

Master of Biology health, speciality Neurosciences and neuropsychopharmacologie

General information

Domain : Sciences, Technologies, Health
Mention : Master MENTION : biology, health
Spécialité : Neurosciences et neuropsychopharmacologie
Discipline : Health, Biology
Concerned public : Formation continue, Formation initiale
Level : Master
Lenght : 2 years
Credits : 120 credits ECTS
Affiliation : Collège Santé
Component : UFR SCIENCES DE LA VIE

Program Structure

1° Year – Semester 1 (September-January N)

30 ECTS

- Scientific communication, 3 ECTS, 54h : early September to end of October (8 weeks)
- Statistics and Neural Modelling, 3 ECTS, 27h : mid-September to mid-November (8 weeks)
- Tutored project, 3 ECTS, 27h : mid-September to mid-December (12 weeks)
- Functional Neuroanatomy, 5 ECTS, 45h : mid-September to end of October (5 weeks)
- Neurophysiology, 4 ECTS, 36h : mid-September to mid-October (5 weeks)
- Higher Brain Functions, 4 ECTS, 36h : mid-October to mid-November (5 weeks)
- Molecular Neurobiology, Development and Neurogenetics, 4 ECTS, 36h : mid-October to mid-November (5 weeks)
- Neuropharmacology, 4 ECTS, 36h : mid- November to mid-December (5 weeks)

1° Year – Semester 2 (January-June N)

30 ECTS

- 5-months lab internship

» Please note that only the 1st year of master is related to Track 6 “Neural Plasticity” ‹

2° Year – Semester 3 (September - January N+1): optional courses in Bordeaux

30 ECTS

- Cellular and molecular neurobiology, 5 ECTS
- Cognitive neuroscience, 5 ECTS
- Pathophysiology of neurological and psychiatric diseases, 5 ECTS
- Neural networks, 5 ECTS
- Addiction, 5 ECTS
- Experimentation in behavioural studies, 5 ECTS
- Pharmacology of psychotropic drugs, 5 ECTS
- Research project literature survey, 9 ECTS
- Industrial research, 3 ECTS
- Microscopy principles, 6 ECTS
- MRI, 6 ECTS
- Non-linear optic imaging, 5 ECTS
- Cell-mechanism dynamics, 5 ECTS
- Biosensors: physical and chemical properties, 5 ECTS
- Multimodal imaging, 5 ECTS
- 3D data handling, 3 ECTS

2° Year – Semester 4 (January-June N+1): Master Thesis Project

30 ECTS

Course Content

1° Year – Semester 1 (September-January N)

Course	ECTS	Description
Scientific communication	3	- Scientific talk, 42h group work - Scientific writing, 12h group work
Statistics and Neural Modelling	3	- Basic statistics for Neuroscience - Principles of Neuronal Modelling
Tutored project	3	- How does Science work (in the US, Europe, France & other countries)? Universities, Governmental agencies and funding - Perspective on Neuroscience: a brief history, Neuroscience now and its future, Neuroscience & Society, Neuroscience & Business - My career: PhD, Postdoc, Industrial jobs, Academic jobs, Clinical jobs, other jobs. - Analysis of grant proposals
Functional Neuroanatomy	5	- Neuroanatomy Overview and Basic Definitions - Brain and Environs: Cranium, Ventricles, and Meninges - Spinal cord - Brainstem - Cranial nerves - Vestibular & Auditory Systems - Cerebellum

		<ul style="list-style-type: none"> - Thalamus and diencephalon - Pituitary and Hypothalamus - Basal Ganglia - Limbic System: Homeostasis, Olfaction, Memory, and Emotion - Eye Movements - Cerebral Hemispheres - Arterial Supply - Corticospinal Tract and Other Motor Pathways - Somatosensory Pathways - Visual System - Higher-Order Cerebral Function - Sleep & Wakefulness - Introduction to Clinical Neuroradiology - A short review of methods in Neuroanatomy (Fixation, cutting and histology; optical, electron, fluorescent microscopy; in situ hybridization; autoradiography; tracing; atlases; stereology; connectomics; new methods) - Clinical cases <p>Practicals:</p> <ul style="list-style-type: none"> - Neuroanatomical puzzles - Dissection - Cutting and mounting - Microscopy observation - Taking pictures and labelling
Neurophysiology	4	<ul style="list-style-type: none"> - Definition and properties of ions in solution - Ionic Basis of the Resting Potential and the Action Potential - Description on Ion Channels - Structure and Mechanisms of Function of Ion Channels and Transporters - Properties and Functions of Neuroglial Cells - Mechanisms of Synaptic Transmission - Release of Neurotransmitters - Transmitter Synthesis, Transport, Storage, and Inactivation - Molecular Signalling within Neurons - Synaptic Plasticity - Cable Properties and Information Processing in Dendrites - Information processing in neural networks <p>Practicals:</p> <ul style="list-style-type: none"> - Single and multiunit recordings - Patch clamp techniques - Optogenetics - Microscopy (including fluorescence) optics - Non-confocal and confocal imaging

		<ul style="list-style-type: none"> - Live cell imaging - FLIM, FRET... and modern technique for cell imaging
Higher Brain Functions	4	<ul style="list-style-type: none"> - Cognitive Neuroscience: Definitions, Themes, and Approaches - The Methods of Cognitive Neuroscience - Perception - The organization of action - Attention - Memory - Emotion - Social Cognition - Language - Executive Functions - Decision Making - Evolution and Development of Brain and Cognition <p>Practicals:</p> <ul style="list-style-type: none"> - EEG, ERP, MEG, PET, fMRI - Animal models and behavioural analysis (memory, emotion)
Molecular Neurobiology, Development and Neurogenetics	4	<ul style="list-style-type: none"> - Cellular Components of Nervous Tissue - Subcellular Organization of the Nervous System: Organelles and Their Functions, Protein trafficking - Energy Metabolism in the Brain - Intracellular Signaling, Modeling and Analysis of Intracellular Signaling Pathways - The Basis of Genetics: DNA, RNA, Chromosomes, and Genes - Regulation of Neuronal Gene Expression and Protein Synthesis - Cell Biology, Evolution and Origins of Ion Channels, - Neurogenetics and Neuropharmacology - Methods of Genetic Discovery and the Human Genome Project - Inheritability - Genes and Environment - Research Methods in Quantitative Genetics - Genetic influences on behavior and behavioral disorders - Development of the Nervous System & Molecular Development - Regeneration of the Nervous System - Principles of Brain Evolution - Neuroimmunology <p>Practicals:</p> <ul style="list-style-type: none"> - Cell culture and basic molecular biology tools - Basis of bio-informatics, genomics, transcriptomics, proteomics, metabolomics
Neuropharmacology	4	<ul style="list-style-type: none"> - Principles of Pharmacology

	<ul style="list-style-type: none">- Chemical Signaling by Neurotransmitters and Hormones- Methods of Research in Neuro-Psychopharmacology- Catecholamines- Serotonin & Histamine- Acetylcholine and Neuropeptides- Glutamate, GABA and glycine- Purinergics and others (NO...)- Drug Abuse and Addiction- Alcohol- The Opioids- Psychomotor Stimulants: Cocaine and the Amphetamines- Nicotine and Caffeine- Marijuana and the Cannabinoids- Hallucinogens, PCP, and Ketamine- Inhalants, GHB, and Anabolic–Androgenic Steroids- Environmental Neurotoxicants and Endocrine Disruptors <p>Practicals:</p> <ul style="list-style-type: none">- Locomotor activity- Drug self-administration- Binding, autoradiography, radio-immuno-essay- Pharmacological challenge- Microdialysis
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2° Year – Semester 3 (September - January N+1): optional courses in Bordeaux

Course	ECTS	Description
Cellular and molecular neurobiology (Blanchet)	5	Cell biology of the neuron, structure of the synapse, synaptic plasticity, neuronal cell development, glia-neuron interactions
Cognitive neuroscience (Micheau)	5	Cognitive processes of action, perception, memory and thought
Pathophysiology of neurological and psychiatric diseases (Michelet)	5	Parkinson disease, sleep disorders, neurodegenerative diseases, multiple sclerosis, OCD, depression, attention disorders, clinical research
Neural networks (Combe)	5	Principles of neural networks, locomotion, post-injury plasticity, sensory networks, ontogeny of neural networks, interacting neural networks
Addiction (Auriacombe)	5	Addiction, tolerance, dependence, vulnerability, diagnosis, public health issues, treatment of addiction
Experimentation in behavioural studies (Guillou)	5	Behavioural pharmacology, behavioural experimental procedures, animal memory analysis
Pharmacology of psychotropic drugs (Spampinato)	5	Anti-depressant drugs, anxiolytics, anti-psychotic drugs, mood stabilizers, stimulants, hypnotics, sedatives, endocannabinoids
Research project literature survey (Desmedt)	9	Epistemology, literature survey, presentation of data, scientific writing
Industrial research (Spampinato)	3	Preclinical and clinical research, the drug industry, jobs in the industry
Microscopy principles	6	Optics, transmission microscopy, fluorescence microscopy, electron microscopy, correlative microscopy
MRI	6	Physical principles, sequence design, new developments
Non-linear optic imaging	5	Basics of multiphoton excitation and microscopy, Basics of single-molecule detection, Basics of superresolution microscopy
Cell-mechanism dynamics	5	Dynamic microscopy: TIRF, FRAP, FRET/FLIM, PALM
Biosensors: physical and chemical properties	5	Basics of instrumentation for fluorescence microscopy, basics of fluorophores, basics of time-resolved protein fluorescence, basics of novel fluorophores
Multimodal imaging	5	PET-CT, PET-MRI, in vivo optical imaging, ultrasonography
3D data handling	3	Algorithms for tomography, 3D visualisation, 3D segmentation and analysis methods

Students who already took the literature survey course in Coimbra are not supposed to take it again in Bordeaux. In the end, you must validate at least 30 ECTS during Semester 3.