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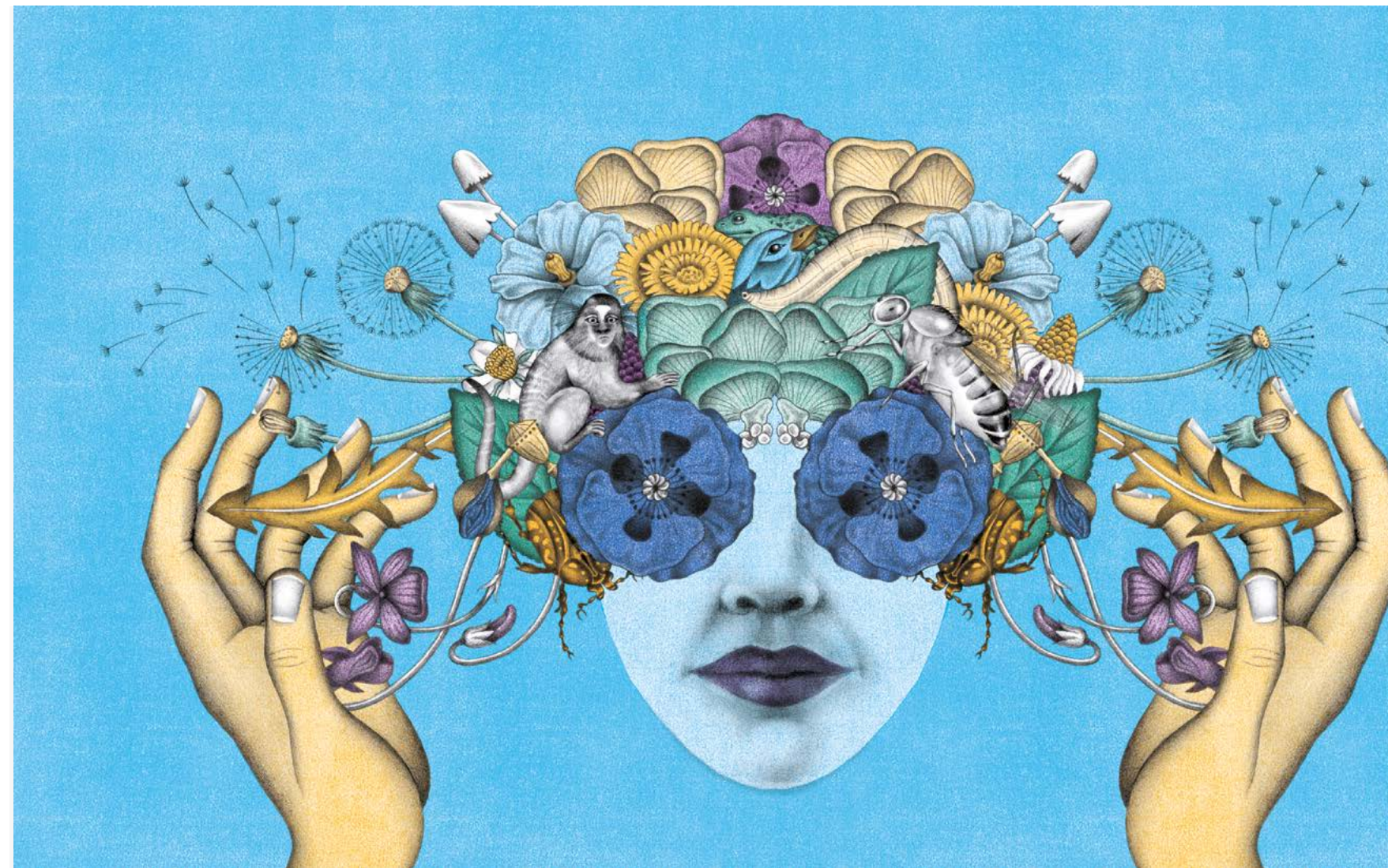
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NeuroMarseille  
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**FEDERATING NEUROSCIENCE  
RESEARCH AND TRAINING**

**TO MEET THE CHALLENGES OF TOMORROW**



With 78,000 students, including 10,000 from abroad, nearly 1,000 national and university degrees, a professional guidance and 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 economic development of its territory, and beyond. Collaborating with socio-economic actors is one of its major goals.

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 12 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 the Mediterranean and Africa.





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## WELCOME

### The second largest French neuroscience community

Marseille is currently the second-largest French neuroscience hub. NeuroMarseille brings together 9 research institutes of more than 70 teams and with NeuroSchool, our graduate school in neuroscience, we represent over 900 researchers, engineers, and students. NeuroMarseille aims to create a coherent and collaborative framework to improve the visibility, attractiveness, and impact of Aix-Marseille University research and training in neuroscience.

NeuroMarseille aims to strengthen the links between training and research and to join the academic and medical community around 4 thematic axes, dealing with development, the pathophysiology of neural networks, the evolution of behaviors and their neural bases, and aging and brain damage. NeuroMarseille's training component revolves around NeuroSchool, a graduate school that brings together Bachelor (3rd year), Master, and PhD students. NeuroSchool works closely with the research laboratories and technical platforms to deliver advanced and tailored education. In collaboration with our partners, we offer courses on cutting-edge subjects and novel training methods. More importantly, we tailor our teaching to the desires and professional objectives of each student. We believe that in a rapidly changing world, students need to learn and be mentally flexible. At the interface between innovative research and education, NeuroMarseille prepares the next generation of students for the challenges of tomorrow.



**PASCALE DURBEC**

Director of NeuroMarseille



# NeuroMarseille Institute

Federating neuroscience research and training to meet the challenges of tomorrow.

- Promoting excellence in basic and clinical research
- Improving the international attractiveness of Aix-Marseille University (AMU)
- Strengthening interdisciplinarity
- Improving the visibility of AMU's neuroscience
- Integrating our platforms into national and international issues
- Improving AMU's neuroscience technology transfer capacity

## Developing and promoting Marseille neuroscience.

At the crossroads between research and training, the Aix-Marseille Université Institutes are new objects, embodying innovation and interdisciplinarity within the university. NeuroMarseille unites Marseille's 9 neuroscience research laboratories, the NeuroSchool Graduate School (Ecole Universitaire de Recherche), the University Hospital (AP-HM), and biotechnology companies. The institute thus aims to promote interlaboratory and international collaborations, collaborations with the industrial world, and integration of students in professional life. NeuroMarseille also has the ambition to reach out to citizens to highlight all levels of research to allow us to invent the future. The creation of NeuroMarseille, in phase with the start of the Graduate School NeuroSchool, is a unique opportunity to accelerate this scientific dynamic and to respond to the scientific and pedagogical challenges of tomorrow.

## Four scientific questions we are working on:

- 1 HOW DOES THE **BRAIN DEVELOP** TO ACHIEVE THE HIGHEST COGNITIVE FUNCTIONS?
- 2 WHAT ARE THE **MULTI-SCALE DYNAMICS OF NEURAL NETWORKS** IN THE HEALTHY AND DISEASED BRAIN?
- 3 HOW CAN WE STUDY THE **EVOLUTION OF BEHAVIORS** AND THEIR NEURAL BASES?
- 4 HOW CAN WE COMBAT THE MALADAPTIVE MECHANISMS INVOLVED IN RESPONSES TO **AGING, NEURODEGENERATIVE DISEASES AND DAMAGE TO THE NERVOUS SYSTEM?**



3

RESEARCH  
CAMPUSES

9

LABORATORIES



12

PARTNER  
UNIVERSITIES

36

TECHNICALS  
PLATFORMS

950

PEOPLE





# NeuroSchool

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

## Two objectives

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

## Advanced and tailored education in neuroscience.

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



## NEUROSCHOOL'S MISSIONS

1

**EXPANDING EXISTING 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 further integrating training into laboratories, by deepening disciplinary and multidisciplinary courses,

3

**OPENING INTERNATIONAL TRAINING PROGRAMS** by funding foreign PhD students, coordinating with international partners to award mobility fellowships, financing co-supervised PhDs, establishing double degrees, and creating summer schools and conferences,

4

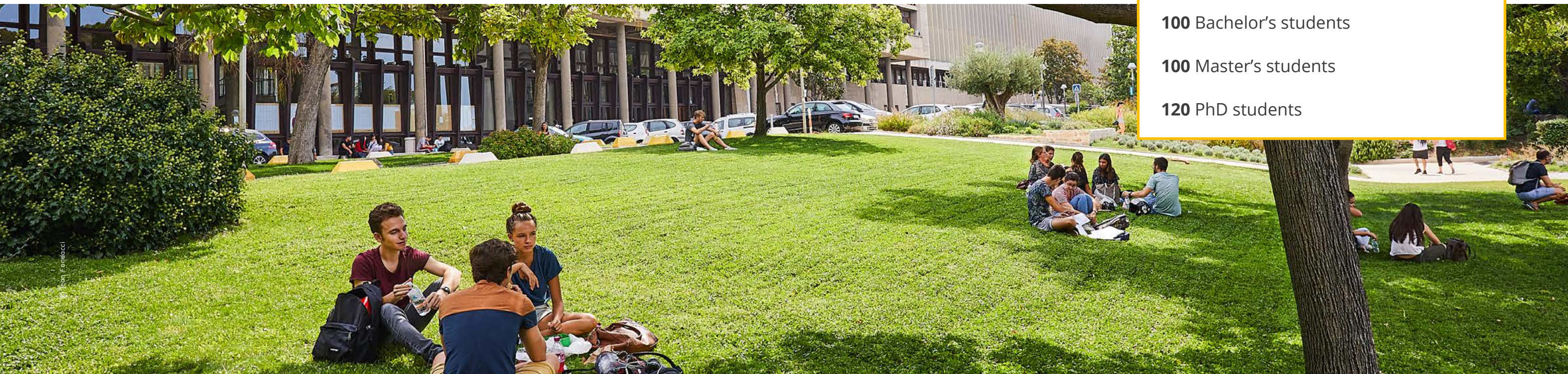
**IMPROVING PROFESSIONAL INTEGRATION** by setting up customized career monitoring and training towards either academic, clinical or industrial research, or in scientific communication.

## Three educational programs in neuroscience

**100** Bachelor's students

**100** Master's students

**120** PhD students





# Meet Our Team



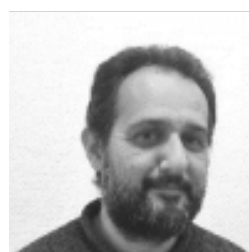
60 people dedicated to innovation, research, education, and professionalization for Marseille's neuroscience.

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

## ► Board of directors



**PASCALE  
DURBEC**  
DIRECTOR



**BORIS  
BURLE**  
DEPUTY  
DIRECTOR  
RESEARCH



**ANNE  
KAVOUNOUDIAS**  
DEPUTY  
DIRECTOR  
TRAINING

## ► NeuroMarseille support team



**GABRIELLE  
GALLON**  
OPERATION  
DIRECTOR



**ISABELLE  
VIRARD**  
NEUROSCHOOL  
COORDINATOR



**LAURIE  
ARNAUD**  
ADMINISTRATIVE  
MANAGER



**INGRID  
MEUCCI**  
COMMUNICATIONS  
MANAGER

## PEDAGOGICAL TEAMS

For each degree (BSc, MSc, PhD), specific committees including Marseille lecturers and researchers work constantly to keep the course content at a level of excellence. Thanks to NeuroMarseille privileged relationship 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



**ANNA  
MONTAGNINI**



**WAFAA  
ZAARAOUI**

### FUNDING

NeuroMarseille and NeuroSchool activities are made possible thanks to the French government under the Programme "Investissements d'Avenir", Initiative d'Excellence d'Aix-Marseille Université via AMidex funding (AMX-19-IET-004), and ANR (ANR-17-EURE-0029).



## OUR TRAINING

### 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 track). 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 track
- Master's degree in neuroscience
- PhD Program

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

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

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

It places great importance on statistical tools and modeling, as well as to practical teaching, so that the student is familiarised early on with the experimental process, good laboratory practices and data analysis.



BSc in Life Science, Neuroscience track : 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,
- Sensori-motor processes: from perception to action,
- Cognitive processes and behaviors.

In addition, the teaching includes:

- **2 mandatory courses** where students are familiarised 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 an initial introduction to academical research or R&D. During these tutored workshops, they are familiarized with the different stages of a research: identification of the scientific question, bibliographic research, design of the protocol, data collection, and processing. Finally, they present their work as a poster.

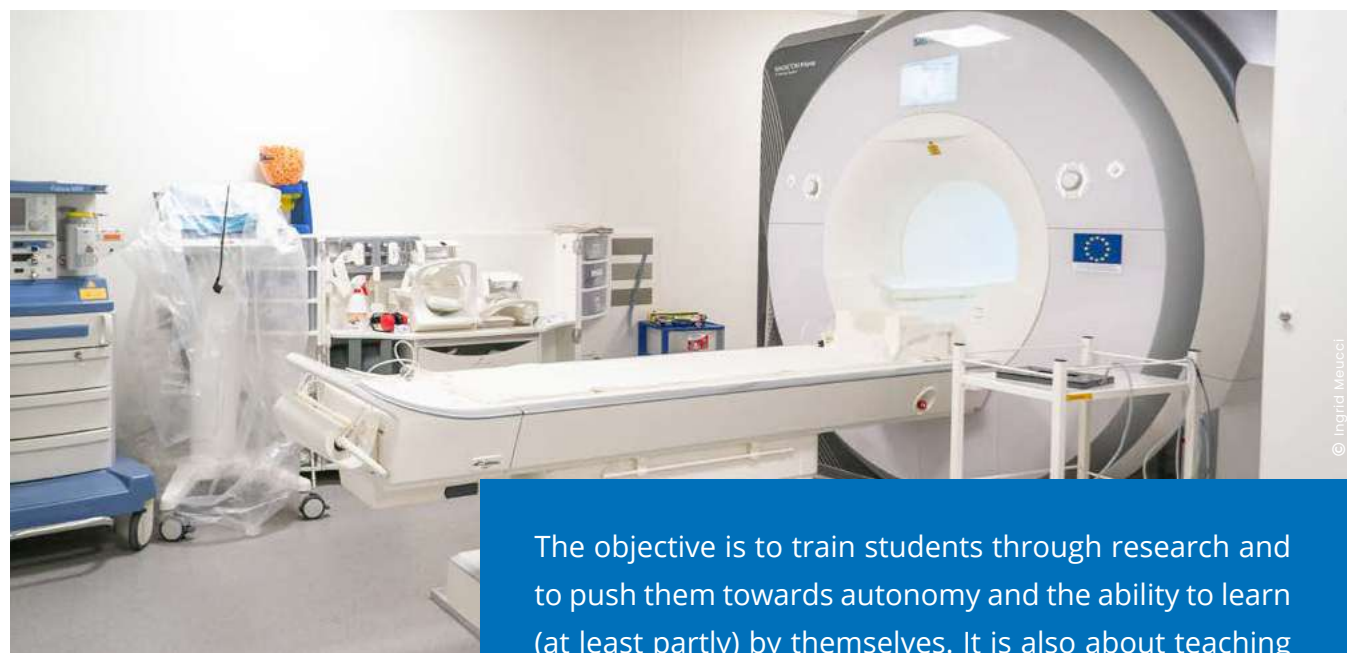


# Master's degree in neuroscience

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

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

- **THE MOLECULAR, CELLULAR AND INTEGRATED NEUROSCIENCE** track trains students in projects relating to the subcellular and cellular functioning of neurons, glia and small networks.
- **THE INTEGRATED COGNITIVE AND BEHAVIORAL NEUROSCIENCE** track trains students in projects relating to the functioning of large neural networks, the different structures of the central nervous system and their communication.
- **THE EMN ONLINE** track is a Euro-Mediterranean Master in Neuroscience and Biotechnology. It trains students in 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 partly) by themselves. It is also about teaching teamwork and collective project management — which does not exclude autonomy — and, when possible, taking initiative. This is accompanied, in all courses, by the development of analytical and critical thinking skills.

## EDUCATIONAL INNOVATION

Research is a key part of the MSc program, with a total of 8 months of laboratory training over 2 years within the 75 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 to present 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 educational innovation is our Problem-Based Learning modules for MSc students. Students address one of 12 transdisciplinary neuroscience questions 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: TAKING THE TOEIC

Proficiency in English is now mandatory for a career 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 provides complementary training tailored for neuroscience students. Through the NeuroSchool PhD Program, PhD students have access to training specifically dedicated to neuroscience and can join a smaller, more focused, community. They benefit from a variety of scientific events (basic and specialized courses, monthly tutored seminars, clinical training...), as well as from professional, social and networking events, in which they actively participate and/or organize (PhD Days, special

events). The events are constantly evolving and are selected every year with the PhD students so as to optimally fulfill their needs.

The PhD program pursues the following objectives:

- Training students by and for research,
- Preparing students for the study-to-work transition from neuroscience graduate students to academic, clinical or corporate worlds,
- Broadening students' scientific culture and develop their critical faculties,
- Building a professional network, locally and internationally.

## OVER THE LAST 4 YEARS



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## AN EDUCATION BASED ON STUDENTS' INVOLVEMENT

At the PhD level, students already work every day in a research laboratory. Our PhD program develops even stronger interactions with researchers through events involving all neuroscience laboratories, such as the monthly tutored seminars or the organisation the annual NeuroDays, and through common courses crossing all Aix-Marseille University neuroscience subfields. These events and courses allow students to gain a wider understanding of neuroscience and to get to better know researchers and fellow graduate students. In order to complete our students' training in highly-specialized fields, we also offer our PhD students mobility fellowships that allows them 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 to actively and critically listen to 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 knowledge.

### Specialized courses

Our students come from different backgrounds and educational systems and, so have a rather heterogeneous knowledge of the different areas of neuroscience and the techniques used. The goal of the basic courses is to standardize their level.

In addition, three specific courses are offered each year, as voted for 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".



© Pierre Albiges



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### Special events

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

In addition, the 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.



# INTERNATIONAL ACTIONS

## OPPORTUNITIES FOR BACHELOR, MASTER AND PHD STUDENTS



20

MOBILITY FOR MSc  
& BSc STUDENTS  
PER YEAR



3

INTERNATIONAL  
PHD FELLOWSHIPS  
PER YEAR



12

PARTNER  
UNIVERSITIES



2

CO-SUPERVISED  
PHD  
SCHOLARSHIPS  
PER YEAR

NeuroSchool sustains strong international links with all the 8 European partners included in the CIVIS Alliance (see next page) plus 3 other foreign universities (Helsinki, Oldenburg, and Montreal). We offer mobility fellowships for bilateral exchange visits to excellent students, following a specific recruitment process. Its also involved in the Euro-Mediterranean Master's programme in Neuroscience & Biotechnology (EMN-Online).

Now open at 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 universities.

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 to Marseille, and reinforced English language courses for NeuroSchool students, with the opportunity to take a standardized English test.

At the PhD level, NeuroSchool offers mobility grants every year for PhD students to attend international summer schools and we and every year we award to 3 to 4 international students a full PhD scholarship.

To further strengthen and develop international partnerships, NeuroSchool also offer financial support for jointly-supervised international PhDs (up to 3 fellowships per year). Currently, 9 AMU students are doing a co-supervised PhD in neuroscience, mainly with European universities but also Ukraine and Canada.

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

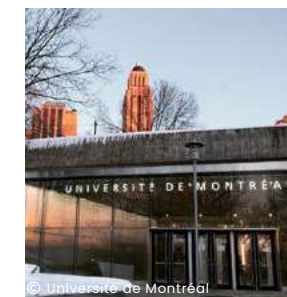
To ensure that NeuroSchool works smoothly and efficiently, we are regularly followed, evaluated, and advised by an international scientific, educational, and economic advisory board. Eight academic and industry researchers conduct yearly reviews and issue recommendations to NeuroSchool and its funding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



### 1. Oldenburg

Germany

- Strong research in sensory neuroscience
- All master's courses given in English
- Many events for international students



### 2. Montreal

Canada

- A globally recognised university
- 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 high performance 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 University of Glasgow (Scotland), 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 has extended its international activity to Civis, through student exchanges and shared courses with these new partner universities.





# RESEARCH

NeuroMarseille hosts 452 full-time permanent researchers, academics, technicians and engineers; including non-permanent staff and PhD students, it represents in total nearly 950 people.

## WE BRING EXCELLENCE IN TRAINING AND RESEARCH.

This network is also involved in 5 Associated International Laboratories (LIA). In addition, the links between fundamental and clinical research are based on the presence in Marseille of one of the three largest university hospitals in Europe.

NeuroMarseille federates all neuroscience units, in connection with their partners such as the FHU (DHUNE, EpiNext) and the Convergence Institutes (ILCB & Centuri). NeuroMarseille also brings together more than a dozen technological platforms in imaging, molecular biology and animal models, backed by neuroscience laboratories.

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, spanning a wide variety 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 a unique way, critical features that NeuroMarseille will capitalize on to offer aspiring researchers the knowledge and knowhow required to achieve scientific excellence.

NeuroMarseille gathers 75 teams spread over 3 campuses representing Marseille's academic research in neuroscience. These teams are distributed in the following 9 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 (including EEG, fMRI, MEG, unitary electrophysiology, microneurography).

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





## 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 dysfunction. Basic research projects are complemented by applied research projects; for example, research on reading in the baboon has led to projects on dyslexia, iPhone applications, eating behavior, smoking, transportation safety... The research is structured around five main themes, each represented by a separate team:

- Cognition and social context
- Perception and attention
- Development and cognitive aging
- Language
- Comparative 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, AND 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 separate 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, with 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 separate 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

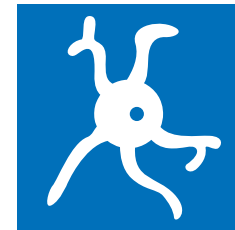
## Institut de Neurosciences de la Timone (INT)



### 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 its dysfunction 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's 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 13 main themes, each represented by a separate 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 the link between training, basic research and translational research is strong. In particular, nearly all neuroscience laboratories have institutional partnerships with departments in neurological science, mainly on the Timone campus.

The federation of fundamental and clinical neuroscience research units has already succeeded in creating two University Hospital Federations (FHUs), in the fields of epilepsy (EpiNext) and neurodegenerative diseases (DHUNE), which aim to advance 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 interfaces and curing 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 training programs in the Assistance Publique-Hôpitaux de Marseille (AP-HM, Marseille Public University Hospitals).

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

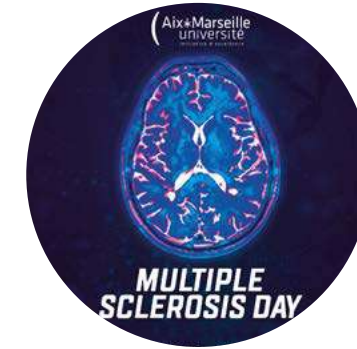


## INTERNSHIPS AT THE HOSPITAL

The PhD program organizes 1-week-long immersive training at the AP-HM, in different clinical units such as:

- 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, surgical procedures. 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, bringing together clinicians and researchers. PhD students help organize 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.
- June 2021: Autism Day.



## PHD SCHOLARSHIPS FOR MDS AND PHARMDS

NeuroSchool PhD Program offers to finance one year of neuroscience PhD study 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 to foster 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 three 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 South region. The main objective of these scholarships is to promote the professional integration of early-career researchers.

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.



# 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 career goals 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 course 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 during their course to have an external advisory overview 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 offered with graded levels of difficulties, including training on scientific writing. International internships are highly encouraged. Undergraduate students are introduced to research early 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 clinical research

NeuroSchool wishes to increase 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's efforts to create an MD/PhD track is being intensified. For example, NeuroSchool researchers and lecturers help prepare second year medical students to enroll in a nationally-recognized educative programs such as the Liliane Bettencourt School of Inserm.



## Track for a career in the industry

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 a 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 postdocs. To intensify 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 opening a new diploma (DESU) in Data Science, specially offered to our graduate students to enhance their skills in big data analysis and visualisation. Our students will be trained in the sciences and competent in computer science, especially in data management. It will open new opportunities in many fields of application, with a predominance in health-related R&D with targeted jobs like Data Scientist, Data Analyst, Data neuroscientist, Research & Innovation Specialist, Clinical data science engineer, etc.



## Track for a career in scientific communication

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, organise lay audience lectures, produce videos on major scientific articles, and present classroom activities for 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**



# 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**  
ATTEND



**2**  
PROFESSIONAL  
EVENTS



**28**  
SCIENTIFIC  
GUESTS



© Neuronautes

## 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 PhD students' status with the various scientific and economic organisations in order to improve their professional integration,
- it informs master's students about the path their studies will take.



© Hippo'Thèse



Meetings with companies or laboratories.



CV writing workshops.



Interview simulations.



Cross-disciplinary training (poster design, etc).



© Hippo'Thèse



**10**  
AFTER-LAB  
MEETINGS  
PER YEAR



**3**  
SCIENTIFIC  
EVENTS  
EACH YEAR





## TESTIMONIALS

Guiding students as well as possible is our priority.

To prepare neuroscience graduate students' study-to-work transition, we propose a range of activities, from building an alumni network to strengthening the links with the biotech industry, clinical research, and scientific communication.

We organize tutored sessions to teach students how to write scientific CVs and cover letters and to create their personal LinkedIn profiles. Neuroschool also supports the Neuronautes students' society, especially for networking events such as meetings with neuroscience graduates who have academic or non-academic careers.

In order to prepare MSc students for professional life in the private sector, we provide 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 activity is funding postdoctoral positions in biotech companies (NeuronExperts, Vect-Horus, NeuroChlore, OZ Biosciences) for young AMU PhDs. We are very happy 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 gave me a lot of freedom and autonomy in my work, and in a climate of trust. The master's program does not only provide in theoretical learning, it is also allowed us to meet people who helped us advance on both professional and human levels.

There wasn't a great difference between basic and clinical research, the goal was more to help develop new therapeutic strategies. Practical training gave us knowledge in biology and a scientific profile, which is essential. We never felt like we were caught off guard, regardless of the medical field in which we had to work.

**Jeremy Mione**

**Clinical research associate**

— 2016 graduate

“

The neuroscience master was for me an obvious step towards a PhD, especially to get an initial feeling on my desire to continue (or not) in laboratory research. The Neuroscience DEA (former name of the master) offered me my first real immersion in a research laboratory, and this is the most important asset of the training. Subsequently, my supervisor gave me their full confidence, 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 basis for the rest of my career. Laboratory internships in M1 and M2 also allowed me to confirm that this was the path in which I wanted to continue.

**Sophie Dutheil,**

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

— 2007 graduate



# PARTNERS

## INSTITUTIONAL PARTNERS



## FINANCIAL PARTNERS



## PRIVATE PARTNERS

