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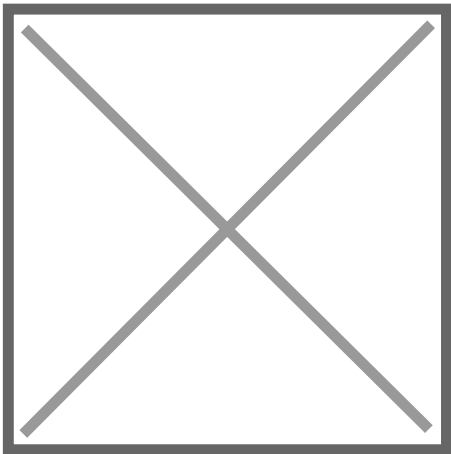
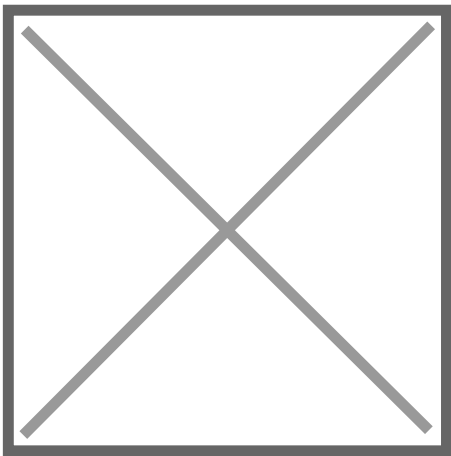
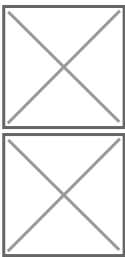
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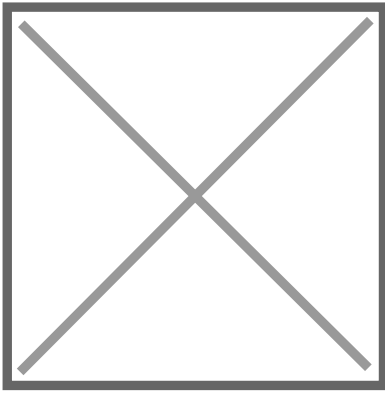
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Une erreur est survenue. Merci de réessayer ultérieurement
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Add to Compare

M2 Computational Neurosciences and Neuroengineering





Master's degree

Specialisation Neurosciences

Enrolment type

Full-time academic programmes Life-long learning

Language(s) of instruction

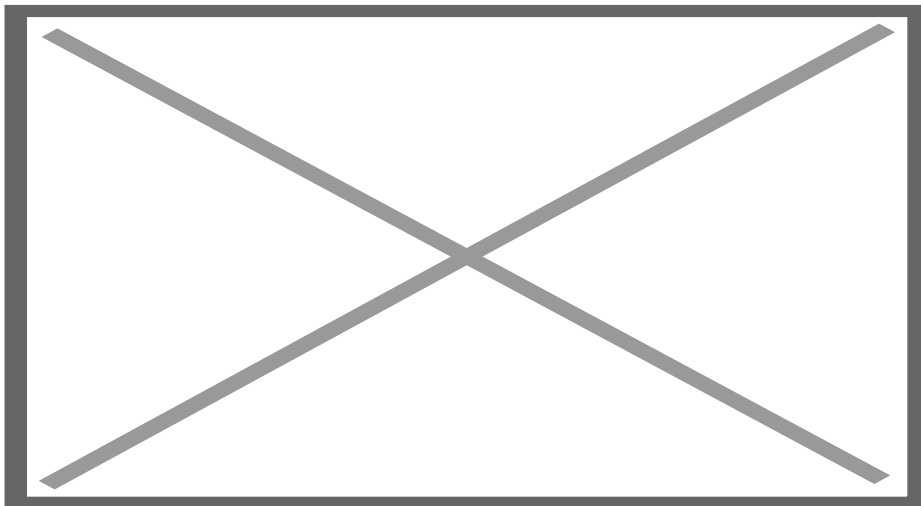
English

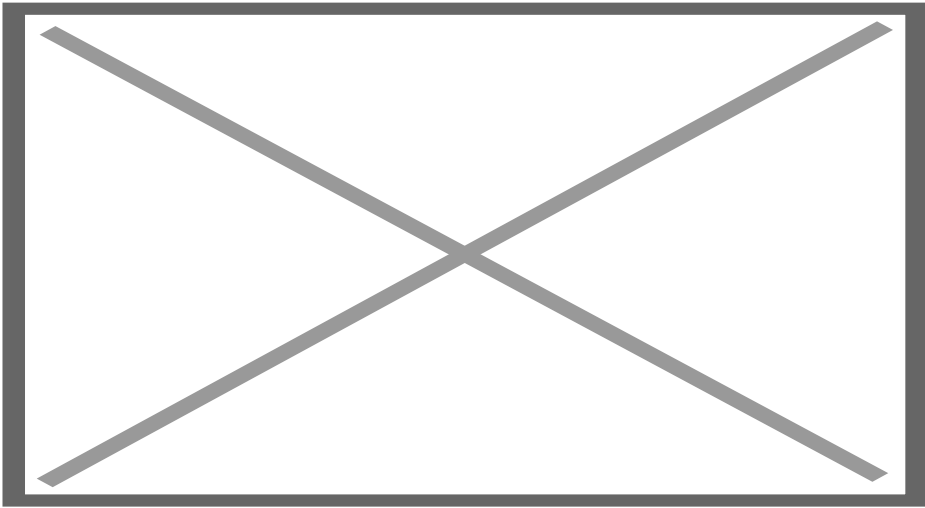
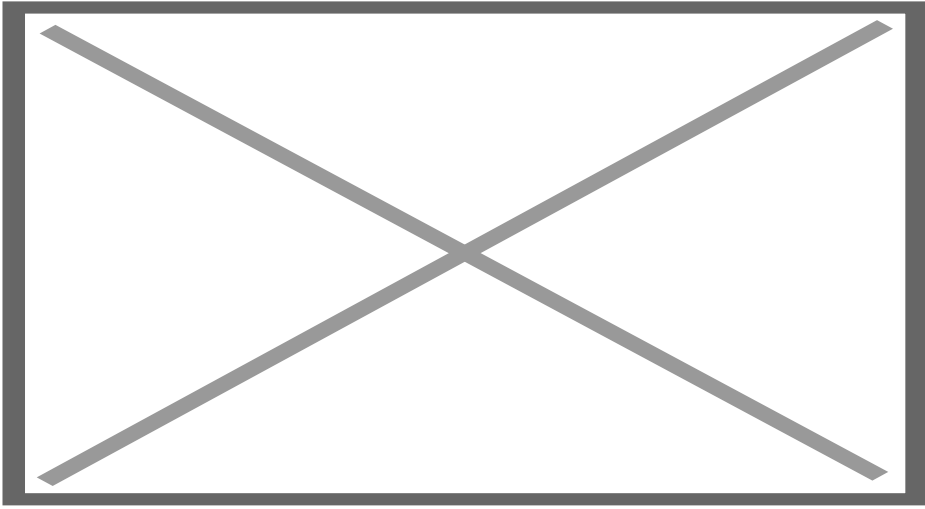
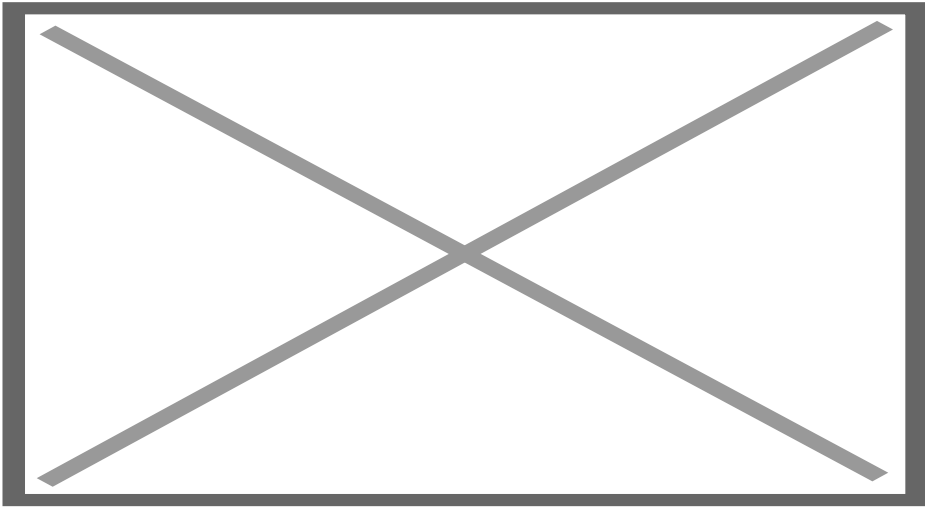
One of the greatest challenges of modern science is to understand how the brain processes information — both to replicate its computing and learning capabilities (as in Artificial Intelligence, neuromorphic circuits, and machine learning) and to compensate for its dysfunctions using computational and technological tools (such as Closed-Loop Neuroscience and Brain-Computer Interfaces). These goals are at the core of the M2 Computational Neuroscience and Neuroengineering track.

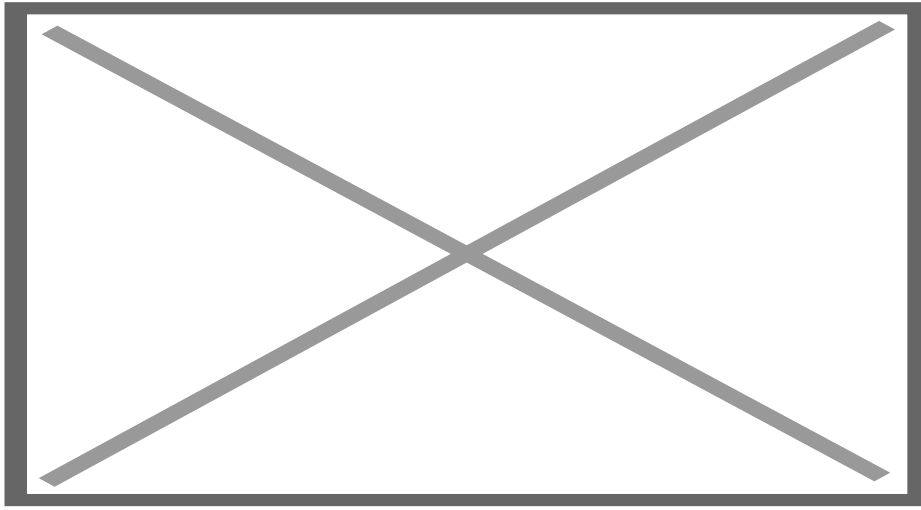
The Master's programme is divided into two semesters, the first of which consists of six teaching units and a supervised project. The second semester is devoted to a 5-6 month internship.

[Télécharger la fiche détaillée](#)

[Apply Now](#)







■ ■

Information

- [Overview](#)
- [Application requirements](#)
- [Schedule](#)

Présentation

Skills

To use adequate models, methods, experiments and technological tools. Students have access to a unique interdisciplinary training, enhancing their skills in research, analysis and scientific presentation and developing their ability to work as part of a multidisciplinary team.

Objectives

The Computational Neuroscience and Neuro-engineering Master aims to train students to face problems raised by brain perception, processing and transmission of information. The training program is based on experimental, computational and theoretical approaches, combining neurosciences, physics, applied mathematics and computer sciences at different scales (cell, network, behaviour) and different organizational levels (micro, meso and macroscopic scales). Thanks to the reputation of the laboratories and research teams involved, the Master degree offers a very high level courses programme with a high international visibility. The target of this Master program is to present the concepts, technological achievements, methodological approaches and research challenges in computational neurosciences and neuroengineering. It also aims to raise students' awareness of the theoretical, experimental, applicative, entrepreneurial and ethical themes of Neurosciences using the concepts of Physics and Engineering Sciences. The CNN Master's degree trains future engineers, researchers and lecturers specialized in Computational Neurosciences and Neuroengineering with an interdisciplinary culture and approaches ranging from theory to experimentation by combining computational methodologies. Engineer jobs and Phd projects in academic, industrial laboratories, integration in R-D departments in France or abroad, represent the main opportunities. The CNN

Master courses programme targets students with a range of backgrounds, including Life Sciences, Computing Science, Mathematics, Physics and Engineering. One part of the courses is focused on the theoretical approaches and the remainder is focused on a research project. Student will achieve the CNN Master with his own skills and interests. During the first semester, lectures such as the physiological bases of neurosciences, the neural bases of perception, the techniques for measuring and stimulating neural activity, the processing and analysis of neural signals, the dynamic systems in neuroscience, will provide the necessary tools to understand the complex phenomena involved in processing and transmitting information in the brain. A supervised scientific project will complete the students' training during the semester one. Semester two begins with a research internship of three to six months. This internship gives students real research experiences in computational neurosciences and neuroengineering. They will have the opportunity to work closely with a leading research team in the academic laboratories and opportunities will be created to work on industry lead projects. They will benefit from the supervision of experienced researchers. The project can be carried out with a research group at University Paris-Saclay, with an industrial partner or with a research institute in France or worldwide.

Débouchés

Career prospects

After a Master's + PhD: researcher or lecturer

Research and Innovation Manager

Design engineer industry / public research

Design engineer in the research / scientific sector

Lecturer (after a PhD)

Academic staff

Research or Design Engineer

Research & Development Engineer

Further Study Opportunities

R&D researcher or data modelling and analysis expert in leading-edge companies or laboratories.

Data Scientist, Data Analyst, Ingénieur·e en Machine Learning dans des secteurs innovants (tech, finance, santé, énergie, etc.) ;

PhD

fields of statistical learning, artificial intelligence and advanced data analysis

train international specialists, producing competitive work within reputable teams from public scientific and technological institutions (EPST), in particular the French National Institute of Health and Medical Research (Inserm) and French National Centre Engineering, research and development
Master of Neurosciences
Research dissertation
PhD thesis

Admission

Admission Route

Computer Science
Mathematics
Physics
Life Sciences
Health sciences
Science and Technology
Engineering Sciences
Undergraduate double degree Mathematics - Physics

Capacity

Available Places

16

Target Audience and Entry Requirements

The Computational Neuroscience and Neuroengineering (CNN) Master's program is designed for students from diverse academic backgrounds, including life sciences, computer science, mathematics, physics, and engineering.

- Student with level equivalent to Master 1 or Master 2
- Student with level equivalent to engineer degree
- English level equivalent to B2 certification

Période(s) de candidature

Inception Platform

From 15/02/2026 to 30/06/2026

Supporting documents

Compulsory supporting documents

Copy diplomas.

Motivation letter.

Letter of recommendation or internship evaluation.

List of other masters requested (excluding Saclay).

All transcripts of the years / semesters validated since the high school diploma at the date of application.

Curriculum Vitae.

Fiche de renseignements.

Additional supporting documents

VAP file (obligatory for all persons requesting a valuation of the assets to enter the diploma).

Supporting documents :

- Residence permit stating the country of residence of the first country
- Or receipt of request stating the country of first asylum
- Or document from the UNHCR granting refugee status
- Or receipt of refugee status request delivered in France
- Or residence permit stating the refugee status delivered in France
- Or document stating subsidiary protection in France or abroad
- Or document stating temporary protection in France or abroad.

Details of the UEs taken for candidates outside the M1 Paris Saclay.

Programme

Master thesis Internship

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	practical class	directed study/practical class	distance learning
Internship	30	Semestre 2							

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	distance learning
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Internship

ECTS : 30

Semester: Semestre 2

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

No prerequisites

Type of assessment

Evaluation Continue non Intégrale

Tronc commun Computational Neuroscience and Neuro-engineering

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	distance learning
Sensory systems and perception	3	Semestre 1	25						

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
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Sensory systems and perception

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 25

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

no prerequisites

Programme/contents

Anatomy and Physiology of the mammalian auditory system, Perception of artificial and natural stimuli such as communication sounds in mammals.

Acoustic communication in songbirds, Sensorimotor learning in juvenile and adult birds.

Anatomy and physiology of the mammalian visual system: from retinal light capture to complex representation of visual scenes

Active vision: Non-canonical modulation of visual cortex

Interactions between somatosensory and motor systems: bases of neuroprosthetic devices

Multisensory processing study with large scale two-photon imaging

Olfaction in vertebrates and insects

Learning objectives

This teaching unit aims at providing detailed knowledge on the anatomical organization and the functional properties of neurons in all sensory modalities. Students will learn the foundations of sensory physiology underlying stable perception despite the flow of fluctuating information coming from the peripheral receptors. Results from electrophysiological recordings and calcium imaging will be used to visualize and quantify the responses of individual neurons, or of large cell

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
Machine learning	3	Semestre 1	17		8				

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
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Machine learning

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 17

Practical study : 8

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

background in signal processing

programming skills

Programme/contents

Regression and classification (Ridge Regression, Generalized Linear Model -including logistic regression, Support Vector Machines). Extensions to core methods.

Generalized Linear Model and Selection of Variables (Sparsity Constraints).

Aggregation methods (Boosting, Random Forrest)

Statistical tools for the analysis of large data.

Model of mixtures

Dimension reduction (Analysis in Principal Components).

K-means / Hierarchical clustering.

Learning objectives

Neuroscience is a field where very large data are generated ("Big Data", several tens of GB per session in fMRI, EEG, high temporal and spatial resolution optical recordings, or multi-electrode electrophysiology). The analysis of these data requires very specific analytical methods, which are themselves the subject of advanced research. This course presents an overview of machine learning methods as well as examples of the application of the different approaches developed.

Overall organisation

CM et TP, challenge

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
Physiological bases of neuroscience	3	Semestre 1	25						

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
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Physiological bases of neuroscience

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 25

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

no prerequisites

Programme/contents

Issues and questions in neuroscience

Development of the nervous system

Nervous system organization: from neuron to network, transmission of the nervous signal

Synaptic transmission

Synaptic plasticity, functional plasticity

Learning objectives

This course will focus on the study of the brain, its functions and its adaptability (brain plasticity) to the environment. The latest knowledge on the molecular and physiological basis of synapse and neuron function will be presented. At a more macroscopic level, the anatomy and structure of the brain will be addressed. The neural processes responsible for processing sensory information and perception, as well as their short- and long-term regulation through interaction with the environment, will be described.

Overall organisation

CM

Skills

At the end of this course, the student will be able to:

- Understand neural communication processes at the physiological level

Subjects	ECTS	Semester	Lecture directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
Supervised project	12	Semestre 1	50					
■								

Supervised project

ECTS : 12

Semester: Semestre 1

Detail

Directed study: 50

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

no prerequisites

Learning objectives

A supervised scientific project will complete the students' training during the semester one. This project is focused on a scientific issue including a bibliographic and/or experimental and/or simulation works.

Overall organisation

A scientific project is proposed to student with supervision of a project leader

Type of assessment

Evaluation Continue non Intégrale

[Closed loop neuroscience](#) 3 Semestre 1 25

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
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Closed loop neuroscience

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 25

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

no prerequisites

Programme/contents

The course is divided into lectures given by research experts. Each researcher will introduce some of the different approaches used in closed-loop neuroscience including experimental, computational, theoretical approaches. One (possibly two) practical classes will be organized in order to practice some algorithmic and analysis skills. Each teacher will provide their course slides after the class.

Learning objectives

This UE addresses the recent interest in closed-loop experiments in neuroscience. Closed loops arise from the bidirectional interaction between a biological system and a technological device. In the case of brain-machine interfaces, for example, it is an interaction between a brain structure and a computer or robot. To this end, this UE presents various techniques for recording and influencing neural activity in real time. It discusses sensory neuroprostheses and brain-machine interface techniques based on interpreting user intentions from EEG signals or invasive recordings, as well as more recent techniques exploiting or studying brain plasticity. Finally, the UE presents neuro-robotics techniques, focusing in particular on neuroinspired learning algorithms (in which the robot is programmed based on knowledge of brain function) and on robotic prostheses or ortheses.

Overall organisation

The course takes place mostly during one week in December (second or third week, to be confirmed).

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
Manipulating and recording neuronal activity	3	Semestre 1	13		12				

Manipulating and recording neuronal activity

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 13

Practical study : 12

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

No prerequisites

Programme/contents

Chapter 1: Introduction to the different scales of neural activity recording and stimulation, what are the main issues and challenges to be addressed?

Chapter 2: Targeted neural stimulation/inhibition methods Chapter 3: Biophysical models of brain signals

Chapter 4: Good practices for data acquisition and analysis, statistical tools for the analysis of large data sets

Chapter 5: Non-invasive neural recording methods used in humans.

Chapter 6: Electrophysiology

Chapter 7: Optical recording of neuronal network dynamics

Chapter 8: Functional Ultrasound Imaging

Learning objectives

The aim of this UE is to present methods for recording and stimulating neuronal activity as a means to access the organization and functioning of the brain. It will present methods to record or stimulate neural activity at different spatial and temporal scales. The principles and main applications of cellular (unit or multiple activity) and network (EEG, ECoG, LFP) electrophysiological approaches as well as invasive (calcium or voltage-sensitive imaging in conventional or multi-photon microscopy) and

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
Dynamical systems and computational neuroscience	3	Semestre 1	19		6				

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
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Dynamical systems and computational neuroscience

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 19

Practical study : 6

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

linear algebra tools

programming skills

Programme/contents

Chapter 1: Mathematical models of neurons

This chapter presents well-known neuron models. It introduces conductance-based models through the famous Hodgkin-Huxley model and underlines its electronic analogy. It then presents simplified models, such as integrate & fire or FitzHugh-Nagumo models, as well as simple models of synapses and neuronal plasticity. Numerical simulation of these models is also introduced.

Chapter 2: Analysis of neuron models

This chapter presents mathematical tools to study neuronal behavior. It introduces the notion of phase diagram and bifurcation. These notions are first given for one-dimensional systems, and then for planar systems. The chapter establishes a link between these bifurcations and the qualitative behavior of the neuron. It also shows how to simplify a neuron model based on singular perturbation theory. It finally introduces the notion of “phase response curve”, which helps simplifying complex oscillatory behaviors to the mere time evolution of its phase, and shows how to use this technique in practice for the prediction of neuronal synchronization.

Chapter 3: Biophysical neuron model

This chapter presents a realistic neuron model based on dendritic modeling.

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
Methods in cognition	3	Semestre 1	2	9	9				

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
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Methods in cognition

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 2

Practical study : 9

Directed study: 9

Language(s) of instruction

Anglais

Remote teaching

non

Programme/contents

The objectives of the module is to show students how to assess cognitive functions in humans and animal models. Students will visit imaging centers for animal and human research in order to learn how to measure brain activity using various cutting edge technics. They will also learn how to test animal and human brain functions and their neural and physiological correlates during practical trainings.

Learning objectives

Learning outcomes (OAVs):

By the end of this unit, students will be able to:

1: understand how to investigate, measure and analyse human and animal brain functions

2: understand the principle of brain imaging in humans and rodent models

3: understand how to study physiological correlates of brain functions

Overall organisation

The course consists of practical assessments of cognitive functions in humans and rodents and of their neurophysiological correlates, and of visits of brain imaging centers dedicated to human and animals to learn the cutting edge current methods

Type of assessment

Evaluation Continue non Intégrale

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
Human developmental cognitive neurosciences	3	Semestre 1	16	4					

Human developmental cognitive neurosciences

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 16

Directed study: 4

Language(s) of instruction

Anglais

Remote teaching

non

Programme/contents

This course explores the neural underpinnings of human cognitive development. It draws parallels between typical and atypical developmental trajectories and integrates insights from adult cognitive neuroscience to better understand developmental mechanisms. Students will be introduced to the main cognitive functions, core neuroscientific methods, and major developmental disorders.

Learning objectives

By the end of this unit, students will be able to:

- OAV 1: understand the main concepts of developmental cognitive neuroscience.
- OAV 2: develop critical lecture of the experimental approach deployed to test typical and atypical developments of cognitive functions.
- OAV 3: Extract and comment relevant information from the literature

Overall organisation

This teaching unit includes 16 hours of lectures delivered by research experts, illustrating the foundations of developmental cognitive neuroscience, the typical development of cognitive functions and educational aspects in healthy and pathological conditions in children. In addition 4 hours of supervised sessions, during which students will work and discuss together with researchers to design some specific studies.

Type of assessment

Evaluation Terminale

Elective courses in CNN

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
Methods in cognition	3	Semestre 1	2	9	9				

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
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Methods in cognition

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 2

Practical study : 9

Directed study: 9

Language(s) of instruction

Anglais

Remote teaching

non

Programme/contents

The objectives of the module is to show students how to assess cognitive functions in humans and animal models. Students will visit imaging centers for animal and human research in order to learn how to measure brain activity using various cutting edge technics. They will also learn how to test animal and human brain functions and their neural and physiological correlates during practical trainings.

Learning objectives

Learning outcomes (OAVs):

By the end of this unit, students will be able to:

1: understand how to investigate, measure and analyse human and animal brain functions

2: understand the principle of brain imaging in humans and rodent models

3: understand how to study physiological correlates of brain functions

Overall organisation

The course consists of practical assessments of cognitive functions in humans and rodents and of their neurophysiological correlates, and of visits of brain imaging centers dedicated to human and animals to learn the cutting edge current methods

Type of assessment

Evaluation Continue non Intégrale

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
Human developmental cognitive neurosciences	3	Semestre 1	16	4					

Human developmental cognitive neurosciences

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 16

Directed study: 4

Language(s) of instruction

Anglais

Remote teaching

non

Programme/contents

This course explores the neural underpinnings of human cognitive development. It draws parallels between typical and atypical developmental trajectories and integrates insights from adult cognitive neuroscience to better understand developmental mechanisms. Students will be introduced to the main cognitive functions, core neuroscientific methods, and major developmental disorders.

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Overall organisation

This teaching unit includes 16 hours of lectures delivered by research experts, illustrating the foundations of developmental cognitive neuroscience, the typical development of cognitive functions and educational aspects in healthy and pathological conditions in children. In addition 4 hours of supervised sessions, during which students will work and discuss together with researchers to design some specific studies.

Type of assessment

Evaluation Terminale

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
Medical Image Processing	3	Semestre 1	25						
■									

Medical Image Processing

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 25

Language(s) of instruction

Français

Remote teaching

non

Prerequisites

Réservé aux étudiants de la mention HSB de CentraleSupélec

Learning objectives

Acquérir des notions de traitement des images médicales et en particulier des images IRM

Type of assessment

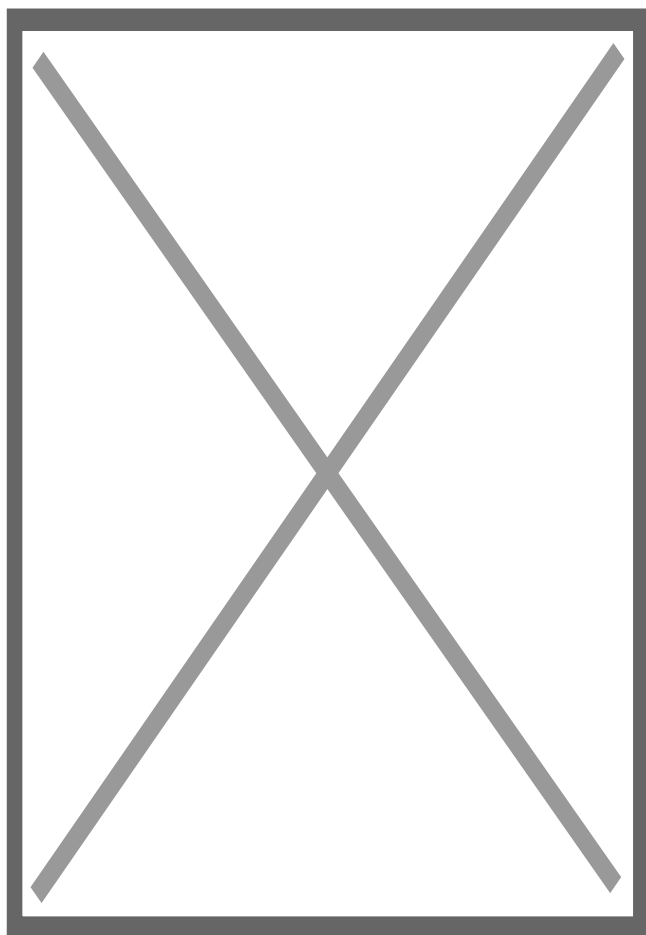
Evaluation Continue non Intégrale

Teaching Location(s)

SACLAY

Training campus

Javascript est requis pour visualiser cette carte.



Orsay Bures

Orsay / Bures-sur-Yvette

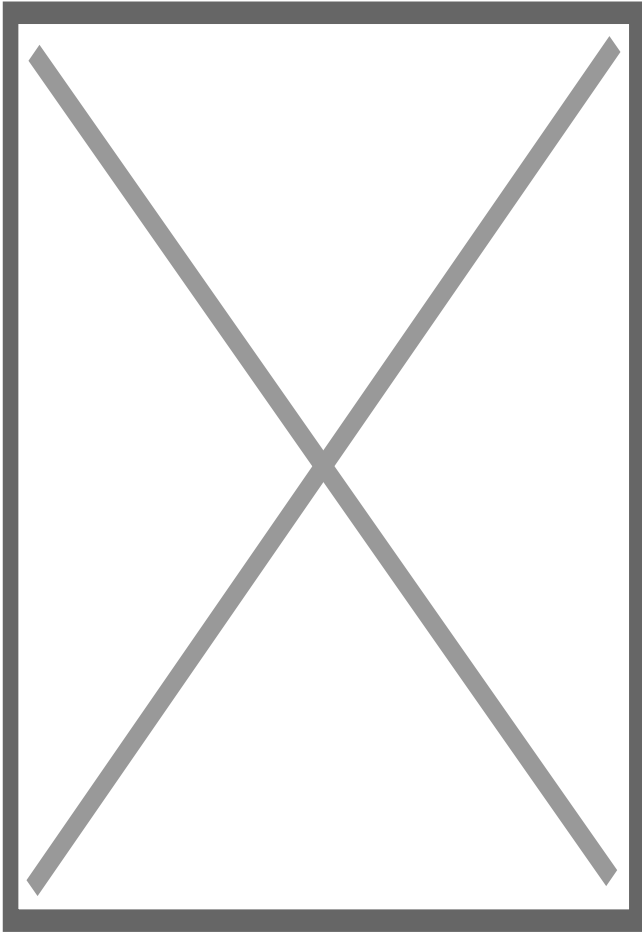
Bus 4607, 4626

RER B Orsay ville ou Bures-sur-Yvette

[Voir](#)

Library

Community center



Saclay Moulon

Saclay / Gif-sur-Yvette / Orsay

Bus 4606 / 4609 / 4611 / 5154

RER B Le guichet

[Voir](#)

Student restaurant (CROUS)

Library

Sports facilities

Student residence

Contact

- **Sabir Jacquir**

PR

<http://www.universite-paris-saclay.fr/formation/master/neurosciences/m2-computational-neurosciences-and-neuroengineering>