



# **A VANGUARD & TAILORED EDUCATION IN NEUROSCIENCE**

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With 78,000 students, including 10,000 from abroad, nearly 1,000 national and university degrees, a guidance and professional integration service for its students, a lifelong training service, 119 research structures linked to the largest research organizations (Inserm, CNRS, IRD, INRA, CEA, etc.) and 12 doctoral schools, Aix-Marseille University is a considerable asset in the service of the economic development of its territory, and beyond. Collaborating with socio-economic actors is one of its major challenges.

The A\*Midex University Foundation, in charge of the long-term Idex project, contributes to the development of a multidisciplinary and interdisciplinary center for world-class higher education and research. Since its creation, Aix-Marseille University has been open to the international community and is now building a European university “CIVIS, a European Civic University” with 7 European partners. Based on the shared civic identities of its members, CIVIS brings together nearly 400,000 students and 55,000 staff around subjects focusing on societal challenges, such as sustainable development objectives, and on the Mediterranean and Africa.





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## WELCOME

### The second largest French neuroscience community

Provence is a fertile ground for neuroscience. The region welcomed world-renowned researchers who made major discoveries. Jean-Henri Fabre was the first to describe pheromones and their effects on behavior. Angélique Arvanitaki performed the very first intracellular recordings of large neurons and explored the photo-excitability of certain neurons. Robert Naquet and Henri Gastaut devised new techniques for the recording of brain waves and became world experts on epilepsy. Suzanne Tyc Dumont emerged as a world specialist of neuron networks and used informatics to perform the first neuron and brain modelling. Laurent Vinay discovered new mechanisms associated to developmental plasticity of the spinal cord, in normal and pathological conditions.

Today, Marseille is the second largest French neuroscience hub. Some hot topics – epilepsy, locomotion, neuronal networks – remain prevalent while others – neurodevelopment, brain modelling, neurodegenerative diseases – emerged. In 2018, the community won a national competition and was awarded a 10 million euro decennial grant (nEUro\*AMU) for creating and running NeuroSchool, a graduate school of neuroscience. Our main aim is to deliver a vanguard and tailored education. Vanguard, because, in collaboration with our partners, we offer courses on frontline topics and innovative ways of training. And tailored, because we adjust our teaching to the desire and job project of every student. More generally, we strongly believe that, in a very rapidly changing world, the students must learn how to learn and display mental flexibility.



**FRANÇOIS FÉRON**

Director of NeuroSchool



# About Us

Since 2018, NeuroSchool has been building excellence in neuroscience training in Marseille.

## Two objectives

- developing excellence and increasing international partnerships through multidisciplinary, transversal and professionalizing training tracks.
- to strengthen the links between bachelor's, master's, PhD students and research laboratories.

## Developing and promoting Marseille neuroscience.

NeuroSchool "École Universitaire de Recherche" (EUR) gathers the neuroscience training and research of Aix-Marseille University, from the third year of the BSc degree to the PhD. NeuroSchool brings together a community of researchers, lecturers and students working on the same scientific theme: neuroscience. Its aim is to further develop and promote Marseille neuroscience.



3

RESEARCH  
CAMPUSES

10

LABORATORIES



71

RESEARCH  
TEAMS

11

PARTNER  
UNIVERSITIES

## OUR MISSIONS

1

AMPLIFYING THE INITIATED EDUCATIONAL INNOVATIONS (problem-based learning, role-playing games, online courses) and introducing new ones (digital tools, FabLabs, reverse classes),

2

DEVELOPING TRAINING FOR AND BY RESEARCH by incorporating training further within laboratories, by deepening disciplinary and multidisciplinary courses,

3

IMPROVING THE ATTRACTIVENESS OF OUR TRAINING by funding foreign PhD students, coordinating with our international partners to award mobility fellowships, financing co-supervised PhDs, establishing double degrees, and creating summer schools and conferences,

4

IMPROVING PROFESSIONAL INTEGRATION by setting up a customized career monitoring and training towards either academic, clinical or industrial research, or scientific communication.

900  
PEOPLE305  
STUDENTS

## Three educational programs in neuroscience

80 Bachelor's students

105 Master's students

120 PhD students



# Meet Our Team



60 people dedicated to pedagogy, professionalization and innovation in Marseille neuroscience training.

NeuroSchool is made up of an executive committee, a technical team including administration, IT and communication staff, and training teams. Each team is supported by committees and working groups from the Marseille neuroscience community. In total, NeuroSchool brings together more than 60 researchers, professors and clinicians, actively working for neuroscience students' benefit.

## ► Board of directors



**FRANÇOIS  
FÉRON**  
DIRECTOR



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DEPUTEE  
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RESEARCH



**VALÉRY  
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DEPUTEE  
DIRECTOR  
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**ISABELLE  
VIRARD**  
EXECUTIVE  
MANAGER

## ► NeuroSchool support team



**LAURIE  
ARNAUD**  
PROJECT  
MANAGER



**INGRID  
MEUCCI**  
COMMUNICATION  
MANAGER



**BAPTISTE  
LAPORTE**  
IT SPECIALIST



**HANTA  
RAVELOSON**  
FINANCE  
MANAGER

## PEDAGOGICAL TEAMS

For each degree (BSc, MSc, PhD), specific committees including Marseille lecturers and researchers work constantly on keeping the course content at a level of excellence. Thanks to NeuroSchool privileged relationships with academic, private and clinical researchers, the teaching teams are able to introduce students to cutting-edge research in these three different research environments.

### ► Head of the 3rd year of the BSc in Neuroscience



**LAURENT  
PEZARD**

### ► Head of professional tracks



**JULIE  
PEYRONNET-  
ROUX**

### ► Heads of the MSc in Neuroscience



**FRANCESCA  
SARGOLINI**



**CHRISTIAN  
GESTREAU**



**JEAN PELLETIER**



**JEAN-PHILIPPE  
RANJEVA**

### ► Heads of the PhD program



**ANNE  
KAVOUNOUDIAS**



**FRÉDÉRIC  
CHAVANE**

### FUNDING

NeuroSchool actions are made possible thanks to the support of the A\*Midex foundation and the French National Research Agency funded by the French Government « Investissements d'Avenir » program (NeuroSchool, nEUro\*AMU, ANR-17-EURE-0029 grant).



## OUR TRAINING

### A neuroscience training from Bachelor's to PhD

NeuroSchool stems from long-established and well-considered graduate programs in neuroscience in Marseille. It now includes the third year of the BSc in Life Science (neuroscience path). Together, these three degrees (BSc, MSc, PhD) represent over 300 students each academic year and offer a complete and innovative neuroscience curriculum.

#### Three educational programs in neuroscience

- Bachelor's degree in Life Science, Neuroscience path
- Master's degree in neuroscience
- PhD Program

## Bachelor's degree in Life Science, Neuroscience path

The neuroscience specialty starts from the third year of the BSc degree, after two years of Life Science courses.

This path provides solid theoretical and practical knowledge in neuroscience. It is organized around complementary disciplinary courses in cell and molecular biology, physiology and behavioral science.

It gives an important place to statistical tools and modeling as well as to practical teaching, so that the student is confronted early with the experimental process, good laboratory practices and data analysis.



BSc in Life Science, Neuroscience path : a solid theoretical and practical foundation in neuroscience

This specialized third year is organized around **4 mandatory courses** that represent the major fields of neuroscience. They focus on:

- Physiology and modelling of the neuron,
- Nerve control of major physiological functions,
- Sensory-motor processes: from perception to action,
- Cognitive processes and behaviors.

In addition, the teaching includes:

- **2 mandatory courses** where students are confronted with the experimental approach in neuroscience and the statistical analysis of experimental data,
- **3 optional** basic courses in various topics (psychopharmacology, behavioral genetics, etc.),
- **1 reinforcement course** depending on the student's project: neurobiology, cognitive neuroscience or computational neuroscience.

#### AN INITIATION TO RESEARCH

The BSc teaching team set up a Tutored Research course. The aim of this course is to offer students a first introduction to research or R&D. During these tutored workshops, they get familiarized with the different stages of a research: identification of the scientific question, bibliographic research, elaboration of the protocol, then data collection and processing, and finally poster presentation of the work.

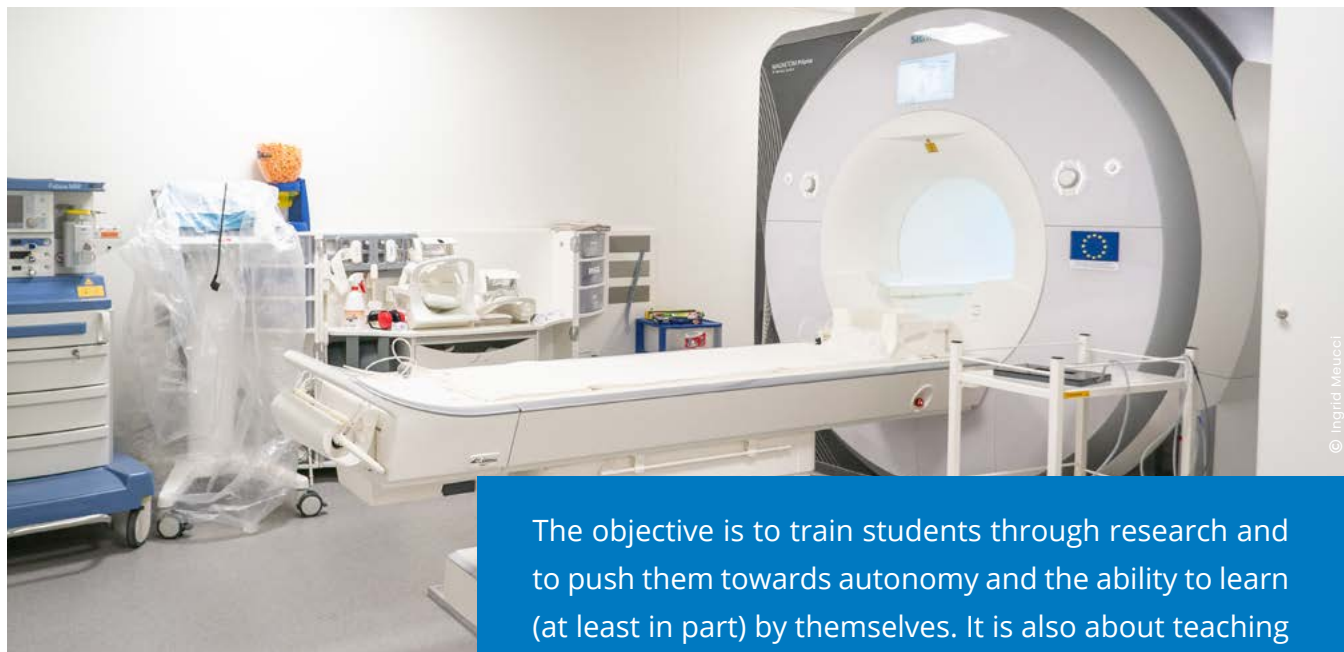


# Master's degree in neuroscience

Our master's program is attached to two of Aix Marseille University (AMU) faculties: the Faculty of Science and the Faculty of Medical and Paramedical Science.

The master's aims to train students in the various fields of neuroscience (molecular and cellular neurobiology, neurodevelopment, neurophysiology, behavioral and cognitive neuroscience...), giving them a common training base as well as skills in one of the three paths of the master's.

- **THE MOLECULAR, CELLULAR AND INTEGRATED NEUROSCIENCE** path contributes to training students for projects relating to the subcellular and cellular functioning of neurons, glia and small networks.
- **THE INTEGRATED COGNITIVE AND BEHAVIORAL NEUROSCIENCE** path contributes to training students for projects relating to the functioning of large neural networks, the different structures of the central nervous system and their communication.
- **THE NEUROSCIENCE AND BIOTECHNOLOGY** path contributes to training students for the development and application of innovative projects in the field of neuroscience and biotechnologies, directly applicable and usable in different professional environments.



The objective is to train students through research and to push them towards autonomy and the ability to learn (at least in part) by themselves. It is also about teaching them teamwork and collective project management — which does not exclude autonomy — and, where possible, taking the initiative. This is accompanied, in all courses, by the development of analytical and critical thinking skills.

## PEDAGOGICAL INNOVATION

Even before NeuroSchool, research was already a strong part of the MSc program, with a total of 8 months of laboratory training over 2 years within the 71 affiliated research teams.

An internationally-recognized training based on specialized courses and multiple research projects.



## SCIENTIFIC SYMPOSIUM

Organized around a central theme, the scientific symposium aims at presenting an emerging neuroscience question, in a transdisciplinary way, from the most molecular aspects to the most integrative and cognitive approaches.

The seminar is given by recognized French and international researchers. M2 students prepare the seminar by reading papers then act as chairpersons by introducing the speakers, preparing questions and leading the discussion. The symposium lasts 2-3 days and comprises around 12 one-hour-long seminars in English.

## PROBLEM-BASED LEARNING

One major pedagogical innovation is our Problem-Based Learning modules for MSc students. Students address one of 12 transdisciplinary neuroscience question proposed conjointly with researchers. In small groups, they work together for 10 days to tackle this genuine neuroscience problem using state-of-the-art research facilities in laboratories and clinical units across Marseille. This approach, which includes stimulating discussion among students and with researchers, emulates the workplace and develops active learning. Students' and tutors' evaluations are overwhelmingly positive.

## ENGLISH: PASSING THE TOEIC

Proficiency in English is now mandatory to work in science. We encourage our students to improve their level of English by:

- offering them weekly English lessons,
- increasing the number of neuroscience courses offered in English,
- registering them to a standardized test (TOEIC).

M1 students receive English lessons each week, until the TOEIC test (planned in the spring). M2 students who did not take or pass this test are also encouraged to take it.

# PhD Program

Since 2011, our program prepare PhD students for a successful international career.

The NeuroSchool PhD Program is a training track offered to Aix-Marseille University PhD students enrolled at the Health and Life Science Doctoral School.

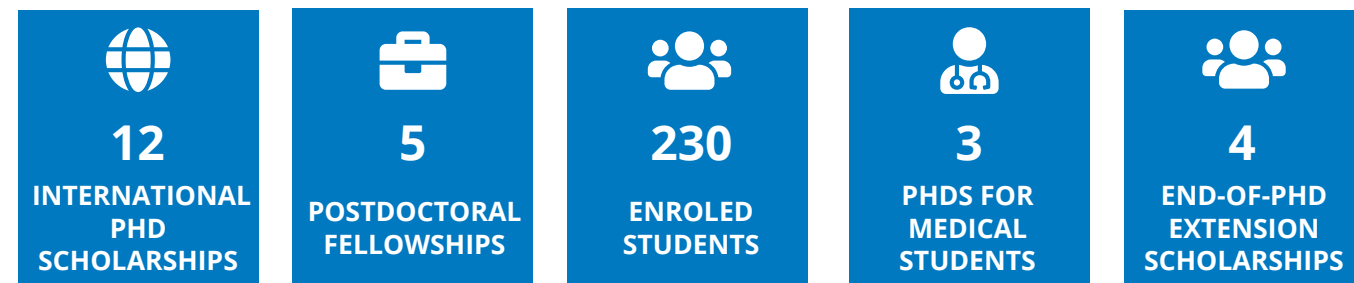
Our program is providing a complementary training tailored for neuroscience students. Through the NeuroSchool PhD Program, PhD students have access to trainings specifically dedicated to neuroscience and join a smaller, more focused, community. They benefit from a variety of scientific events (basic and specialized courses, monthly tutored seminars, clinical trainings...), as well as from professional, social and networking events, where they actively participate and/or organize (PhD Days, special events).

The events are constantly evolving and selected every year with the PhD students to optimally fit their needs.

The PhD program pursues the following objectives:

- training students by and for research,
- preparing students the study-to-work transition of neuroscience graduate students in academic, clinical and corporate worlds,
- broadening students' scientific culture and develop their critical sense,
- building a professional network, locally and internationally.

## OVER THE LAST 4 YEARS



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## A PEDAGOGY BASED ON STUDENTS' INVOLVEMENT

At the PhD level, students already work every day in a research laboratory. Our PhD program developed even more robust interactions with researchers through events involving all neuroscience laboratories, such as the monthly tutored seminars or the annual PhD Day, and through common courses crossing all Aix-Marseille University neuroscience subfields. These events and courses allow students to get a wider understanding of neuroscience and to get to know researchers and fellow graduate students better. In order to complete our students' training in highly-specialized fields, we also offered our PhD students mobility fellowships to attend international summer/ winter schools.



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### Tutored seminars

Once a month a renowned scientist is invited by NeuroSchool to give a seminar to our students and discuss a specific topic with them. Throughout the course of their PhD, students have to attend these tutored seminars on topics related to basic or clinical research. Students prepare for active and critical listening of the seminar by reading articles related to the presentation. After the seminar, a one-hour private discussion between the PhD students and the speaker takes place. The objective is to encourage students to speak in public and prompt them to ask questions, even on topics that are far from their research area, thus expanding their general scientific culture.

### Specialized courses

Students are coming from different background and educational systems and, hence, have quite a heterogeneous knowledge across the different areas of neuroscience and regarding the techniques used. The goal of the basic courses is to standardize their levels.

In addition, three specific courses are offered each year, as voted by the students, such as "Signal and image processing", "Statistical thinking about data in neuroscience" and "Advanced functional neuroanatomy: an overview of the main brain systems".



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© Frédéric Chavane

### Special events

Each year, the Neuroschool PhD Program provides students with the opportunity to organize events by themselves for PhD students, the entire scientific community or the general public. The main event of the year, called "PhD Days", is organized by a group of about six students every year and consists in two days of conferences based on one theme of neuroscience. Every year, students also organize a special events, such as a day dedicated to neuroscience and philosophy and a meeting with professional in the non-academic world. We support and guide students in the organization and the communication of those events.

In addition, Neuroschool PhD program organizes, at the beginning of each year, a special day to welcome new students. It is the occasion for them to learn more about how the program works, and an opportunity for them to get to know each other.



# Student life

Two student associations offer events every month that allow our students to meet and broaden their knowledge of neuroscience.

## NEURONAUTES

2016 / 153 members

The purpose of this society is to serve as a place for students and alumni to meet and to organize scientific and cultural events. It also aims to strengthen the link between the university, research laboratories, private companies and students. In addition to student events, the Neuronautes organize events for the general public.



**18**  
EVENTS  
EACH YEAR



**1,300**  
ATTENDANTS



**2**  
PROFESSIONAL  
EVENTS



**28**  
SCIENTIFIC  
GUESTS



## HIPPO'THÈSE

2001 / 14 members

Hippo'Thèse was created by a group of PhD students from the Doctoral School of Life and Health Science in 2001. Its purpose is to bring together PhD students and young doctors working in the field of life science.

- It represents PhD students in University bodies, as well as at the national level,
- it informs PhD students about post-PhD prospects (professional integration into academia or R&D),
- it promotes their status with the various scientific and economic actors in order to improve their professional integration,
- it informs master's students about the continuation of their studies.



Meetings with companies or laboratories.



CV writing workshops.



Interview simulations.



Cross-disciplinary training (poster design, etc).



**10**  
AFTER-LAB  
MEETINGS  
PER YEAR



**3**  
SCIENTIFIC  
EVENTS  
EACH YEAR





## TESTIMONIALS

Guiding our students as well as possible is our priority.

To prepare neuroscience graduate students' study-to-work transition, we propose a range of actions, from building an alumni network to strengthening the links with the biotech industry, clinical research and science communication. We organize tutored sessions for our students to learn how to write scientific resumes and cover letters and to create their personal LinkedIn profiles. Neuroschool also supports the Neurautes students' society, especially for networking events such as meetings with neuroscience graduates with academic or non-academic careers.

In order to prepare MSc students for a professional life in the private sector, we give them information about CIFRE scholarships, organizes meetings with professionals and visits to business incubators.

The PhD program also organizes sessions with CEOs of biotech companies and representatives of transfer-focused organizations.

Another important action is funding postdoctoral positions in biotech companies (NeuronExperts, Vect-Horus, NeuroChlore, OZ Biosciences) for young AMU PhDs. We are very enthusiastic that two of our past laureates now hold a full-time position in these companies.

## WHAT OUR STUDENTS SAY

“

The neuroscience master's program has especially helped me acquire the scientific approach. During my M2 internship, I had the chance to be mentored by Prof. François Féron and Dr Gaëlle Guiraudie-Capraz, who allowed me to have a lot of freedom and autonomy in my work, and in a climate of trust. The master's does not only consist in theoretical learning, it is also meeting people who help us advance on the professional and human levels.

The difference is not so great between basic and clinical research, the goal is more to help develop new therapeutic strategies. The master's training allows us to have knowledge in biology and a scientific profile, which is indispensable. We never feel like we are caught unaware, regardless of the medical field in which we have to work.

**Jeremy Mione**

**Clinical research associate**

— 2016 graduate

“

The neuroscience master's was for me an obvious step towards a PhD, especially to get a first impression on my desire to continue (or not) in laboratory research. The Neuroscience DEA (former name of the master's) offered me my first real immersion in a research laboratory, and this is the most important asset of this training. Subsequently, I received full confidence from my supervisor, which gave me great freedom and autonomy to carry out my PhD.

This allowed me to develop skills that were quite useful during my postdoc in order to stand out in a highly competitive environment where complete autonomy was essential. So a certain self-taught (though guided) approach to research helped me to handle failures and to find solutions to problems that arise in a researcher's career. All this led me to build my own path and my own scientific identity, which certainly contributed to my recruitment.

**Emmanuel Nivet**

**Researcher (CNRS), group leader**

— 2004 graduate

“

The master's gave us a strong neuroscience background, which was a good support for the rest of my career. Laboratory internships in M1 and M2 also allowed me to confirm that this was the path that I wanted to continue in.

**Sophie Dutheil,**

**Researcher in a pharmaceutical company in New York**

— 2007 graduate





# RESEARCH

NeuroSchool is fully integrated with the neuroscience research community of Marseille through research training actions conducted within NeuroMarseille, a University Institute counting 71 neuroscience teams of 10 Research Units, which are under the joint umbrella of AMU and either CNRS or Inserm. NeuroMarseille

UNITED WITH NEURO-  
MARSEILLE, WE BRING  
EXCELLENCE IN  
TRAINING AND  
RESEARCH.

hosts 452 full-time permanent researchers, academics, technicians and engineers; including non-permanent staff and PhD students, it represents in total nearly 950 people. Our goal is to establish win-win training-research interactions: the research laboratories provide NeuroSchool with a training ground of excellence, while in return NeuroSchool reinforces knowledge and knowhow training that is the most relevant to research.

The strength of Marseille research in neuroscience arises from three main features: first, an exceptionally broad range of multi-scale approaches, extending from molecular and cellular levels to systems and computational modeling to behavioral science and cognitive psychology, on a large span of experimental models, from rodents to humans; second, tight links with clinical units and translational research; third, a stimulating interdisciplinary environment fostering interactions between different fields of research, represented by prestigious research institutes of physics, computer science and mathematics, as well as major institutes in other fields of biology such as immunology and developmental biology.

As a consequence, neuroscience in Marseille combines, in quite a unique way, critical features that NeuroSchool will capitalize on to offer aspiring researchers the knowledge and knowhow required to achieve scientific excellence.

In order to promote access to research, NeuroSchool is in close partnership with 71 teams spread over 3 campuses representing Marseille academic research in neuroscience. These teams are distributed in the following 10 institutes (called “laboratories”, in France), each with specific field of study.



## Cognitive neuroscience (Saint-Charles)

### Cognitive Neuroscience Laboratory (LNC)



#### DECIPHERING THE NEURAL BASES OF COGNITIVE PROCESSES BY STUDYING BEHAVIOR AND NEURAL ACTIVITY

The Cognitive Neuroscience Laboratory studies the neural bases of cognitive processes, through the analysis of behavior and brain activity using different techniques (EEG, fMRI, MEG, unit electrophysiology...).

The following nine research themes are developed in separate teams:

- Cognition and pathophysiology of basal ganglia
- Attention, timing and brain dynamics
- Neural bases of spatial cognition
- Neural bases of sensory-motor skills
- Dynamics of auditory and motor learning
- Neurodevelopment of social and motor cognition
- Neural bases of somatosensation
- Brain, obesity and eating disorders
- Neural bases of motivation





## Sensory and Cognitive Neuroscience Laboratory (LNSC)

### APPREHENDING THE NEURAL BASES OF SENSORY PHENOMENA AND THEIR COGNITIVE AND BEHAVIORAL CORRELATES

The scientific objectives of the Sensory and Cognitive Neuroscience Laboratory (LNSC) consist in:

- Advancing our understanding of neural mechanisms and processes involved in normal or pathological functioning of sensory systems.
- Analyzing how these systems interact to sustain body perceptions and extra-personal space, and the underpinning cerebral mechanisms and mental representations.
- Understanding how cognition modulates these perceptions and representations.
- Designing new cognitive rehabilitation methods, assessing their potential to promote sensory and/or cognitive recovery, and gaining insight into the cerebral mechanisms engaged in this recovery.

The LNSC is composed of 4 teams:

- Neuronal dynamics and audition team
- Pathophysiology and therapy of vestibular disorders team
- Multisense and body team
- Sensory and cognitive rehabilitation team

## Laboratory of Cognitive Psychology (LPC)



### STUDYING THE FUNCTIONS THAT CHARACTERIZE PERCEPTION, COGNITION, REASONING AND SOCIAL BEHAVIOR IN HUMANS AND ANIMALS

At the intersection of experimental psychology and cognitive neuroscience, the LPC brings together specialists in vision, perception, attention, memory, reasoning, social cognition and language. The studies carried out in this laboratory focus on cognitive plasticity (development, aging) as well as on the cerebral bases of cognitive functions and their modulation by the social context or their dysfunctioning. Basic research projects are complemented by applied research projects; for example, research on reading in the baboon led to projects on: dyslexia, iPhone applications, eating behavior, smoking, transportation safety... The research is structured around five main themes, each represented by a team:

- Cognition and social context
- Perception and attention
- Development and cognitive aging
- Language
- Compared cognition



# Integrative & clinical neuroscience (La Timone)



## Center for Magnetic Resonance in Biology and Medicine (CRMBM)

### INNOVATIVE MRI AND MRS METHODS FOR THE EXPLORATION OF CARDIOVASCULAR, MUSCULOSKELETAL, CENTRAL NERVOUS SYSTEMS.

The Center for Magnetic Resonance in Biology and Medicine conducts translational research by developing and applying Magnetic Resonance methods and instruments to explore the morphology, metabolism and physiology of human diseases and associated animal models (rodents).

With the support of methodological and engineering teams, our research teams aim at (i) better characterizing healthy and pathological states of the central nervous, cardiovascular and musculoskeletal systems, and (ii) defining new diagnostic and/or therapeutic strategies. The research is structured around three main themes, each represented by a team:

- Central nervous system
- Cardiovascular system
- Musculoskeletal system

## INSTITUTE DE NEUROSCIENCES DES SYSTEMES (INS)



### COMBINING FUNDAMENTAL THEORIES WITH INNOVATIVE APPROACHES

The Institut de Neurosciences des Systèmes (INS) focuses on understanding the complex dynamics of the brain, and capitalizing on symbiotic proficiencies by integrating experimental, theoretical and clinical approaches towards understanding brain function and dysfunction.

The INS houses a wide range of state-of-the-art facilities of brain research, which includes a MEG facility, TMS-EEG with a Brain Navigation system, various electrophysiology laboratories, an epileptic patient unit, and The Virtual Brain platform. INS researchers perform research across species ranging from the rodent to the human brain to uncover the mechanisms underlying the functioning of the healthy brain and its disorders, notably epilepsy as the paradigmatic dynamic brain disease. The INS is comprised of 4 research groups:

- Dynamical brain mapping
- Dynamics of cognitive processes
- Physiology & physiopathology of brain networks
- Theoretical neuroscience





## Institute of NeuroPhysiopathology (INP)

### STUDYING NEURAL CELL ORGANIZATION, FUNCTION AND INTERACTION, AND DEVELOPING INNOVATIVE CELLULAR AND MOLECULAR THERAPEUTIC STRATEGIES

The INP teams promote the development of diagnostic and therapeutic approaches, based in particular on the identification of biomarkers and therapeutic targets, on the development of new therapeutic molecules and on cell therapy strategies involving olfactory stem cells and iPS cells. The teams ambition valuation and partnership with the pharmaceutical industry, in particular through the creation of a "Joint Research Laboratory" with Vect-Horus biotechnology company. This partnership aims at developing new vectorization strategies across the Blood-Brain Barrier (BBB), and innovative therapeutic or imaging agents. The research is structured around ten main themes, each represented by a team:

- Neural plasticity and degeneration
- Genes, rhythm and neurophysiopathology
- BBB and neuroinflammation
- Neurobiology of mnesic processes
- Neuro-inflammation and multiple sclerosis
- Stem cells, disease modeling and neuroregeneration
- NeuroCyto: the neuronal cytoskeleton in health and disease
- GlioME: Gliomagenesis and MicroEnvironment
- Cytoskeleton and neurophysiopathology
- Angiogenesis and tumor microenvironment

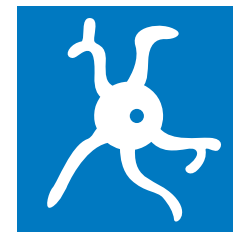
## Institut de Neurosciences de la Timone (INT)



### A NEW APPROACH IN INTEGRATIVE NEUROSCIENCE

The objectives of the INT are to carry out world class research in fundamental neuroscience, from cellular to cognitive levels, and to fill the gap between fundamental and clinical approaches. Integrative neuroscience, bridging levels of organization of the nervous system within a functional approach, plays an essential role in understanding the neural underpinnings of our behavior and of their dysfunctions in neurological and psychiatric diseases. The INT hosts 11 teams:

- Spinal cord and cerebro-spinal fluid interface
- Live imaging of cell interactions in the normal and diseased brain BBB
- Plasticity and physio-pathology of rhythmic motor networks
- Cognitive motor control
- Neuronal operations in visual topographic maps
- Inference in visual behaviors
- Neural basis of communication
- Basal ganglia, motivation and reward
- MicroRNA and social cognition
- Social cognition across lifespan and pathologies
- Methods and computational anatomy



# Cellular and developmental neuroscience (Luminy)

## Developmental Biology Institute of Marseille (IBDM)



### UNDERSTANDING DEVELOPMENT TO UNDERSTAND PATHOLOGIES

The IBDM is an interdisciplinary research institute whose activity focuses on biology and developmental pathologies, but also has complementary expertise in embryology, physiology, molecular/cellular biology, genetics, genomics and bioinformatics. Neuroscience research, conducted on a variety of animal models, focuses on stem cell biology, cell identity acquisition, cell division and migration, axonal guidance and circuit formation, and neuroplasticity under normal and pathological conditions. Technological equipment is gathered on innovative and high-performance platforms including imaging, animal facilities and functional exploration.

A stated objective of the IBDM is to develop new approaches by encouraging interfaces with other disciplines (chemistry, mathematics, physics). In addition to its primary mission of fundamental research, the IBDM continues its commercialization effort by promoting the emergence of applied research with therapeutic aims.

The IBDM brings together about twenty teams, half of which address biological issues related to the development, maturation and plasticity of the nervous system. Deciphering these processes is essential to understand the pathogenesis of neurological diseases and to identify new therapeutic targets. The research is structured around twenty-one main themes, each represented by a team:

- Polarization and binary cell fate decisions in the nervous system
- Molecular control of neurogenesis
- Stem cells and brain repair
- Transcriptional regulatory networks in development and diseases
- Mechanisms of gene regulation by transcription factors
- Computational biology
- Development and pathologies of neuromuscular circuits
- Genetic control of heart development
- Cellular interactions, neurodegeneration and neuroplasticity
- Biology of ciliated epithelia
- Cell polarity and morphogenesis of epithelia
- Tissue architecture and plasticity
- Physical approaches to cell dynamics and tissue morphogenesis
- Signalling networks for stemness and tumorigenesis
- Axon plasticity in development and cancer
- Neural stem cell plasticity
- Physical and molecular principles governing cytoskeletal organization
- Chronic pain: molecular and cellular mechanisms
- Evolution and development of morphology and behavior
- Host pathogen interaction in the Drosophila model
- Muscle dynamics





## Mediterranean Institute of Neurobiology (INMED)

### FOCUS ON THE DEVELOPMENT AND PLASTICITY OF NEURONAL CIRCUITS IN HEALTH AND DISEASE

The Institut de Neurobiologie de la Méditerranée (INMED) focuses on the development and plasticity of synapses and neural circuits under healthy and pathological conditions. Over the years, INMED scientific strategy has been to bring together groups that share a common scientific goal, but with complementary experimental approaches that describe and manipulate the structure and function of synapses and neural circuits with unprecedented precision in intact preparations. INMED is internationally recognized for its contributions in the fields of developmental neurophysiology and epilepsy by bringing together electrophysiologists and neuroanatomists. INMED expertise thus covers the entire spectrum of brain study, from the molecule to behavior.

Currently, INMED has 150 members, in 13 independent teams, including three ERC projects and two associated international laboratories (LIA). INMED hosts facilities and shared services organized into administrative or technological platforms: an "Inmagic" imaging platform, which includes biphotonic and light-sheet microscopes, a molecular and cellular biology platform, two animal facilities, a service that allows the development of new models of brain pathologies based on in utero electroporation, a histology service and one of the largest collections of electrophysiology facilities (in vivo and in vitro). The research is structured around thirteen main themes, each represented by a team:

- A developmental scaffold for cortical networks
- Early activity in the developing brain
- Neuronal coding of space and memory
- The neural bases of sensorimotor learning
- Neuronal coding and plasticity in epilepsy
- Neonatal, infantile and childhood epilepsies and encephalopathies
- Molecular basis and pathophysiology of cortical development disorders
- Early life imprinting and neurodevelopmental disorders
- Adolescence and developmental vulnerability to neuropsychiatric diseases
- Maturation and plasticity of cortical maps
- Developmental Plasticity of GABAergic synapses
- Structural plasticity in the post-traumatic and developing brain
- Autism



## Ion Channel and Synaptic Neurobiology Laboratory (UNIS)

### UNDERSTANDING THE ROLE OF ION CHANNELS IN NEURONAL SIGNALING, PLASTICITY AND DISEASES OF THE NERVOUS SYSTEM

The Ion Channel and Synaptic Neurobiology Laboratory is comprised of three research groups whose main objectives are to understand the molecular mechanisms of neurotransmission and the role of ion channels in neuronal communication, plasticity and brain diseases. The laboratory also has a technological platform which aims to develop novel molecular tools for the diagnosis and prognosis of autoimmune neurological diseases. The staff include 35 research scientists, technicians, postdoctoral researchers and students, grouped in 5 teams:

- Molecular mechanisms of neurotransmitter release
- Dynamics of neuronal excitability
- Robustness of excitability
- Excitatory transmission and plasticity mechanisms in the cerebellar cortex
- Biomarkers and diagnostics







# CLINICAL RESEARCH

With the third largest University Hospital in Europe (Timone University Hospital), Marseille stands out as a city where there is a strong link between training, basic research and translational research. In particular, nearly all neuroscience laboratories have institutional partnerships with departments in neurological science, soon federated at one site (Timone campus).

The federation of fundamental and clinical neuroscience research units already succeeded in creating two University Hospital Federations (FHUs), in the fields of epilepsy (EpiNext) and neurodegenerative diseases (DHUNE), which aim at advancing groundbreaking research into clinical practice. In addition, outstanding results emerging from neuroscience laboratories have yielded over 80 patents for the development of

biomarkers, new diagnostic/therapeutic/drug delivery tools and rehabilitation strategies, including human-machine interface to cure neuropsychiatric disorders.

To intensify collaboration with clinical units and to introduce PhD students to careers in clinical research, NeuroSchool has set up one-week-long immersive trainings in Assistance Publique-Hôpitaux de Marseille (AP-HM, Marseille Public University Hospitals).

NeuroSchool PhD program is also promoting many events linked to medicine, such as tutored seminars and an annual clinical day co-organized by clinicians and researchers. The PhD also launched a fellowship program for inciting medical students to start a PhD.

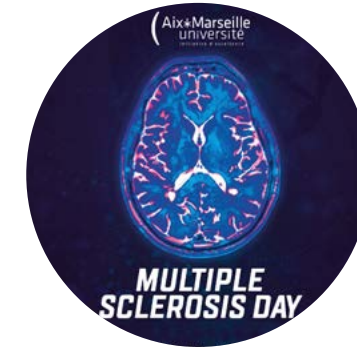


## INTERNSHIPS AT THE HOSPITAL

The PhD program organizes 1-week-long immersive trainings in AP-HM, in different clinical units like:

- Functional and Stereotactic Neurosurgery,
- Neurology and movement disorders,
- Neurology and stroke unit,
- Neurology and neuropsychology,
- Ophthalmology.

AP-HM clinical units invite 3 or 4 PhD students from our program during one week. The students follow the clinicians in their different tasks. They attend consultations and, if possible, surgeries, and they participate in staff meetings and in different events organized by the hospital.



## CLINICAL DAY

Once a year, our PhD program organizes a thematic day about a pathology or advanced technology joining clinicians and researchers. PhD students help organizing the event and chair the discussions.

- February 2015: Parkinson's Disease Day,
- June 2016: Brain-Machine Interface Day,
- Mai 2018: Multiple Sclerosis Day,
- July 2019: Epilepsy Day.



## PHD SCHOLARSHIPS FOR MDS AND PHARMDS

NeuroSchool PhD Program offers to finance one year of neuroscience PhD studies in an AMU laboratory for residents or young medical doctors or doctors in pharmacy. By involving medical and pharmacy doctors in experimental research, this scholarship aims at fostering links between clinical and fundamental research.







## PRIVATE RESEARCH

MSc students can already do internships in biotech companies. Soon, NeuroSchool will also offer scholarships for PhDs in collaboration with the private sector. In addition, we are setting up new courses on the creation and management of biotech companies, in association with specialized institutes (such as Aix-Marseille Graduate School of Management) and the four NeuroSchool industrial partners.

Furthermore, every year, NeuroSchool launches a call for post-doctoral fellowships for young AMU neuroscience PhD graduates who wish to work in a biotechnology company specializing in neuroscience in the Sud region. The main objective of these scholarships is to promote the professional integration of young doctors.

NeuroSchool is building a network of private partners to initiate meetings between students and entrepreneurs and to favor student internships in R&D. The companies benefit from our students' knowledge and research skills, while the students gain experience in both research and business.



### TRANSPORTING THERAPEUTIC AND IMAGING AGENTS INTO THE BRAIN USING AN INNOVATIVE TARGETING TECHNOLOGY

Founded in 2005, VECT-HORUS invests its efforts in targeted delivery by conjugating therapeutics or imaging agents to "molecular vectors" that specifically target receptors involved in Receptor Mediated Transport (RMT, a physiological system for the transport into cells of endogenous substances). This targeting approach is presently considered as one of the most effective and safest way to by-pass cell barriers for delivering biomolecules to the brain, to target tumors and diseased tissues. The company already established the proof of concept of its technology in animal models by vectorizing various molecules including small molecules, peptides and large molecules such as antibodies.



### CENTRAL NERVOUS SYSTEM CRO FOR TRANSLATIONAL DATA

Neuroservices Alliance is a One Stop Shop CNS Contract Research Organization (CRO) for translational data, providing pharmaceutical industries with functional readouts in neuro-pharmacology. Data are generated from complementary CNS platforms: in silico dynamic ligand-receptor modeling, in vitro & in vivo CNS electrophysiology and Behavioral tests. Empowered by a strong college of experts, our integrated functional data from rodent and human tissues accelerate CNS and pain research programs thanks to fast and robust lead selection & optimization, investigation of mechanism of action, and validation of target engagement.



### THE ART OF TRANSFECTION

Since 2003, OZ Biosciences creates, develops and produces innovative molecular delivery systems specialized in transfection and transduction tools, for the worldwide scientific community and pharmaceutical industry. OZ Biosciences is focused on delivery technologies of biomolecules such as DNA, RNA and protein for in vitro and in vivo applications. Our mission is to provide cutting-edge transfection and transduction reagents in order to enable life science researchers to achieve outstanding success. The company has established a strong position in the field of molecular delivery system with several patents and know-how for Magnetofection™, Magneto-biolistic, magnetic-assisted transduction, Polyfection, Lipofection and 3D transfection, technologies.



### UNCOVERING NEW INSIGHTS ABOUT THE HUMAN BRAIN

Founded in 2011 by tech entrepreneurs Tan Le (CEO) and Dr Geoff Mackellar (CTO), the company is headquartered in San Francisco, U.S.A. with facilities in Sydney, Hanoi and Ho Chi Minh. EMOTIV is a bioinformatics company advancing understanding of the human brain using electroencephalography (EEG). Its mission is to empower individuals to understand their own brain and accelerate brain research globally.



# INTERNATIONAL ACTIONS

## A GLOBAL PERSPECTIVE



20

MOBILITY FOR MSc  
& BSc STUDENTS  
PER YEAR



4

INTERNATIONAL  
PHD FELLOWSHIPS



11

PARTNER  
UNIVERSITIES



15

CO-SUPERVISED  
PHD  
SCHOLARSHIPS

NeuroSchool sustain strong international links with 3 foreign universities (Helsinki, Oldenburg, and Montreal) as well as its involvement in the Euro-Mediterranean Master's programme in Neuroscience & Biotechnology (EMN-Online). We offer mobility fellowships for bilateral exchanges to excellent students, following a specific recruitment process.

Now open to the BSc level, our mobility fellowship program gives the opportunity to up to 5 BSc students every year to do a lab internship abroad in one of our partner university.

At the MSc level, we allocate each year up to 10 outgoing and 10 incoming mobility fellowships. We supply personalized help to find accommodation and a buddy program to facilitate the arrival of incoming students in Marseille, and reinforced English language courses for NeuroSchool students, with the opportunity to do a standardized English test.

At the PhD level, NeuroSchool offers every year mobility grants for PD students to attend international summer schools and we welcome 3 international PhD students thanks to full PhD scholarships.

To further strengthen and develop international partnerships, NeuroSchool will also offer financial support for jointly-supervised PhDs (15 1-year fellowships). Currently, 9 AMU students are doing a co-supervised PhD in neuroscience, mainly with Mediterranean universities but also Ukraine and Canada.

NeuroSchool coordinators regard their international strategy as a major factor to greatly improve teaching quality and efficiency. NeuroSchool supports bilateral missions for visiting partners and NeuroSchool lecturers in order to give them the possibility of working together with international colleagues to develop innovative pedagogy. We will also establish new international partnerships focusing on research topics that are complementary to our local expertise (such as neuroengineering or humanoid robotics), on interdisciplinary science, in order to provide additional specialized training.

To ensure that all NeuroSchool actors work smoothly and efficiently, we are regularly followed, evaluated and advised by an international scientific, educational and economic advisory board. Eight academic and industry researchers conduct yearly reviews and issue recommendations to NeuroSchool and its funding bodies (ANR and A\*Midex).



### 1. Oldenburg

Germany

- Important research in sensory neuroscience,
- all master's courses given in English,
- many events for international students.



### 2. Montreal

Canada

- A university recognized globally,
- A major neuroscience research cluster,
- Cutting-edge research in all fields of neuroscience.



### 3. Helsinki

Finland

- A reputable university (top 100),
- a Neuroscience Center with highly performant technical platforms,
- all master's courses given in English.

#### CIVIS, A PANEUROPEAN UNIVERSITY:

AMU has recently formed an alliance with the National and Capodistrian University of Athens (Greece), the Free University of Brussels (Belgium), the University of Bucharest (Romania), the Autonomous University of Madrid (Spain), the Universities of La Sapienza in Rome (Italy), Stockholm (Sweden) and Eberhard Karls in Tübingen (Germany) to create a paneuropean university, Civis. NeuroSchool will extend its international actions to Civis, notably exchange students and share courses with these new partner universities.



# STUDY-TO-WORK TRANSITION

Recognizing the scarcity of tenure-track academic positions, we have the ambition to transform our scientific training from a one-size-fits-all approach into a tailored program that maximises quality and efficiency and values individual preferences and skills. We seek to increase our trainees' employability and lead them to satisfying professional lives by improving the personal professional project of each individual and implementing four new tracks.

The BSc in Life Science has set up a Personal Professional Project (PPP) course which spans from Year 1 to Year 3, and the MSc in Neuroscience includes in its program three courses dedicated to professionalization.

We now aim to enlarge these career management modules to the whole cursus and create an Individual Career Plan. The Plan will allow each trainee to define their needs, analyze their motivations, identify their skills, determine their possibilities of orientation and draw up a well-thought-out and realistic professional project. All students will choose a career mentor, preferably from a professional track close to their own objective, whom they will meet at their own pace along their cursus to have an external advisory overlook of their career trajectory. We also offer advanced courses on research or career management, use and care of laboratory animals, scientific communication and computer skills. Undoubtedly, these complementary training units will improve students' employability, whatever the professional path they choose.

We offer our students a training plan through 4 different tracks:



## Track for an academic career

This track is dedicated to students who wish to pursue a career as a researcher or a lecturer in France or abroad. A panel of specialized courses is proposed with graded levels of difficulties, including training on scientific writing, while international internships is highly encouraged. Undergraduate students are introduced early to research as they work on small collaborative research projects. New courses and workshops on laboratory management will be included. Finally, a distinctive mentoring of postdoctoral projects will be part of the Individual Career Plans.



## Track for a career in scientific communication

NeuroSchool wishes to increase the interactions between basic and clinical research. Both medical and scientific students can attend or organize courses or international workshops on clinical topics. To reinforce the link between research and clinical practice, Neuroschool will offer ten 1-year PhD fellowships to highly motivated and talented medical or paramedical (orthophonists, orthoptists, physiotherapists, radiographers...) students to do a PhD in neuroscience. The PhD program efforts to create an MD/PhD track is being amplified. For example, NeuroSchool researchers and lecturers help prepare second year medical students who enroll in a nationally-recognized educative programs such as the Liliane Bettencourt School of Inserm.



## Track for a career in clinical research

For several years, the master's and doctoral programs have had fruitful interactions with local biotechnology companies. For example, MSc students can do an internship in a biotech company and benefit from one-week training in business creation while young AMU PhDs in neuroscience can be awarded one-year postdoctoral salary to work in a biotech linked to neuroscience. Note that all our previous grantees now have a long-term contract in the companies that hired them as postdoc. Amplifying this effort, we will offer internships and PhD scholarships similar to CIFRE-type grants for PhDs in collaboration with the private sector. In addition, we are setting up diplomas (DESU) and a Summer School on the creation and management of neuroscience biotech, in association with specialized institutes and the four NeuroSchool industrial partners. This will allow interested students to graduate in intellectual property and business creation. We will also introduce students to good laboratory research practices, a major issue for biotech.



## Track for a career in the industry

Nowadays, pharmaceutical and biotechnology companies are eager to hire scientists capable of communicating and linking production to marketing. Furthermore, a growing number of students wish to move towards scientific popularization. Fitting this dual request, we set up a diploma (DESU) in partnership with AMU School of Journalism (EJCAM), which should improve employability. In addition, students organize, among other things, lay audience lectures, produce videos on major scientific articles, and present classroom activities for the Brain Awareness Week.



## MY POSTDOC IN A START-UP

First of all, I want to emphasize the fact that linking young PhDs with local companies is a very good idea. This opens an additional channel to PhDs who cannot or do not wish to go abroad. For me, this award was very convenient because I was already interested in the themes developed in the NeuronExpert society. When I discovered that they were participating in the post-doctoral fellowship program, I did not hesitate to apply, especially as this scholarship allowed me to discover and get into a private company, while keeping the possibility to change at the end of the contract if it did not suit me.

**Nathalie Py, 2014**





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# THE FUTURE

## EXPANDING OUR SCOPE OF ACTIONS

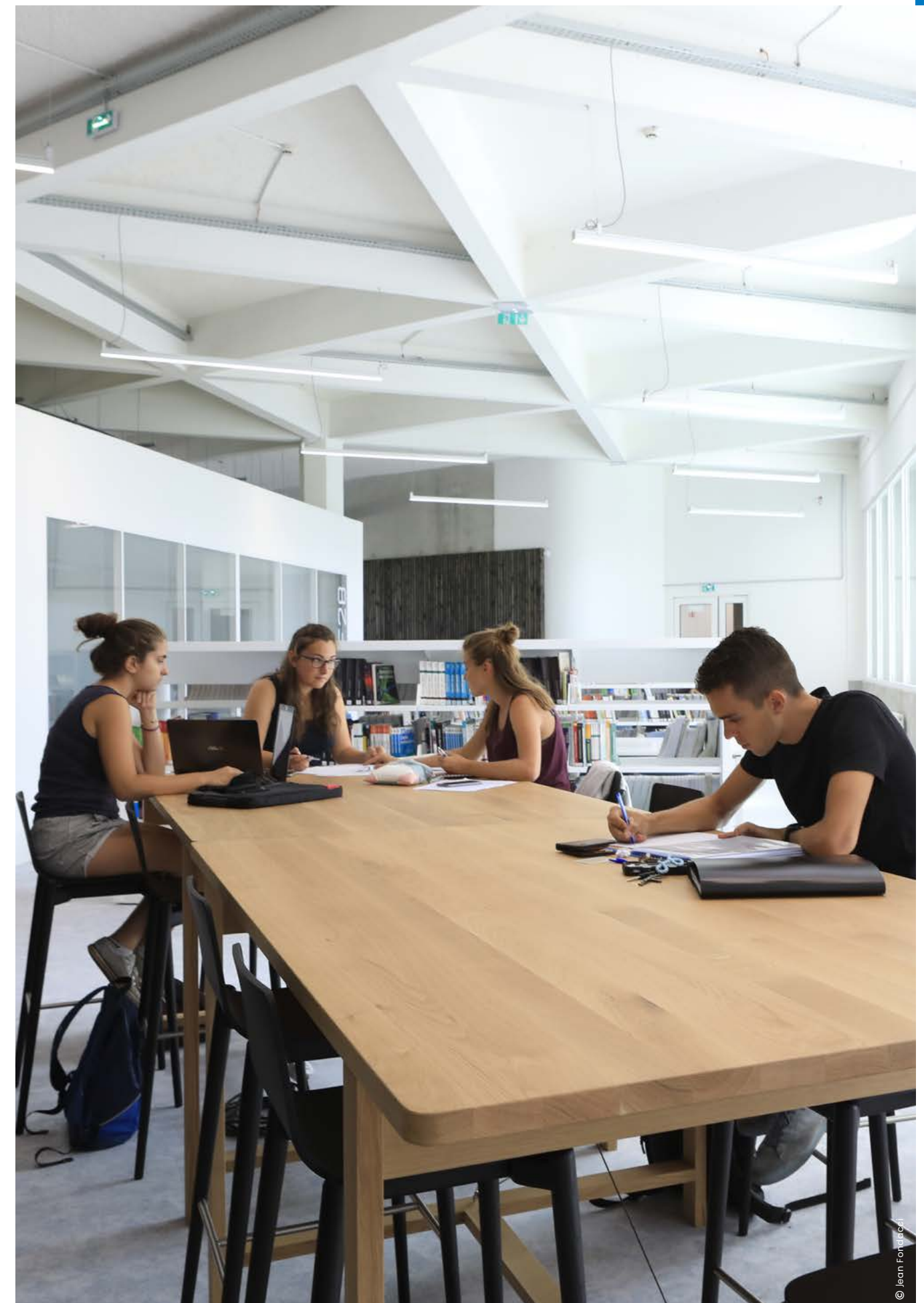
In the coming months and years, NeuroSchool will expand its scope and enrich its training programs.

1

In April 2019, Aix-Marseille University decided to create and fund a neuroscience institute. NeuroMarseille will include a research and an educational component, the latter being represented by NeuroSchool. Together, researchers and lecturers will improve training « by and for research » and increase Marseille visibility on the global neuroscience scene.

2

Aix-Marseille University is currently involved in the creation of Civis, a European university, including eight universities located in the cities of Athens, Brussels, Bucharest, Madrid, Marseille, Rome, Stockholm and Tübingen. NeuroSchool has and will take an active part in the construction of this European campus and will ensure that at least 50% of its students collaborate with one or more of Civis partners.



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# PARTNERS

## INSTITUTIONAL PARTNERS



## FINANCIAL PARTNERS



## PRIVATE PARTNERS







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