

Mention - Biologie-Santé

M2

# Computational Neurosciences and Neuroengineering

Formation initiale

Formation continue

## Objectifs pédagogiques de la formation

**Presentation** One of the greatest challenges of modern science is to understand how the brain processes information in order to imitate its computing and learning capabilities (Artificial Intelligence, neuromorphic circuits, machine learning,...) and to compensate the brain failures with computational and technological tools (Closed-Loop Neurosciences, Brain Computer Interface,...). Thus, the Computational Neuroscience and Neuroengineering 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.

**Goals** 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. Students have access to an unique interdisciplinary training, enhancing their skills in research, analysis and scientific presentation and developing their ability to work as part of a multidisciplinary team.

**Job opportunities** 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.

**Courses program** 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 institut in France or worldwide.

## Compétences

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To use adequate models, methods, experiments and technological tools.

## Admission

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- **Prérequis**

The Computational Neurosciences and Neuro-engineering (CNN) Master courses programme targets students with a range of backgrounds, including Life Sciences, Computing 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

- **Capacité d'accueil (Information rentrée 24-25)**

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- **Modalités de sélection**

Sur dossier

## Organisation des enseignements

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- **Langues d'enseignement**

Anglais

- **Lieux d'enseignement**

91400 - ORSAY