

Academic year 2021 – 2022

TEACHING TEAM

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- Dual Master's Program in Brain and Mind Science

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- International Master in Neurodegenerative Diseases (iMIND)

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- Vision Sciences

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hedi.soula@sorbonne-universite.fr

- Aeging and Longevity

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- Marine Biology and Bioresources

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- Neurosciences

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- Nutrition, Quality and Health

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- **Systems biology**

sciences-master-bip-bs@sorbonne-universite.fr

- **Ageing and longevity**

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- **Marine biology and bioresources**

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- **Human physiology and pathophysiology**

sciences-master-bip-pmph@sorbonne-universite.fr

- **Neurosciences**

sciences-master-bip-neurosciences@sorbonne-universite.fr

- **Nutrition, quality and health**

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<https://sciences.sorbonne-universite.fr/formation-sciences/masters/master-biologie-integrative-et-physiologie-bip>

PRESENTATION OF THE BIP MASTER'S PROGRAM

The scientific objective of this master's course is to train students in the emerging concepts of integrative biology and physiology and to provide them with an understanding of molecular, cellular and integrated physiological and pathological mechanisms in animals and humans. Beyond this scientific knowledge, this master's course also enables students to acquire the transverse, conceptual and methodological skills required for professional integration and for the pursuit of doctoral studies.

The BIP master's program covers a broad disciplinary field, with six M2 specialties and five international programs.

The six M2 specialties:

- Systems biology (SB)
- Ageing and longevity (AL)
- Marine biology and bioresources (MBB)
- Neurosciences
- Nutrition, quality and health (NQH)
- Human physiology and pathophysiology (HPP)

The four international masters programs:

- Biology of marine organisms, in partnership with the University of Santiago in Chile, as part of the MBB specialty (currently being restructured)
- Dual master in brain and mind science, in partnership with the ENS and UCL, as part of the Neurosciences specialty
- International master in neurodegenerative diseases, in partnership with Trinity College Dublin, the University of Vienna, KU Leuven and the Technical University of Munich (TUM), as part of the Neurosciences specialty
- Vision sciences, in partnership with the UNAM, as part of the Neurosciences specialty

The professional objectives of the BIP master's program favor the progressive orientation of students, guiding them towards integration into the workplace at the end of M2, or towards further doctoral studies or complementary studies to qualify in two different areas.

- This master's course has existed since 2004, providing us with 10 years of data concerning the careers and posts held by the recipients of this diploma, revealing numerous professional possibilities.
- The principal sectors recruiting our graduates are: biotech, pharmaceutical and agrofood companies, commerce, regulatory agencies for human health and social action, specialist scientific and technical activities, service activities, local and regional government, research and teaching.
- 98% of the 2014/2015 BIP master's graduates have found employment, according to a ministerial survey of master's students 30 months after their graduation performed by the BVA polling agency, with a response rate of 46%. These figures have remained relatively stable from year to year, indicating the effective integration of our graduates into the workplace.
- The rate of access to a first job is 98%, with a median duration of one month to obtaining this first job. After 20 months, 46% of the students were pursuing doctoral studies, 45% were working (permanent, short-term and other contracts), 5% were pursuing complementary studies and 4% were seeking employment.
- 80% of the graduates became executives and senior managers, consistent with the objectives of the training. Finally, 70% agreed that their employment corresponded to the content of their training. The careers of the graduates were highly diverse, although almost all were covered by the "study, research and development" and "cultural, health, social, sport" BVA categories. This adaptability of the diplomas obtained appears to be chosen and not imposed, because 94% of those questioned were entirely or rather satisfied with the missions conferred on them.

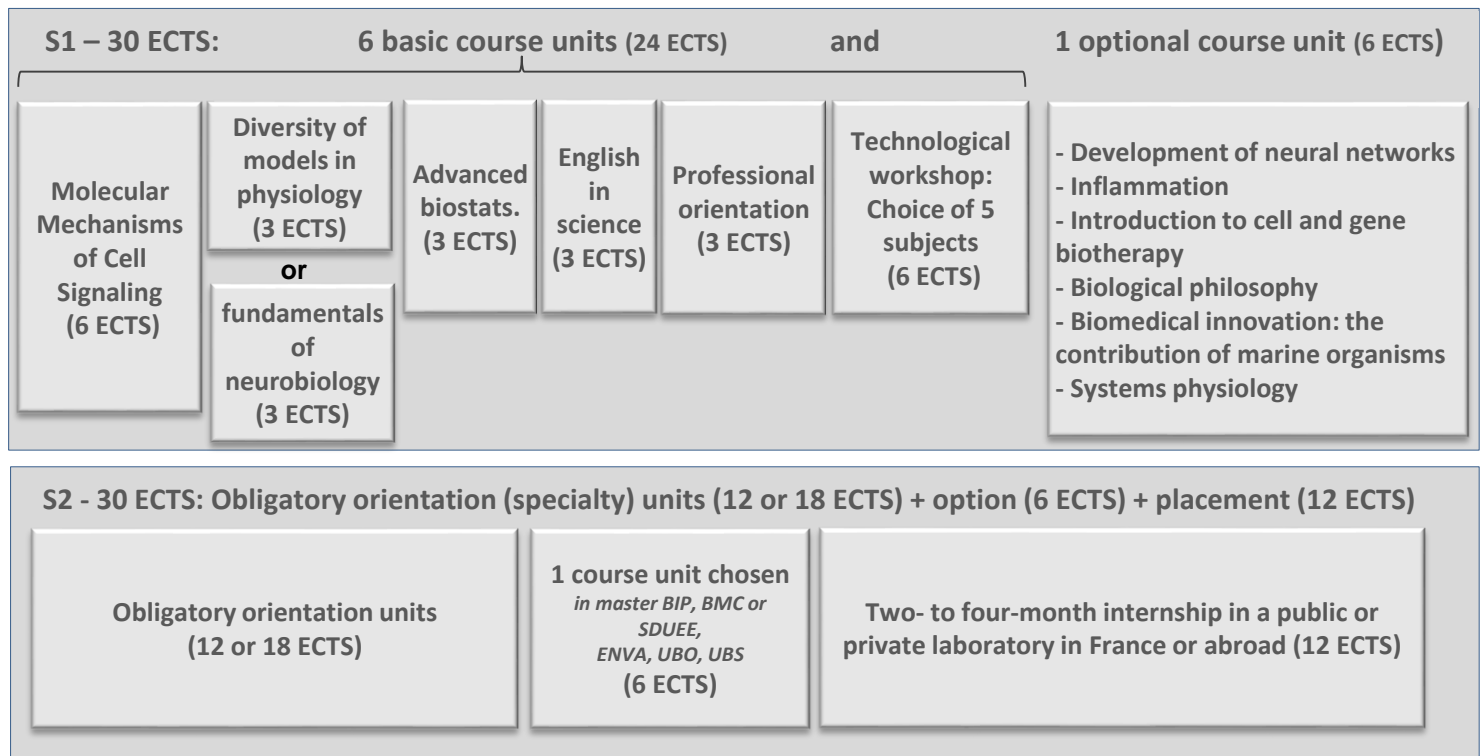
Conditions of admission

• Students holding a bachelor's degree in life sciences, life and earth sciences or science for health from French university, foreign universities via the *Etudes en France* program, engineering school students or students from the Erasmus exchange program.

• Applications are made through an online procedure, as described on the home page of the Sorbonne University website www.master.bip.sorbonne-universite.fr. Admission to this masters course is selective and depends on the type of bachelor's degree obtained. The examination of the application dossier may, in some cases, be followed by an interview.

M1 YEAR: Course organization for the 1st and 2nd semesters

1st semester of M1



2nd semester M1

• Choice of course units according to educational orientation (specialty)

Systems biology: Python for physiological modeling, Tutored project for systems biology, *1 optional unit from the following:* Exploration of physiological functions in small animals, Tools for biology and applied molecular analyses, Physiology of integrated systems, Integrated neurophysiology.

Ageing and longevity: Ageing: from biology to societal issue – Brain ageing, *1 optional unit from the following:* Physiology of integrated systems, Exploration of physiological functions in small animals, Integrated regulation of energy balance, Python for physiological modeling.

Marine biology and bioresources: “Marine organisms and biological models” workshop, “Marine genomic projects” workshop, *1 optional unit from the following:* Schmid training course, “Methodologies in ecophysiology” workshop.

Neurosciences: Principal methodological approaches in neurosciences, Integrative neurophysiology, *1 optional unit from the following:* Brain ageing, Python for physiological modeling.

Nutrition, quality, health: *3 units from the following:* Exploration of physiological functions in small animals, Integrated regulation of energy balance, Digestive physiology, Impact of animal nutrition and conservation of agro-resources on the nutritional quality of products and human health, Python for physiological modeling.

Human physiology and pathophysiology: *3 units from the following:* Exploration of the physiological functions of small animals, Aging: from biology to societal issue, Digestive physiology, Tools for biology and applied molecular analyses, Physiology of integrated systems, Integrated regulation of energy balance, Python for physiological modeling.

Of note: for all specialties, it is possible to take either Business passport

• Obligatory internship

The placement takes place in a research laboratory in France or abroad (2 to 4 months). The student must then present their internship results as a poster, in front of a jury.

Secretary: Building C, 1st floor, door 105

9, quai Saint-Bernard 75252 Paris Cedex 05

University postbox 118 ☎ : 01 44 27 23 89

Academic manager for M1: Laurence Bonnet-Lericque - laurence.bonnet-lericque@sorbonne-universite.fr

M2 Specialty: Systems Biology

Systems biology is a priority axis of research in many international and national institutions, including Sorbonne University.

This specialty responds to the need for training in the rapidly growing domain of systems biology.

Objective of the training

This specialty consists of a series of specific course units enabling students to develop skills and knowledge in computing (programming, development, simulation) and mathematics (modeling, formalism, prediction) applied to contexts in integrative biology and physiology.

This specialty also includes physiology units, providing the student with dual skills in biology and systems biology. This specialty trains students to be autonomous in modeling/data integration in the biomedical domain, equipping them for integration into companies and research laboratories.

The skills acquired enable the students to be immediately operational and to deal with a large range of systems biology problems.

Conditions for admission

- Open to M1 students in biology from Sorbonne University or other universities, medical students, students from engineering schools, veterinary students and students from outside the European Union via Campus France.
- Selection by dossier and an interview.

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University postbox : 118 ☎ : 01 44 27 32 06
Academic manager : Véronique De Surirey - veronique.de_surirey@sorbonne-universite.fr

Specialty Director:
Prof. Hédi Soula

Course organization

All taught courses take place in the third trimester.

The fourth semester is devoted to a six-month internship, either in one of the host teams (EA) from the list of laboratories supporting this specialty, or in a company. The student must then write a dissertation relating to the internship, which is defended in front of a jury. This internship can take place in France or abroad (subject to validation by the directors of the specialty and the head of Mobility).

M2 course units	ECTS
3 obligatory course units 15 ECTS	
Advanced systems physiology	6
Statistics for data classification and mining in genomics	6
Biological networks and systems biology	3
4 optional course units (from the list below) 15 ECTS	
Introduction to human physiology and pathophysiology 1 (unit from the Human physiology and pathophysiology specialty)	3
Introduction to human physiology and pathophysiology 2 (unit from the Human physiology and pathophysiology specialty)	3
Neuronal networks (unit from the Neurosciences specialty)	6
Nutrigenomics (unit from the Human physiology and pathophysiology specialty)	6
Vision: from the retina to the primary visual cortex (unit from the Neurosciences specialty)	6
Brain To Market* (unit from the Neurosciences specialty)	6

Examples of topics for internship projects

Biomathematics

- Systems physiology
- Dynamic systems for physiology
- Modeling of nervous systems

Data science

- Analysis of medical and tissue imaging data
- Reconstruction of metabolic networks
- Biomedical machine learning

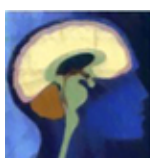
Computer simulation

- Tissue modeling
- Cell modeling



Possible careers after M2 BIP specialty Systems biology

- Study/research officer
- Data scientist (medical, biomedical)
- Researcher or researcher/lecturer
- Development engineer (BioTech)
- Head of R&D



M2 specialty: Ageing and Longevity

With the increasing life expectancy of the population, the maintenance of quality of life has become a major issue for our society. Ageing is, thus, a major field encompassing crucial issues in terms of both basic science (understanding the biological processes of aging) and multiple applications (particularly in the domain of health). An understanding of these issues and the optimization of quality of life in the elderly require improvements in our comprehension of the mechanisms underlying aging and the increasing vulnerability of major physiological functions during the course of life.

Objectives of the training

This course has two main objectives.

First, to impart a knowledge of the physiological mechanisms, from the scale of the molecule to that of the whole body, underlying ageing and longevity.

Second, it aims to help students develop an understanding of the relationships between normal and pathological ageing of the major organs and changes in the functions of these organs

In various models and in humans, the students will analyze the physiology of the body, the genes involved in its regulation and its changes over time, as a function of environmental factors.

The course will also shed light on the consequences of increasing life expectancy for public health and society.

An introduction to gerontechnologies and geriatrics will also be provided.

Conditions of admission

- Open to M1 students in biology from Sorbonne University or other universities, medical, pharmacy and veterinary students, students from engineering schools and students from outside the European Union, via Campus France
- Selection by dossier



Parcours en collaboration avec le
groupe hospitalier
La Pitié-Salpêtrière - Charles Foix



Secretary: Building B, 3rd floor, door 314
9, quai Saint-Bernard 75252 Paris Cedex 05

Specialty Directors:
Prof. Bertrand Friguet and Prof. Rachel Sherrard

University postbox :118 ☎ : 01 44 27 23 88

Academic manager : Véronique De Surirey - veronique.de_surirey@sorbonne-universite.fr

Course organization

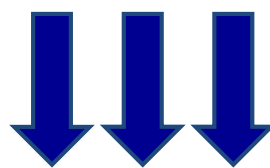
All the taught courses will take place in the third semester.

The fourth semester is dedicated to a six-month internship in a research laboratory. The student will then write a dissertation on the internship, which will be defended in front of a jury. The internship may take place in France or abroad (subject to validation by the course directors and the Head of Mobility).

M2 course units	ECTS
3 compulsory course units	24 ECTS
Mechanisms and models for studies of aging	12
Ageing and regeneration of muscle tissues	6
Design and management of a research project	6
1 optional course unit from another specialty	6 ECTS
Science and society (course unit from the Human physiology and pathophysiology specialty)	6
Cancer and environment (course unit from the Human physiology and pathophysiology specialty)	6
Inflammatory and disabling diseases (course unit from the Human physiology and pathophysiology specialty)	6
Physiopathology of sensory diseases and translationnal research (course unit from the Human physiology and pathophysiology specialty)	6
Additional course	
Animal experimentation	6

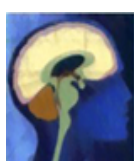
Examples of topics for internship projects

Endothelial dysfunction and Alzheimer's disease.
Genomic changes associated with age and implicated in tumor initiation.
Changes to the secretome of human myoblasts induced by replicative senescence.
Molecular basis of age-related memory loss.
Can rTMS prevent age-related cognitive decline?
Detection *in vivo*, by MRI, of Alzheimer's disease lesions in a primate model.
Effects of acute stress on the immune system in the elderly.
Gerontechnology and accessibility.



Possible careers after the BIP M2 specialty Ageing and longevity

Study/research officer
Executive or senior manager in bioindustries or in the cosmetic or pharmaceutical industry
Academic/bioindustry researcher or researcher-lecturer (master's + PhD)
Clinical research assistant
Technical and commercial executive
Scientific communication



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M2 specialty: Marine Biology and Bioresources

The term “marine biotechnologies” encompasses both studies and the use of marine bioresources (microorganisms, macroalgae and metazoans), together with the use of biotechnological and industrial tools arising from marine biology. This high-level specialty aims to train the scientific leaders of tomorrow in the domain of marine biology and biotechnology, to meet the challenges of research and innovation.

Objective of the training

This specialty aims to provide students with fundamental and applied training in the integrative biology of marine organisms. It accords considerable importance to research, the learning of concepts and the development of methods and techniques widely used in laboratories.

This specialty also includes a specific professionalization option in the domain of marine biotechnologies.

Training is dispensed at multiple sites: the Pierre and Marie Curie Campus, the three marine stations of Sorbonne University (the biological station at Roscoff and the oceanological observatories at Villefranche-sur-Mer and Banyuls-sur-Mer) and the partner universities in Brittany (West Brittany University and South Brittany University).

The professionalization option relies on support from employers in the Brittany region, including companies with sea-related activities.

Conditions for admission

- Open to M1 students in biology from Sorbonne University or other universities who have taken options in cell or molecular biology, organism biology, or chemistry/biology and students from outside the European Union, via Campus France .
- Selection by dossier.

International master's program:

Biology of marine organisms

In partnership with the *Pontificia Universidad Catolica de Chile* (Santiago, Chile)

Directors: Laurence Besseau & Yves Desdevises

laurence.besseau@sorbonne-universite.fr

yves.desdevises@sorbonne-universite.fr

Additional Spanish courses (not included in the educational contract) are available for students going to study in Spanish-speaking countries as part of their international masters program.

Contact: the language department

Marie-Laure Refort marie-laure.refort@sorbonne-universite.fr



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Specialty Directors:
Prof. Eric Quéinnec and Prof. Patrick Cormier

Course organization

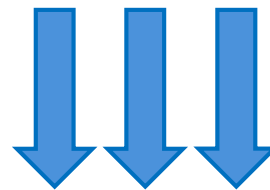
All the taught courses take place in the third semester.

The fourth semester is devoted to a six-month internship in a research laboratory or company, depending on the student's professional plans. At the end of the internship, the student must write a dissertation, which is defended in front of a jury. The internship may take place in France or abroad (subject to validation by the course directors and the Head of Mobility).

M2 course units	ECTS
18 obligatory ECTS	
Marine models in development and evolution	6
Biotechnology of the macromolecules of marine organisms	6
Biotechnology of marine algae	6
12 exploratory ECTS from the following	
Biotevents and bioresources in the marine environment	6
Translational regulation (course unit common to the BMC masters)	6
Creating a start-up company	6
Biofilms	6
Biorythms	6
Biology and adaptation in extreme environments	6
Adaptation in the marine environment	6

Examples of topics for internship projects

Integrative biology of marine organisms.
-omics: from genes to the organism in its environment.
Evolutionary scenarios for the molecular mechanisms governing cellular life or the development of organisms.
Genome evolution.
Valorization of marine resources.
Innovations in the biomedical and biotechnological domains originating from marine organisms.



Possible careers after the BIP M2 specialty Marine biology and bioresources

Study/research officer
Quality assurance manager
Academic/industrial researcher or lecturer-researcher (master's + PhD)
R&D manager
Commercial representative



Thanks to their teaching infrastructures and accommodation and their immediate proximity to the sea, the marine stations of Sorbonne University at **Roscoff**, **Villefranche-sur-Mer** and **Banyuls-sur-Mer** provide a perfect framework for these studies and ideal working conditions. The partnership established with the Brittany region and the Breton partner universities provides students with access to the employment market linked to the sea.



CNRS UPMC INSU

Station Biologique
Roscoff



M2 specialty: Neurosciences

The Master BIP-Neuroscience program trains students in all fields of neuroscience:

- cellular and molecular neuroscience
- integrated neuroscience
- cognitive neuroscience
- systems and computational neuroscience
- behavior
- development
- psychiatric diseases
- neurodegenerative diseases
- vision
- ...

Objective of the training

This specialty aims to offer broad, high-quality training in neurosciences. To help students organizing their formation, **5 thematic tracks** are proposed but courses from different thematic can be selected by each student to build his own personal curriculum:

- **cellular and integrative neuroscience**
ann.lohof@sorbonne-universite.fr
- **cognitive and behavioral neuroscience**
philippe.fossati@aphp.fr
- **vision science**
gregory.gauvain@sorbonne-universite.fr
- **neurodegenerative diseases**
helene.cheval@sorbonne-universite.fr
- **neurobiology of psychiatric diseases**
peter.vanhoutte@sorbonne-universite.fr
sandrine.betuing@sorbonne-universite.fr

Our training program is based on:

- more than 30 teaching modules in neuroscience supported by recognized specialists (researchers, teachers/researchers, clinicians, ...)
- more than 200 research teams, in France and abroad, regularly involved in our training.
- close collaboration, for teaching and research training, with the 4 Sorbonne Université neuroscience institutes (Neuroscience Paris Seine, Institut du Cerveau et de la Moelle épinière, Institut de la Vision, Institut du Fer à Moulin), and with the Institut Pasteur and the Ecole Normale Supérieure (ENS)
- 3 international training programs in partnership with University College London, University of Vienna, Technical University of Munich, KU Leuven, National Autonomous University of Mexico, and Trinity College Dublin
- 10 months of internship in internationally-recognized laboratories in France or abroad

Conditions for admission

The Neurosciences are fundamentally interdisciplinary, and our program is aimed at students from many different backgrounds

- Open to M1 biology students from Sorbonne University or other universities, medical students (interns, medicine and science, INSERM school), students from engineering schools and *grandes écoles*, students from outside the European Union, via Campus France.
- Admission upon application online; dossiers evaluated by the Neurosciences education team

International master's programs:

Dual master's program in brain and mind science

In partnership with University College London

Director: Ann Lohof : ann.lohof@sorbonne-universite.fr

Vision Sciences

In partnership with *Universidad Nacional Autónoma de México* - UNAM

Director: Grégory Gauvain

gregory.gauvain@sorbonne-universite.fr

International master in neurodegenerative diseases (iMIND)

In partnership with the University of Vienna, Trinity College Dublin, KU Leuven and the Technical University of Munich (TUM).

Director: Hélène Cheval helene.cheval@sorbonne-universite.fr



Secretary: Building B, 3rd floor, door 314
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Academic manager : Camille Leroy - camille.leroy@sorbonne-universite.fr

Specialty Director: Prof. Régis Lambert

Course organization

All the taught courses take place in the third semester.

The fourth semester is dedicated to a six-month internship in a research laboratory. At the end of this internship, the student must write a dissertation that is defended in front of a jury. The internship may take place in France or abroad (subject to validation by the course directors and the Head of Mobility).

General organisation	ECTS
1 obligatory course unit 6 ECTS	
Design of a research project	6
Core course units total of 18 ECTS to be selected from the following list according to the chosen thematic track	
Pasteur Course *	12
ENS – SU of neurophysiology *	12
ICM course: Brain to market summer school *	6
Development of the nervous system	6
Neuronal networks: information processing and representation	6
Cellular communication	6
Sensory and motor physiology and pathophysiology	6
Glial and neurodegenerative diseases	6
Physiological and pathological neurotransmission and signaling	6
Vision: from retina to primary visual cortex	6
Physiology of perception	6
Physiopathology of sensory diseases and translational research	6
Novel technologies applied to human neuropathologies	6
Understanding psychiatric disorders : from signaling molecules to circuit & behavior	6
The social brain and emotions	6
Neurobiology and psychiatric diseases	6
Cerebral basis of cognitive functions	6
Hot topics : transdisciplinary approaches to neurodegenerative and psychiatric diseases	6

Additional course	
Experimentation animale	6

Exploratory course units (2x3 ECTS)
2 modules must be chosen from the following list common to every thematic tracks.

Hormonal brain and behavior
Molecular neuropharmacology
Neuron-glia interactions
Memory and spatial navigation
Hippocampus: from cells to physiology and human disease
Brain imaging
Cerebellum
Neural basis of olfactory perception
Pharmacological approaches in neuroscience
Neuropsychiatry genetics
Thalamocortical rhythms
Modeling in biophysical and computational neuroscience
Animal models in behavioral neurosciences

Examples of topics for internship projects

Genetics and pathophysiology of familial epilepsy
Processing of sensory information and neurovascular imaging
Role of axon guidance molecules
Cellular interactions in neurodegenerative diseases
Development of neural networks



Possible careers after the BIP M2 specialty Neurosciences

- Study/research officer
- Academic/industrial researcher or lecturer-research (master's + PhD)
- Technical manager in neurosciences
- Clinical research associate at a clinical investigation center or in the private sector.

Training in the program helps students develop skills that transfer to other professions outside of the neuroscience field:

project management, data management & analysis, scientific writing, presentation skills, entrepreneurship, developing scientific expertise, critical reading of the scientific literature, creativity ...

*: Selective course units

Institut Pasteur



Universités Paris 5 - 6 - 7-II
Ens
Master de Biologie
de l'École Normale Supérieure



M2 specialty: Nutrition Quality and Health

In this specialty, we approach human nutrition from fundamental and public health standpoints. The increasing frequency of diseases linked to nutrition, such as obesity and diabetes, and the complications associated with them, must be seen in relation to changes in eating habits. Indeed, in developed countries, we are seeing not only a marked increase in calorie intake, but also a dangerous drift in terms of the quality of the foods ingested. In addition, problems of undernutrition are observed in developing countries, but also in certain deprived populations and the elderly in Western countries. In this context, access to high-quality food has become a major societal demand. Recent sanitary crises have revealed that fears (which may or may not be justified) remain concerning the origin and quality of foods.

In this master's specialty, we propose training in the domains of food hygiene, quality and safety, nutrition/health communication, and research and development in the domain of nutrition. The relationships between diet and human health are at the heart of this training.

Objective of the training

The objective of this specialty is to provide students with the skills required to evaluate future strategic, economic, industrial and societal issues relating to nutrition.

The students are sensitized to the impact of nutrition on health, through molecular, cellular and integrated aspects of nutrition research.

This specialty facilitates the professionalization of students in the theoretical and practical domains of food quality and safety for health, nutritional communication, health/nutrition communication or nutritional innovation and R&D, with support from companies (more than 80 companies, institutions and start-ups). In this way, the students acquire the knowledge and skills required for:

- Analyses of relationships between food, quality and health, the preventive role of diet, an understanding of the pathophysiological mechanisms underlying nutritional diseases
- Evaluation and expert advice, regulatory issues, analyses of dietary dangers and risks and their management
- Project management, teamwork, nutritional innovation and written and oral communication, in French and English.

Conditions for admission

- Open to M1 students in biology from Sorbonne University or other universities, medical and veterinary students, students from engineering schools and students from outside the European Union, through Campus France
- Selection by dossier and interview



Parcours en partenariat avec
l'Ecole Nationale Vétérinaire d'Alfort (ENVA)

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Academic manager : Carole Harduin - carole.harduin@sorbonne-universite.fr

Specialty Directors:
Prof. Khadija El Hadri and Dr. Véronique Béréziat

Course organization

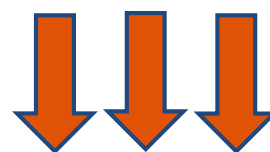
All the taught courses take place in the third semester.

The fourth semester is dedicated to a six-month internship in a company. At the end of the internship, the student must write a dissertation, which is defended in front of a jury. The internship may take place in France or abroad (subject to validation by the directors of the specialty and the Head of Mobility).

M2 course units	ECTS
2 obligatory units 12 ECTS	
Scientific and technical project	6
Business knowledge	6
3 units from the list below, 18 ECTS	
Food and health	6
The hygiene component of quality and risk management	6
Initiation in bioengineering	6
Innovation and communication	6
Quality management in a company (UE from the QUESS masters)	6
Nutrigenomics (course unit from the specialty Human physiology and pathophysiology)	6
Introductory unit PPH1: choice of a course unit from the following list: cardiovascular diseases or hepatic pathophysiology	3
Introductory unit PPH2: choice of a course unit from the following list: renal pathophysiology, pulmonary pathophysiology, metabolic pathophysiology	3
Science and society (course unit from the specialty Human physiology and pathophysiology)	6

Examples of topics for internship projects

Organization of nutrition trade fairs
 Scientific advice and support – nutritional audits
 Product control during and after production
 Ensuring the setting up and/or application of sanitary management plans
 Performance of sanitary audits
 Updating of food hygiene control procedures
 Contribution to the obtainment of ISO certification
 Product development
 Development of sanitary accreditation dossiers
 Development of accreditation requests for tools in accordance with national health and nutrition plans
 Scouting, commercial strategy and marketing in nutrition



Possible careers after the BIP MP specialty Nutrition, quality and health

Project manager in health education
 Scientific assistant in a communication agency
 Controller in the domains of competition, consumption and fraud prevention
 Project leader in nutritional communication
 Product manager
 Food hygiene, quality and safety manager
 Project manager (communication, innovation, new products)
 R&D manager in industry
 Health Safety and Quality Manager (Health, Safety, Quality and Environment) in IAA
 Regulatory affairs manager



Nutrition, Quality and Health is also a network of former students:

<https://nutribip.wordpress.com>

M2 specialty: Human Physiology and Pathophysiology

In this specialty, we learn about the major functions required to maintain metabolism and homeostasis of the internal environment. The students address the molecular and cellular origin of a large range of organ-specific and multi-system diseases through studies of the mammalian body, focusing on humans in particular. Current and future therapies in development for these diseases will also be presented.

Objective of the training

This specialty aims to provide students with a precise vision of modern animal physiology and the pathophysiological mechanisms leading to disease.

At the end of this training, the students will have the skills required:

- To perform research in the domain of pathophysiology, to elucidate the physical, cellular or biochemical mechanisms leading to the appearance of a disease and its consequences.
- To analyze the biological signs of a disease, to perform experiments and to identify the mechanisms by which a possible treatment could re-establish the normal functioning of the affected organ or tissue.
- To develop and organize theoretical interpretations of experiments and analyses, to communicate and valorize the results in the form of scientific publications and oral presentations in French and/or English.

Conditions for admission

- Open to M1 students in biology from Sorbonne University or other universities, medical, pharmacy and veterinary students, students from engineering schools, students from outside the European Union via Campus France.
- Selection by dossier.



COLLÈGE
DE FRANCE
—1530—



Secretary: Building C, 1st floor, door 105
9 quai Saint-Bernard 75252 Paris Cedex 05
University postbox : 118 ☎ : 01 44 27 23 88
Academic manager : Camille Leroy – camille.leroy@sorbonne-universite.fr

Specialty Director: Prof. Philippe Le Rouzic

Course organization

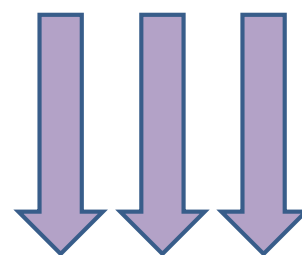
All the taught courses take place in the third semester.

The fourth semester is dedicated to a six-month internship in a research laboratory or company, according to the option chosen by the student. At the end of the internship, the student must write a dissertation, which is defended in front of a jury. The internship may take place in France or abroad (subject to validation by the directors of the specialty and the Head of Mobility).

M2 course units	ECTS
2 compulsory course units (12 ECTS)	
Design of a scientific project	6
Introductory unit PPH1: choice from the following units: cardiovascular diseases or hepatic pathophysiology	3
Introductory unit PPH2: choice from the following units: renal pathophysiology, lung diseases, metabolic pathophysiology	3
3 units from the following list (18 ECTS)	
Cancer and environment	6
Drug Odyssey	6
Endocrinology: from cell to organism	6
Initiation in bioengineering	6
Inflammatory diseases: from pathophysiology to new treatments	6
Nutrigenomics	6
Science and Society	6
Physiopathology of sensory diseases and translationnal research	6
Additional course	
Animal experimentation	6

Examples of topics for internship projects

Inflammation and joint diseases linked to aging
Genetics of hereditary diseases
Cell signaling and cardiac remodeling
The mineralocorticoid receptor: pathophysiology and therapeutic innovations



Possible careers after BIP M2 Human physiology and pathophysiology

Clinical research assistant
Academic/industrial research or researcher-lecturer (master's + PhD)
Biomedical engineer
Study/research officer
Technical/commercial assistant



Practical information



Address

Campus Pierre et Marie Curie
Building C, 1st floor, door 105
9, quai Saint Bernard – University postbox
118
75252 Paris Cedex 05

Open to the public

Monday to Friday, from 8.45 a.m. to 5:30
p.m.

Principal partners

Higher education establishments

• National level

- Alfort National Veterinary School
- La Pitié Salpêtrière - Charles Foix Hospital Group
- South Brittany University
- The Ecole Normale Supérieure – ULM
- The Pasteur Institute
- The Brain & Spine Institute (ICM)

• International level

- The National Autonomic University of Mexico (Mexico City, Mexico)
- Miguel Hernandez de Echa University (Alicante Spain)
- The Pontifical Catholic University of Chile (Santiago, Chile)
- University College London (United Kingdom)
- Catholic University of Leuven (Belgium)
- University of Vienna (Austria)
- Trinity College Dublin (Irlande)
- Technical University of Munich (TUM)
- Københavns Universitet (Danemark) : **4EU+**
- Università degli Studi di Milano (Italie) : **4EU+**
- Ruprecht-Karls-Universität Heidelberg (Allemagne) : **4EU+**
- Univerzita Karlova (République Tchèque) : **4EU+**
- Uniwersytet Warszawski (Pologne) : **4EU+**

• Laboratories and PhD schools

- Sorbonne University institutions
- The Brain & Spine Institute (ICM)
- Institute of Complex Systems
- The Vision Institute
- Institute of Cardiometabolism and Nutrition
- Intelligent Systems and Robotics Institutes
- Biology Institute Paris Seine

• Institutions outside Sorbonne University

- ENS, ENVA, Collège de France, the Pasteur Institute, ESPCI, INRA, IRD, IBPC

• PhD schools

- Brain, cognition, behavior (ED 158)
- Physiology, pathophysiology and therapeutics (ED 394)
- Complexity of living organisms (ED 515)

Sorbonne University marine stations

- Roscoff biological station
- Oceanological observatory at Villefranche-sur-Mer
- Oceanological observatory at Banyuls-sur-Mer

Companies

- | | |
|-------------------------|---------------------|
| - Activ International | - Lesieur |
| - Agence Protéines | - Orly Distribution |
| - Alma Consulting Group | - Ozymes |
| - Cabinet Vidon | - Proméga |
| - Daco France | - Sup'Biotech Paris |
| - Danone | - Universal Medica, |
| - Innovation SAS | |

Marine biology
 Medical systems biology
 Neurobiology
 Functional biology of organisms
 Metabolism
 Health and safety
 Obesity and diabetes
 Relationship between diet and health
 Molecular biology
 Human aging
 Longevity
 Electrophoresis
 Electrophysiology
 Drugs
 Genetic variability
 Pathophysiology
 Inflammation
 Marine biology
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 Functional biology of organisms
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biologie intégrative et physiologie