

✓ Develop critical thinking regarding an experimental design, results and literature

✓ Develop analysis and synthesis skills

6 ECTS
20 students maximum



GLIAL PATHOLOGIES AND NEURODEGENERATIVE DISEASES

Overview of **major neurodegenerative diseases** and their clinical manifestations

Provide an understanding of the **mechanisms** of neurodegenerative diseases such as Alzheimer's, Parkinson's, and Huntington's as well as insight **into neuronal cell death, genetics and existing treatments**

Focus on the various physiological roles that different **glial cells** play and the pathologies that are associated with them

Talks from expert scientists and clinicians studying

- ➔ Physiopathology of neurodegenerative disorders
- ➔ Mechanisms of neuronal cell death
- ➔ Genetics of neurodegenerative diseases

- ✓ Understand some of the techniques for developing new treatments for neurodegenerative pathologies
- ✓ Gain information on different types of glial cells and their functioning
- ✓ Understand the physiopathology involved in diseases related to glial cells (for example multiple sclerosis, peripheral neuropathy, glial tumours)
- ✓ Understand some of the therapeutic strategies for treating glial cell-related disorders
- ✓ Learn how to critically analyse neuroscience literature

6 ECTS

DEVELOPING A RESEARCH PROJECT

Acquire the tools to **describe and present a research project**

Students will introduce the scientific question that they will study during their **Master's thesis**

With the help of their host laboratory, students will **develop their experimental approach** with detailed protocols and feasibility considerations.

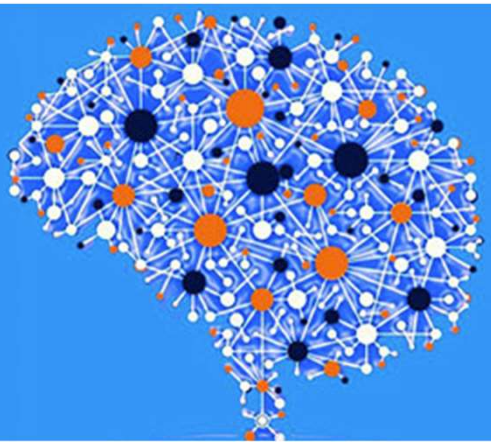
Opportunity to acquire the pre-requisites skills necessary to complete the Master's thesis, with literature analysis and discussion with the host team during the first semester.

- ➔ **Writing a letter of intention** (scientific background, question raised, experimental strategy)
- ➔ **Oral presentation** and discussion with a researcher

- ✓ Present in a synthetic manner
- ✓ Conduct a literature review and critical analysis
- ✓ Describe a research project and experimental protocols
- ✓ Acquire theoretical skills necessary to apprehend useful concepts for experimental practice in biology
- ✓ Assess feasibility and limits associated with planned experiments

6 ECTS

The Brain to Market Summer School



BRAIN TO MARKET SUMMER SCHOOL
PARIS BRAIN INSTITUTE (ICM) COURSEWORK

Brings together a diverse group of students from backgrounds in science, engineering, design and medicine **to develop original solutions for people living with brain disorders**

Basis of **entrepreneurship** and **business plan development** including project management

Themes have included depression, Parkinson's, MS, epilepsy, ALS, Alzheimer's disease and rehabilitation.

Continuity with Paris Brain Institute tech transfer team's annual hackathon and prototyping sessions

No prerequisite in marketing or business required

Day 1 — Introduction of the scientific topic by all the care workflow (researchers, clinicians, paramedical staff).

Days 2-3 — Basis of marketing, business, health economy, ethic and regulatory aspects by actors of the Health and Wellbeing Business Community examples (companies, patients, regulators professionals).

Days 3-5 — Within multidisciplinary teams, design of a valuable proposal to develop concepts and products transferable from research to business and vice versa.

Day 5 — Presentation of the projects to a panel of experts.

Topic of this year:
Autism

- ✓ Identify challenges raised by a neurological/psychiatric disease in the context of ageing
- ✓ Learn and exchange within a multidisciplinary group
- ✓ How to prepare a marketable project
- ✓ Create a network of alumni
- ✓ How to pitch a project in front of potential investors

6 ECTS
10 students maximum

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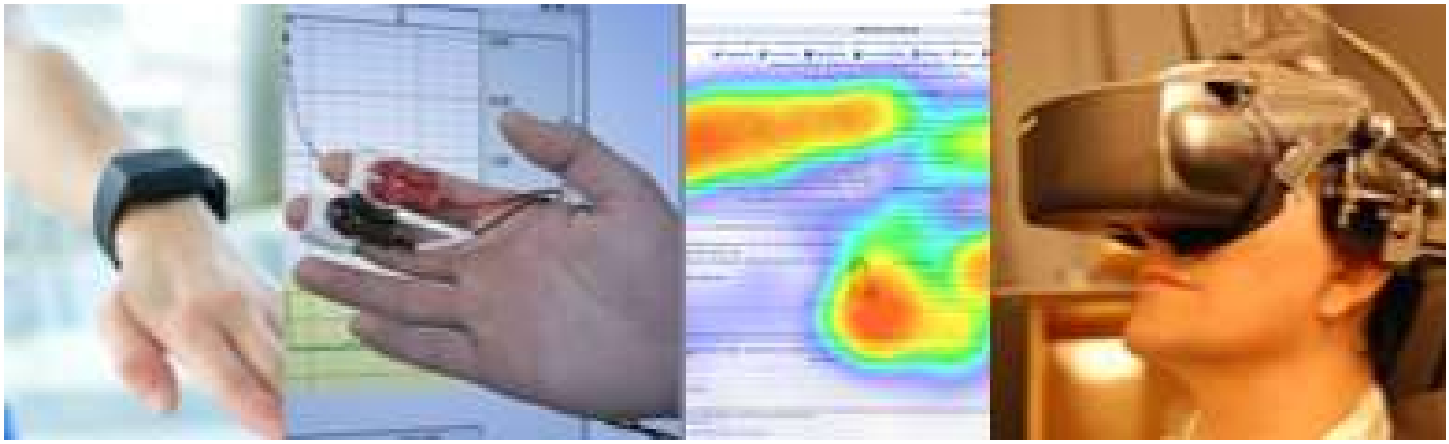


NEW METHODS FOR BEHAVIORAL & COGNITIVE EXPLORATIONS: APPLICATIONS TO NEURODEGENERATIVE DISEASES (NDD)

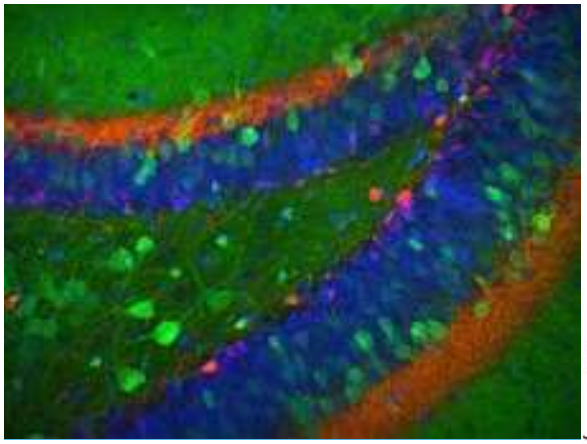
Overview of the **latest methods** from cognitive, behavioral and engineering sciences to refine our understanding of the behavioral and cognitive aspects of NDD.

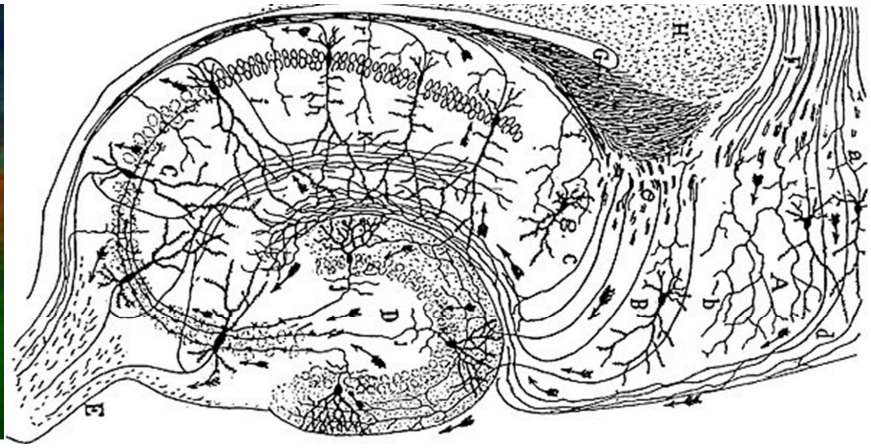
Approach centered on humans: focus on methodologies to quantitatively assess the **behaving patients**.

- ➔ **Practical demonstrations** of the research tools available at the Paris Brain Institute (ICM), for exploring the behavior and the cognition (emotion and thought processes) in patients, mostly at the PRISME core facility.
- ➔ Presentation of a **variety of assessment tools** such as: computerized cognitive tests, eye-tracking systems, movement trackers, digital devices.
- ➔ **Talks from expert scientists** illustrating through concrete research programs how such tools have been used to investigate motivational disorders in Parkinson's Disease, apathy in Fronto-temporal Dementia, spatial memory deficits in Alzheimer's Disease.
- ➔ Connections with **functional brain imaging** (brain imaging facility, CENIR).
- ➔ **Demonstrations of real-life market-ready applications** in partnership with the ICM startup program.

- ✓ Introduction to cognitive and behavioural research
- ✓ Basic knowledge of the cognitive and behavioural symptoms of NDD
- ✓ Interests and limits of current methodologies used in experimental psychology
- ✓ Evaluate the validity and relevance of these approaches and tools in NDD
- ✓ Understanding the current hypotheses on the connections between psychological disorders and neurobiological mechanisms in NDD

3 ECTS
12 students maximum





HIPPOCAMPUS: FROM CELLS TO PHYSIOLOGY AND HUMAN PATHOLOGY

Overview of the **physiological functions of the hippocampus and their alterations** in a variety of neurological and psychiatric disorders, including epilepsy, schizophrenia and Alzheimer's disease

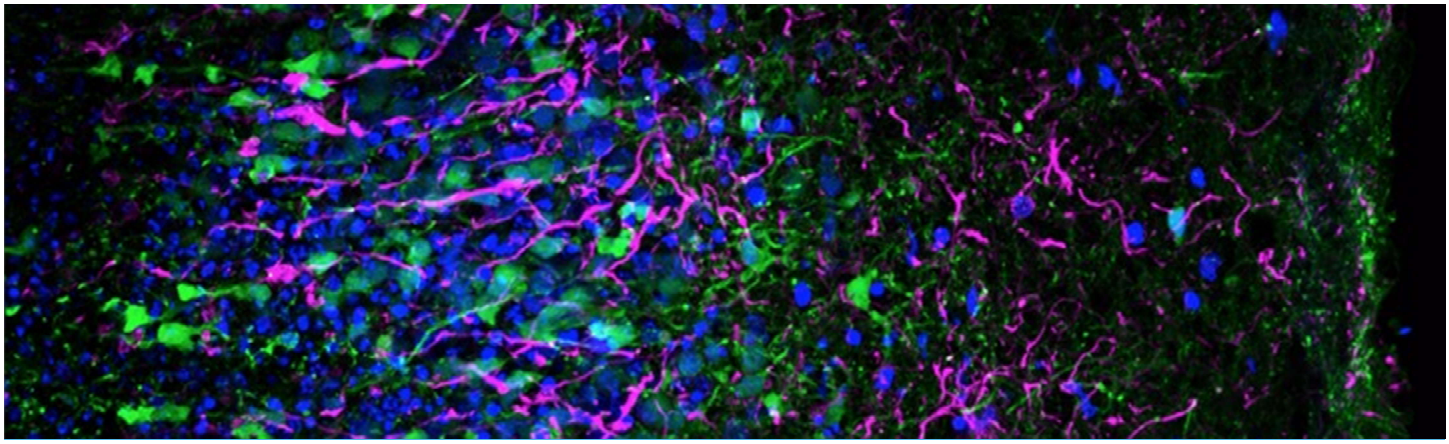
Description of the hippocampal functions at all levels, **from cells and their synapses to human brain and its pathology**

Talks from expert scientists studying

- ➔ Development, anatomy and morphology of the hippocampus
- ➔ Cellular and synaptic physiology
- ➔ Long-term synaptic plasticity
- ➔ Hippocampal rhythmogenesis and behavior
- ➔ Spatial navigation
- ➔ Functional imaging and memory
- ➔ Hippocampus and diseases

- ✓ In depth knowledge about hippocampal anatomy, cells, circuits and synaptic functions
- ✓ In depth knowledge of hippocampal rhythmogenesis in normal and pathological conditions
- ✓ Basic concepts on fMRI and clinical imaging approaches
- ✓ Clinical and cellular aspects of temporal lobe epilepsy
- ✓ Anatomical alterations in Alzheimer's disease

3 ECTS



NEURON-GLIA INTERACTIONS

Discovery of the fascinating world of neuron-glia interactions and **their roles in the brain physiology and pathophysiology**.

Different examples of neuroglia-interactions will be illustrated along 11 lectures:

- Astrocytes/neurons (tripartite synapse, synapse development, astrocyte networks…)
- Oligodendrocytes/neurons (myelin plasticity in health and disease)
- OPCs/neurons (NG2 cell/neuron synapse)
- Microglia/neurons(roles in neuronal functions and neurodegenerative diseases)
- Neuroglia metabolic coupling
- Glioma cells/neurons (role in gliomagenesis)
- Specific techniques to study glial cells
- Neuron-astrocyte interactions in brain diseases
- Glia cell development
- Glial cell roles in complex behaviors

✓ Basic knowledge on neuron-glia interactions in health and disease

✓ Technical approaches to study neuron-glia interactions

3 ECTS

NEUROPSYCHIATRY GENETICS

Introduction to the study of **etiopathogenic factors of neuropsychiatric disorders**.

Overview of a variety of techniques and their developments, including epidemiological and molecular genetics, gene expression regulation, brain imaging, neuropsychology evaluation, animal models, and tools for gene x gene and gene x environment interactions.

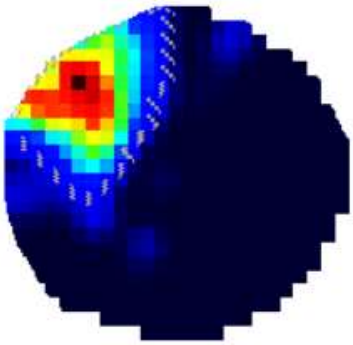
Applications to various diseases: bipolar disorder, schizophrenia, suicidal behaviour, autism, intellectual disability, attention deficit and hyperactivity disorders.

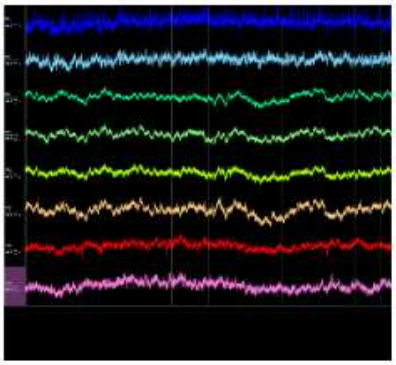
Talks from expert scientists studying

- ➔ Molecular genetics of psychiatric disorders
- ➔ Epigenetics and psychiatric disorders
- ➔ Pharmacogenetic and biomarkers of the response to treatments
- ➔ Neuro-imaging
- ➔ Psychotic disorders and immuno-inflamatory hypothesis
- ➔ Autistic spectrum disorders and developmental hypothesis
- ➔ Suicidal behavior: a trans-nosographical entity
- ➔ Genetic of substance abuse disorders
- ➔ Bipolar disorders and circadian hypothesis

- ✓ Update in psychiatry genetics: recent findings, technology, expected progress…
- ✓ How to appreciate scientific publication: take home message, limits, strength and weaknesses.

3 ECTS





SPATIAL NAVIGATION AND MEMORY

• Presentation of the anatomical, physiological, and behavioral foundations of spatial cognition through complementary courses and a multidisciplinary approach.

• Multi-scale vision addressing these questions through research in humans (Brain imaging, virtual reality, normal and pathological behavior) and animals (Plasticity, neurophysiology, and behavior).

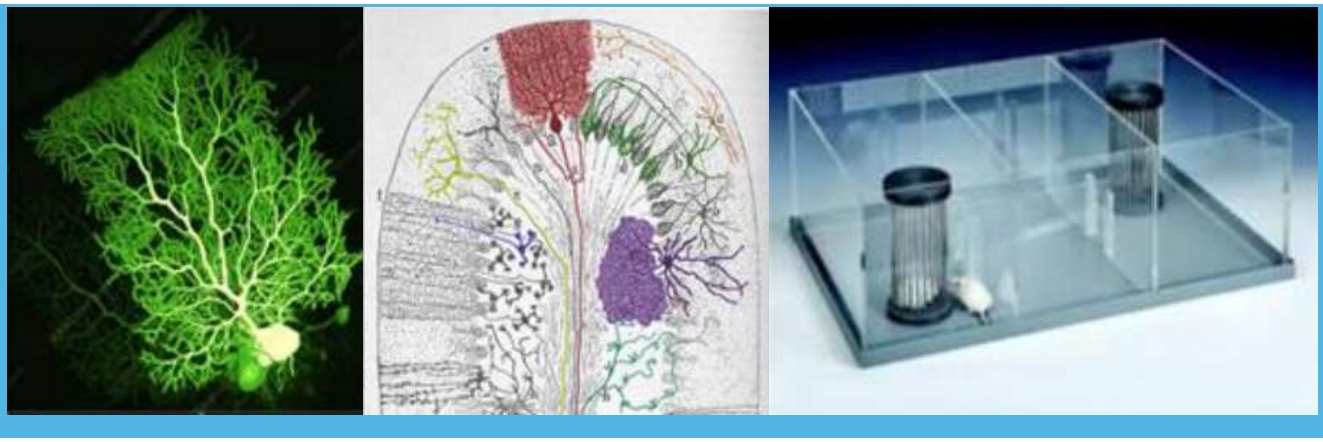
Key Questions addressed:

➔ How can we connect cellular bases, neurophysiology, and behavior?
➔ What insights do modeling studies provide in understanding the living system?
➔ How can we bridge studies in humans and animals?

✓ Theoretical and bibliographic expertise in the field of neural coding of space, goal-directed navigation behaviors, and brain regions involved in memory and spatial navigation.

✓ Knowledge of the various advanced tools used to study this function (virtual reality, imaging, in vivo electrophysiology, etc.).

3 ECTS



CEREBELLUM : FROM CELLS AND CIRCUITS TO MOTOR AND COGNITIVE BEHAVIORS

- Detailed knowledge of the anatomical, physiological, and functional organization of the cerebellum, a key structure in neuroscience.
- Role as an excellent model system for studying fundamental questions in neuroscience, from physiological information processing to cognitive functions.
- Role of the cerebellar synaptic physiology, plasticity, circuit connectivity, and activity on specific behaviors.

Key Questions addressed:

- ➔ Anatomical and physiological connectivity of the cerebellar circuit.
- ➔ Cerebellar development & synaptic plasticity
- ➔ Cerebellar network activity & behavior
- ➔ Motor Learning & Reflexes
- ➔ Cerebellum and cognition

- ✓ Thorough knowledge of the anatomical and physiological organization of the cerebellum and its functional implication.
- ✓ Synthetic presentation of a scientific article on recent discoveries in relation to the course.
- ✓ Critically analyze the scientific literature: know how to analyze and criticize the experimental results and/or protocols of experiments, evaluate the validity and the limits of the tools and methods used.
- ✓ Master the approaches and tools related to the discipline

3 ECTS

Contacts

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Hélène Cheval (helene.cheval@sorbonne-universite.fr)

Applications: from March 27th to June 12th 2025
Should you have any questions, please contact: **Hélène Cheval**

https://sciences.sorbonne-universite.fr/formation-sciences/offre-de-formation/masters/master-neurosciences/international-master

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