Teaching organization

Euro-Mediterranean Master in Neuroscience and Biotechnology : Year 1

YEAR	Semester	Name	Type	ECTS	Partner in charge
	1	**Language and Communication**	Core Course	**3**	**All partners**
		Biotechnology and bioinformatics	Core Course	**9**	**AU**
		Functional and cognitive anatomy General presentation of cognitive functions, Neuroanatomy, cognitive and emotional connexions, animal behavioural models, animal vs human models	Core Course	**9**	**UV**
		Cellular neurobiology/physiology synaptic connections, membrane excitability, action potential	Core Course	**9**	**All Partners**
		Total semester 1		**30**	
	2	**Methodologies** Tutorials, Short training period, Practical workshop	Core Course	**6**	**All Partners**
		Experimental approaches of neuropathology Neuropathology, Experimental models, Methods Mechanisms, Therapeutic strategies *Focus on Pain and Neurodegenerative disorders*	Core Course	**6**	**AMU** **UB**
		Behaviour, emotion and cognition Language, consciousness, learning capacities, memory, motivation, stress and emotion	Core Course	**6**	**UB**
		Elective courses : 2 teaching units (6 ECTS each) have to be chosen in the following list			
		Biophysics	*Elective Course*	**6**	**AU** **UCA**
		Neuropharmacology	*Elective Course*	**6**	**UB**
		Case study in Biotechnology	*Elective Course*	**6**	**UB** **UNITO**
		Developmental biology & ageing	*Elective Course*	**6**	**UNITO**
		Total semester 2		**30**	

<table>
<tr><td>Module</td><td colspan="5">BIOINFORMATICS AND BIOTECHNOLOGY (FRENCH AND ENGLISH COURSES)</td></tr>
<tr><td>Module coordinator</td><td colspan="5">MOHAMED GAD</td></tr>
<tr><td>Course name</td><td colspan="5">BIOINFORMATICS AND BIOTECHNOLOGY / BIOINFORMATIQUE ET BIOTECHNOLOGIE</td></tr>
<tr><td>Course teacher</td><td colspan="4">MOHAMED GAD</td><td>ECTS</td></tr>
<tr><td>Year</td><td colspan="4">FIRST YEAR</td><td rowspan="2">9</td></tr>
<tr><td>Semester</td><td colspan="4">1</td></tr>
<tr><td rowspan="3">Workload</td><td>Total nb of hours</td><td colspan="4">Nb of hours</td></tr>
<tr><td rowspan="2">135</td><td>Tutored chat</td><td>Reports</td><td>Practical Course/Lab work</td><td>Personal work</td></tr>
<tr><td>9</td><td>32</td><td>47</td><td>47</td></tr>
<tr><td>Course Description</td><td colspan="5">Bioinformatics is the field that deals with the analysis of the scientific information. In this module computer is be the lab and softwares are the tools used in this lab. Learners deal with the information in the databases PubMed, nucleotides and proteins. They use bioinformtics tools to compare proteins and DNA sequences. They also use structure modeling to understand proteins structure-function relationship related to neurological diseases.</td></tr>
<tr><td>Aims and Outcomes</td><td colspan="5">At the scientific information's level learners will be able to:
•Navigate in the databases and analyze their information.
•Construct protocols to carry out DNA to protein structure prediction tasks.

At the traversal competences' level learners will be able to:
•Evaluate the quality of their own work based on an evaluation network
•Interpret his/her ideas in the form of protocols
•Correlate what they read to what they write</td></tr>
<tr><td>Course Structure</td><td colspan="5">The module is entirely designed for elearning processes. In Elearning, the learner is the center of the learning process and carry out the majority of the learning activities.

Module is composed of an introduction section, three learning sections and one final evaluation section.
•Section 1 (module introduction) contains all the documents needed to understand the module enrolment.
•Section 2 deals with databases. The section focuses on PubMed, DNA and proteins databases.
•Section 3 deals with the analysis of DNA and proteins sequences using BLAST as alignment tool.
•Section 4 deals with proteins structure prediction as a tool to understand proteins function.
•Sections are sequential. Learners can not carry out tasks in section 3 without understanding the functionality in section 2 and so on. Late arrivals will have to do some effort to catch on with their colleagues.
•Learners provide scientific reports with the results of their findings for each section

Module course materials
1.Some of the course materials are found on the platform. Learners have to search most of theneeded information for the completetion of the tasks in the corresponding scientific servers.
2.Module sections and activities are distributed on 9 weeks period as can be seen in the module calendar.
3.Weeks 1 and 2 are dedicated for taking an idea about the module construction and the activities that will be carried out. The learners are encouraged to see the activities in the sequences. A video conference session will be carried out to answer the learners questions.
4.weeks 3-8 are for sections 2-4 activities. Two weeks for each section.
5.Week 9 is dedicated for the white evaluation and the final module evaluation.
6.During weeks 1 and 2, each learner will download and read course materials before beginning of the module activities to have a solid idea about the amount of work in the module. This will help later for the construction of the action plan.

Action plan
7.Action plan is the document in which all the activities that will be realised by the learner in asection and the time needed for each activity are cited. It is like a contract between learners and himself. Learners respect the time plan that they put for themselves without exceeding the time scheduled for each module section pre-determined by the module calendar. A model of an action plan is at the disposition of learners in the introduction section</td></tr>
</table>

Knowldge-evaluation tests
8.Learners will carry out the "knowledge-evaluation tests" which are several answered and commented question that helps in learning each section.
9.Learners can carry out these knowledge-evaluation tests as many times as they want.
10.The scores obtained in these tests are not taken into consideration in the module scoring butcarrying out these tests is taken into consideration in the total module score.
11.Knowledge-evaluation tests represent the minimum information needed for better understanding of module's sections. The upper limit of knowldge is determined by the enthusiasm of the learners themselves. Module evaluation is limited to the minimum limit determined by the knowledge-evaluation tests.
12. Lerarners are encouraged to work in groups at their own organization to reduce task load.
13. For each section, each learner will provide asked reports individually.

Activity report
Nature of an activity report:
14. The first page of a report should contains your personal information and report title.
15. The reports pages should be numbered.
16. Report for section 2 is composed of 3 sections.These sections are,
17. Introduction, Materials and methods (m&m) and References. They are abreviated as «IMR».
18. For reports of section 3 and 4, the results and discussion sections are considered. The data obtained from the case study and their interpretation are considered as the laboratory work.So for sections 3 and 4 the report is composed of Introduction, Materials and methods, Results, Discussion and references. They are abbreviated as "IMRAD".
19. Introduction section cover a presentation for the aim of the report and what will be presented in the following sections.
20. The m&m section covers the methodology used or studied in the task and presented in the report. In this section, the use of each component of the method should be presented.
21. The results section presents the data obtained from cas analysis.
22. The discussion section presents the interpretation of the data obtained in the results section.
23. The references section presents the scientific sources of the information presented in the report. A reference is considered as scientific when it is peer-reviewed. Scientific papers, text books, master's and Ph.D.'s theses are considered as scientific references.
24. Wikipedia is not a scientific source of information unless the information is mentioned in wikipedia with a scientific reference. In this case the scientific reference in wikipedia is used instead of wikipedia itself.
25. The use of wikipedia directly as a reference will result in the in-acceptance of your reports.

Report self-evaluation form
26. The report self-evaluation is found in each sequence.
27. It will be used by the learners themselves to evaluate their own report before the evaluation of the mentor. It will be submitted with each sequence activity report.
28. Delay in uploading asked documents in respect to module's sequence schedualed time will lead to loss of 5% of the score for each day of delay. This loss will be deduced from the score of the document(s)

29.A day begins and ends at mednight based on plateforme time.

White evaluation and final evaluation
30.At the end of the module the learners will have the opportunity to carry out a white module evaluation (WME).
31.WME It is a simulation of a typical final evaluation of the module except that the score of this white evaluation is not considered in the module total score.
32.A final module evaluation (FME) will be carried out at the end of the module.
33.WME and FME are based on case analysis gathering all the information studied during the module. You will be given a case and you will be asked to analyse this case with bioinformatics tools and answer the related evaluation questions.
34.Both WME and FME last for 2 hours and both need internet connection.
35.WME and FME are open book evaluations. Leaarners can assist these evaluations with their course materials.
36.The FME will follow each university roles. it will be carried out in your university computer unit under the total supervision of the local tutor.

General information
37.There will be one tutored chat per week, one chat for starting the module and another for closing of the module. During the rest of the time mentor can be contacted by the platform

	mail. 38.Mails sent by learners on mentor personal mail with tasks reports will not be taken into consideration. 39.For each tutored chat there will be a meeting agenda which will be sent on the "news forum", found in the introduction section, before each tutored chat
Prerequisite	DNA and proteins chemistry information
Course Requirements	Internet connection and access to scientific sites
Required text	
Recommended Texts & Other Readings	Marco Biasini, Stefan Bienert, Andrew Waterhouse, Konstantin Arnold, Gabriel Studer, Tobias Schmidt , Florian Kiefer, Tiziano Gallo Cassarino, Martino Bertoni, Lorenza Bordoli, and Torsten Schwede. (2014) SWISS-MODEL: modelling protein tertiary and quaternary structure using evolutionary information. Nucl. Acids. Res. 12: 252-258
Online Resources	NCBI home page: http://www.ncbi.nlm.nih.gov/guide/ NCBI Handbook: http://www.ncbi.nlm.nih.gov/books/NBK21101/ NCBI on youtube: http://www.youtube.com/ncbinlm NCBI help manual: http://www.ncbi.nlm.nih.gov/books/NBK3831/ Entrez help: http://www.ncbi.nlm.nih.gov/books/NBK3836/ PubMed help: http://www.ncbi.nlm.nih.gov/books/NBK3830/; BLAST help page:http://blast.ncbi.nlm.nih.gov/Blast.cgi?CMD=Web&PAGE_TYPE=BlastDocs BLAST handbook: http://www.ncbi.nlm.nih.gov/books/NBK21097/ BLAST selection guide: http://blast.ncbi.nlm.nih.gov/Blast.cgi?CMD=Web&PAGE_TYPE=BlastDocs&DOC_TYPE=ProgSelectionGuide Blast home page: http://blast.ncbi.nlm.nih.gov/about/ http://www.proteinstructures.com/index.html http://www.proteinstructures.com/Modeling/Modeling/modeling-tutorial-1.html http://swissmodel.expasy.org/ http://mordred.bioc.cam.ac.uk/~rapper/rampage.php
Evaluation and Grading	Knowldge evaluation test: 40 points: is to evaluate their capacity to Navigate in the databases and analyze their information. Correlate what they read to what they write Activity report and report self evaluatin form: 100 points: to evaluate their capacity to Interpret his/her ideas in the form of protocols Correlate what they read to what they write Evaluate the quality of their own work based on an evaluation network Final evaluation: 60 points: Construct protocols to carry out DNA to protein structure prediction tasks. Navigate in the databases and analyze their information.

<table>
<tr><td>Module</td><td colspan="5">FUNCTIONAL AND COGNITIVE ANATOMY</td></tr>
<tr><td>Module coordinator</td><td colspan="5">FRANCISCO OLUCHA BORDONAU</td></tr>
<tr><td>Course name</td><td colspan="5">FUNCTIONAL AND COGNITIVE ANATOMY</td></tr>
<tr><td>Course teacher</td><td colspan="4">FRANCISCO OLUCHA BORDONAU
SAADIA BAMOHAMMED
ENRIQUE LANUZA</td><td>ECTS</td></tr>
<tr><td>Year</td><td colspan="4">1ST</td><td rowspan="2">9</td></tr>
<tr><td>Semester</td><td colspan="4">1ST</td></tr>
<tr><td rowspan="3">Workload</td><td>Total nb of hours</td><td colspan="4">Nb of hours</td></tr>
<tr><td rowspan="2">225</td><td>Lecture</td><td>Seminar</td><td>Practical Course/Lab work</td><td>Personal work</td></tr>
<tr><td>12</td><td>12</td><td>16</td><td>185</td></tr>
<tr><td>Course Description</td><td colspan="5">The course is aimed at study the basic structure of the nervous system and the general connections between its components subserving neural function.

General organization of the nervous system. general divisions of the nervous system. Information flow in the nervous system.

Chemical neuroanatomy. glutamatergic systems, GABAergic, cholinergic, serotonergic, dopaminergic, noradrenergic, nitrergics, peptidergic.

Somatosensory pathway. Receptors. somatosensory pathways anterolateral system and epicritic sensitivity

Vestibular system and proprioception. Centers, roads. Cerebellum

Auditory System. Cochlea. Auditory centers of the brainstem, thalamus and cortex. tonotopy

Visual pathways. visual centers and representation of space in the retina, thalamus and cortex. Centers for eye movements

Gustatory system and barorecepción. Receptors. Central pathways

Olfactory systems. olfactory mucosa. olfactory tract

Motor systems. Common motor final pathway. Extrapyramidal pathways

Cognitive systems. Hippocampus, entorhinal cortex, neocortex. subcortical circuits and attention

Emotional systems. Amygdala, prefrontal cortex, ventral striatum, thalamus nucleus accumbens and.

Metabolic homeostatic systems. Circumventricular hypothalamic nuclei. Brainstem

Circadian regulation systems. Circuits of the sleep-wake succession</td></tr>
<tr><td>Aims and Outcomes</td><td colspan="5">After course completion student has the knowledge about/knows how to/is able to…

1. Demonstrate an understanding of the structural and functional organization of the nervous system and its relations with other systems.

2. Obtain series of histological brain sections and application of conventional immunocytochemical techniques. The student will be able to mount a complete series of rat brain and apply a conventional histochemistry and immunocytochemistry techniques.

3. Be able to define the major divisions of the brain in histological sections</td></tr>
</table>

	4. Ability to assign a particular region or cerebral core to any of the functional systems 5. Ability to discriminate subdivisions within a region based on the distribution of certain markers 6. Organize information effectively in public exhibitions on functional systems 7. Demonstrate ability to solve theoretical and related to the subject under study practical issues.
Course Structure	The course is organized in 6 tracks and each track is opened every week untl completion of the course. For each tract an opening session is delivered by visioconference in which a basic explanation of the topic is delivered. Also some documents are available for the studdents and a set of activities to work these basic concepts. The activities becomes closed at the end of each week and evaluated. At the end of the course a general evaluation process is delivered.
Prerequisite	No prerequisits
Course Requirements	Internet connection
Required text	Documents are delivered in the plateform
Recommended Texts & Other Readings	Neuroscience, Fifth Edition 5th Edition by Dale Purves Elsevier Principles of Neural Science, Fifth Edition (Principles of Neural Science (Kandel)) Eric R. Kandel Fundamental Neuroscience for Basic and Clinical Applications: by Duane E. Haines
Online Resources	http://www.e-masters.univ-bordeaux.fr/login/index.php
Evaluation and Grading	50% of the grade is the final exam 50% is the average of the activities along the course

<table>
<tr><td>Module</td><td colspan="5">CELLULAR NEUROBIOLOGY AND PHYSIOLOGIE</td></tr>
<tr><td>Module coordinator</td><td colspan="5">MARC LANDRY</td></tr>
<tr><td>Course name</td><td colspan="5">NEURONAL MORPHOLOGY
NEUROTRANSMITTERS AND RECEPTORS
BASIS OF NEURONAL EXCITABILITY</td></tr>
<tr><td>Course teacher</td><td colspan="4">MARC LANDRY
ERIC HOSY</td><td>ECTS</td></tr>
<tr><td>Year</td><td colspan="4">1ST</td><td rowspan="2">9</td></tr>
<tr><td>Semester</td><td colspan="4">1ST</td></tr>
<tr><td rowspan="3">Workload</td><td>Total nb of hours</td><td colspan="4">Nb of hours</td></tr>
<tr><td rowspan="2">220</td><td>Lecture</td><td>Seminar</td><td>Practical Course/Lab work</td><td>Personal work</td></tr>
<tr><td>30</td><td>10</td><td></td><td>180</td></tr>
<tr><td>Course Description</td><td colspan="5">Neuronal cell types
Ultrastructural organisation of neuronal cells
Structure and function of the axon initial segment
Neuronal cytoskeleton and axonal transport
Synaptic organisation
Neuronal classifications
Glial cell types and functions
Basis of neurotransmitter classification
Receptor theory
Ligand-receptor interactions

Principles of electro-diffusion
Resting potential
Action potential
Basis of neurotransmitter release</td></tr>
<tr><td>Aims and Outcomes</td><td colspan="5">Understand how a neuron is organized
Know and understand specific morpho-functional features of neurons
Know different neural cell types (neurons and glial cells)
Understand the concepts and mechanisms of neurotransmission
Understand the chemical principles of ion movements across the membrane
Understand the basis of neuronal excitability
Understand how an action potential is generated and propagates
Understand the main techniques used to probe cellular activity of neural cells (morphological approaches, cell cultures, electrophysiology, basis of biochemistry and molecular biology, basis on mutant animal models)
Analyse critically scientific publications of cellular neurobiology
Collect and organise data on a previously unknown topic</td></tr>
<tr><td>Course Structure</td><td colspan="5">Videoconferences
Recorded courses
Interactive activities on the Moodle platform (quiz, wiki, chat, forum)
Group work for article analysis
Group work and flipped classroom</td></tr>
<tr><td>Prerequisite</td><td colspan="5">Basis in cell biology (ultrastructural cellular organisation, intercellular communication,…),
Theoretical knowledge on common techniques to be performed in cell biology studies,
Practical knowledge of some techniques</td></tr>
<tr><td>Course Requirements</td><td colspan="5">Access to the Master Moodle platform</td></tr>
</table>

Required text	
Recommended Texts & Other Readings	Principles of Neuroscience, Kandel et al. Neuroscience, Purves et al. Articles and reviews proposed in the dedicated course section on Moodle
Online Resources	Master Moodle platform
Evaluation and Grading	Article presentation OR course presentation (flipped classroom) (40%) Final exam (60%)

<table>
<tr><td>Module</td><td colspan="5">EXPERIMENTAL APPROACHES IN NEUROPATHOLOGY</td></tr>
<tr><td>Module coordinator</td><td colspan="5">MARC LANDRY</td></tr>
<tr><td>Course name</td><td colspan="5">NEURODGENERATIVE DISEASES
PATHOPHYSIOLOGY OF PAIN
BIOLOGICAL ASPECTS OF AGGRESSION</td></tr>
<tr><td>Course teacher</td><td colspan="4">MARC LANDRY
NÓRA KEREKES
CHRISTIAN GESTREAU</td><td>ECTS</td></tr>
<tr><td>Year</td><td colspan="4">1ST</td><td rowspan="2">6</td></tr>
<tr><td>Semester</td><td colspan="4">2ND</td></tr>
<tr><td rowspan="3">Workload</td><td>Total nb of hours</td><td colspan="4">Nb of hours</td></tr>
<tr><td rowspan="2">153</td><td>Lecture</td><td>Seminar</td><td>Practical Course/Lab work</td><td>Personal work</td></tr>
<tr><td>25</td><td>8</td><td>0</td><td>120</td></tr>
<tr><td>Course Description</td><td colspan="5">General introduction to neurodegenerative diseases (prevalence, common characteristics and causes potential risk and protective factors.
Detailed pathophysiologies of Parkinson’s and Alzheimer diseases.
Current view on neuroprotective strategies developed in research and clinic.

General pathways of nociceptive transmission
Animal models used to study nociception and chronic pain
Physiological mechanisms of nociception in the periphery and in the spinal cord
Pathological processes of pain sensitization
Therapeutic approaches

Presentation of antisocial aggressive behaviour
Details of the complex network of neuroanatomical, neurochemical, genetic, physiological and psychological correlates of human behaviours
Neurological and psychological aspects of self-control/self-governance
Philosophical concept of free-will versus determinism</td></tr>
<tr><td>Aims and Outcomes</td><td colspan="5">Understand the neurobiological and molecular correlates of neurological disorders, especially in neurodegenerative diseases and chronic pain
Understand preclinical research in the field of neurological disorders
Integrate new data from the literature to the state of the art picture of neurological disorders
Acquire capacity to build a personal view on relationships between pathophysiological processes in neurons and clinical expression of neurodegenerative diseases.
Understand neuroanatomical and neurochemical basis of aggression
Understand psychological characteristics that coupled to antisocial behaviour.
Couple the results of up to date molecular and quantitative genetic research to antisocial aggression as a phenotype,
Understand holistic diagnostic and treatment strategies in the field of Neurological disorders.</td></tr>
<tr><td>Course Structure</td><td colspan="5">Videoconferences
Recorded courses
Interactive activities on the Moodle platform (quiz, wiki, chat, forum)
Group work for article analysis
Group work and flipped classroom</td></tr>
<tr><td>Prerequisite</td><td colspan="5">Basis on cellular neurobiology
Notions of physiology and neuroanatomy</td></tr>
<tr><td>Course Requirements</td><td colspan="5">Access to the Master Moodle platform</td></tr>
</table>

Required text	
Recommended Texts & Other Readings	Articles and reviews proposed in the dedicated course section on Moodle
Online Resources	Master Moodle platform
Evaluation and Grading	Article presentation OR course presentation (flipped classroom) (40%) Final exam (60%)

Module	**BEHAVIOR, EMOTION, COGNITION**				
Module coordinator	**ROSE-MARIE VOUIMBA**				
Course name	**NEUROBIOLOGY OF EMOTION AND COGNITION**				
Course teacher	**ROSE-MARIE VOUIMBA**				**ECTS**
Year	**1ST**				**6**
Semester	**2ND**				
Workload	**Total nb of hours**	**Nb of hours**			
	36	**Lecture**	**Seminar**	**Practical Course/Lab work**	**Personal work**
		4 (in visioconference)	NA	NA	At least 32
Course Description	This course is divided in 3 main chapters. The first one provides an overview of past and current theories of emotion. It discusses the biological substrates of two emotions (pleasure and fear) and pathologies (such as addiction and phobias) related to dysfunctions in these substrates. The second chapter highlights the neural mechanisms underlying cognitive functions such as attention, perception, visual recognition and memory. This chapter focus include how brain damage affects these functions and how patients with brain lesions can contribute to our understanding of the normal brain. The third chapter, focuses on the importance of the interplay between emotion and cognition. It discusses on how emotion influences cognition and how cognitive processes can have emotional consequences, with an overview of the underlying mechanism of such an interaction.				
Aims and Outcomes	This course allows students to strengthen their integrated approach of higher mental functions. Students will learn how to address pathophysiological issues, relative to psychiatric and neurological disorders, from basic research in neuroscience.				
Course Structure	The course will be delivered online, and will be accompanied by 2 Video conference lectures introducing the different chapters.				
Prerequisite	Prior knowledge on brain neuroanatomical substrates and their organizations (especially the structures of the limbic system and cortical structures) and on chemical substrates of the brain (neurotransmitters, neuromodulators and neuro-hormones) will help in a better understanding of the course.				
Course Requirements	Internet connection				
Required text					
Recommended Texts & Other Readings					
Online Resources					
Evaluation and Grading	The final grade is based on a written exam (75%) and online assessments (25%).				

<table>
<tr><td>Module</td><td colspan="5">NEUROPHARMACOLOGY</td></tr>
<tr><td>Module coordinator</td><td colspan="5">PHILIPPE DE DEURWAERDÈRE</td></tr>
<tr><td>Course name</td><td colspan="5">NEUROPHARMACOLOGY</td></tr>
<tr><td>Course teacher</td><td colspan="4">PHILIPPE DE DEURWAERDÈRE</td><td>ECTS</td></tr>
<tr><td>Year</td><td colspan="4">1ST</td><td rowspan="2">6</td></tr>
<tr><td>Semester</td><td colspan="4">2ND</td></tr>
<tr><td rowspan="3">Workload</td><td>Total nb of hours</td><td colspan="4">Nb of hours</td></tr>
<tr><td rowspan="2">38</td><td>Lecture</td><td>Seminar</td><td>Practical Course/Lab work</td><td>Personal work</td></tr>
<tr><td>16</td><td>22</td><td>na</td><td>60</td></tr>
<tr><td>Course Description</td><td colspan="5">The objective of the Neuropharmacology unit is to give the knowledge and a scientific background sufficient to understand the orientations or the pharmaceutical options for the treatment of various pathologies of the CNS. The overall course will present most classes of CNS medicines and the targeted neurotransmission systems. A large part will be dedicated to the methodologies to get and present the information. Students will be also actors of their knowledge.</td></tr>
<tr><td>Aims and Outcomes</td><td colspan="5">At the end, students should have developed automatisms in Neuropharmacology (Kd, Ki, Km, IC50, EC50, agonist, antagonist, inverse agonist, inhibitors, efficacy) applied to targets of neurotransmitter systems. They should identify a class of medicine and pharmacological agents. They should know to what kind of neurotransmitter systems a medicine is designed for.</td></tr>
<tr><td>Course Structure</td><td colspan="5">A core teaching will present the pharmacological basics for pharmacodynamic studies. A core course will present the neuropharmacological basis of some classes of medicines (antipsychotics, antidepressant drugs) covering also the physiology and the pathophysiology of some neurotransmitter systems. Other classes of medicines will be studied by the students with the help of the teachers. Pharmacokinetics will be also discussed through works done by students.

Thus, groups of 2 students will have to elaborate presentations for a neurotransmitter system and its pharmacological targets in front of the other students. In addition, students will have punctual works specifically on one medicine, a concept in pharmacology, a receptor or an enzyme (example: H3 receptors; Catechol-O-methyl transferase, Cytochrome P450 2D6, biased agonism, fentanyl, Cheng and Prussoff…).

Courses and works done by the students and the teachers will be available on the platform.</td></tr>
<tr><td>Prerequisite</td><td colspan="5">none</td></tr>
<tr><td>Course Requirements</td><td colspan="5">Internet connection/access to specified recourses or web sites. The lectures and oral presentations are given by video conference.</td></tr>
<tr><td>Required text</td><td colspan="5">No</td></tr>
<tr><td>Recommended Texts & Other Readings</td><td colspan="5">Psychopharmacology (Drugs, the brain and Behavior) – JS Meyers and LF Quenzer (Sinauer Edition)</td></tr>
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Online Resources	
Evaluation and Grading	Homework: 50% (works on pharmacological target and neurotransmitter systems + oral presentation) Exam: 50% (3 hours with 2 parts: a dissertation and exercices)

<table>
<tr><td>Module</td><td colspan="5"></td></tr>
<tr><td>Module coordinator</td><td colspan="5">Alexandre FAVEREAUX</td></tr>
<tr><td>Course name</td><td colspan="5">CASE STUDY IN BIOTECHNOLOGY</td></tr>
<tr><td>Course teacher</td><td colspan="4">Alexandre FAVEREAUX</td><td>ECTS</td></tr>
<tr><td>Year</td><td colspan="4">1st</td><td rowspan="2">6</td></tr>
<tr><td>Semester</td><td colspan="4">2nd</td></tr>
<tr><td rowspan="3">Workload</td><td>Total nb of hours</td><td colspan="4">Nb of hours</td></tr>
<tr><td rowspan="2">150</td><td>Lecture</td><td>Seminar</td><td>Practical Course/Lab work</td><td>Personal work</td></tr>
<tr><td>12</td><td>---</td><td>---</td><td>138</td></tr>
<tr><td>Course Description</td><td colspan="5">This course is designed to develop critical thinking and experimental design skills in the specific context of cell and molecular neurosciences. You will use previous learning in new and concrete situation. Case study articles will be discussed to support the experimental design project that will be required. Experimental approaches discussed will include: reverse genetics, RNA interference, site directed mutagenesis, fusion proteins, expression vectors, immunolocalization; protein-protein interactions (immunoprecipitation, pull- down, two-hybrid, energy transfer, dominant negative).</td></tr>
<tr><td>Aims and Outcomes</td><td colspan="5">This course is aimed to acquire on desk skills necessary for experimental plan
After studying this course, you should be able to:
Analyze and decode “materials and methods” from case study articles. Propose appropriate in vitro experimental approaches to concrete situation Design experiments to reproduce published results
Use collaborative instruments for group work
Communicate using proper scientific terms and presentation</td></tr>
<tr><td>Course Structure</td><td colspan="5">The course is structured as flipped classroom in which short video lectures and support materials are viewed by students at home before the videoconference class sessions which are devoted to questions, exercises and discussions.
Specific individual and group activities including participation to chat and forum, quiz, assays and projects will be submitted by students over scheduled deadlines.</td></tr>
<tr><td>Prerequisite</td><td colspan="5">Cellular neurobiology, biotechnology and bioinformatics, recombinant DNA methodologies</td></tr>
<tr><td>Course Requirements</td><td colspan="5">Internet connection, google account and “socrative student” app</td></tr>
<tr><td>Required text</td><td colspan="5">None</td></tr>
<tr><td>Recommended Texts & Other Readings</td><td colspan="5">Advanced molecular and cell biology text books</td></tr>
<tr><td>Online Resources</td><td colspan="5">NCBI resources</td></tr>
<tr><td>Evaluation and Grading</td><td colspan="5">Evaluation is based on: continuous individual activities submitted during the course (20%); group experimental design project (30%) and individual final exam (30%). The final exam is based on material covered in lectures, assignments, readings and other online activities.</td></tr>
</table>

<table>
<tr><td>Module</td><td colspan="4"></td></tr>
<tr><td>Module coordinator</td><td colspan="4">SILVIA DE MARCHIS</td></tr>
<tr><td>Course name</td><td colspan="4">DEVELOPMENTAL NEUROBIOLOGY</td></tr>
<tr><td>Course teacher</td><td colspan="3">SILVIA DE MARCHIS AND ISABELLE PERROTEAU</td><td>ECTS</td></tr>
<tr><td>Year</td><td colspan="3">1ST</td><td rowspan="2">6</td></tr>
<tr><td>Semester</td><td colspan="3">2ND</td></tr>
<tr><td rowspan="3">Workload</td><td>Total nb of hours</td><td colspan="3">Nb of hours</td></tr>
<tr><td rowspan="2">150</td><td>Lecture</td><td>Seminar</td><td>Practical Course/Lab work</td><td>Personal work</td></tr>
<tr><td>16</td><td>---</td><td>---</td><td>134</td></tr>
<tr><td>Course Description</td><td colspan="4">The course will deal with basic principles of developmental neurobiology, including neural induction, neural patterning, neural stem cells, neurogenesis and gliogenesis, neural migration, differentiation, axonal growth and guidance, synaptogenesis and plasticity. Neural developmental processes will be also discussed in terms of their relevance in the context of neural regeneration and recovery of function following disease and injury. The course focuses on the use of different animal models (both invertebrates and vertebrates) and different experimental approaches (e.g. transgenic models, cell transplantation approaches, organotypic/cell culture) as discovery tools to investigate the fundamental principles of CNS development.</td></tr>
<tr><td>Aims and Outcomes</td><td colspan="4">Develop knowledge on the main principles and experimental models in Developmental Neurobiology.
On successful completion of the course students should be able to:
describe the main model organisms and experimental approaches used in the field
describe the main principles and cellular/molecular events in CNS development
understand specialized seminars in the field;
discuss scientific papers in the field;
to figure out the appropriate methodological framework to address a scientific question in the field.</td></tr>
<tr><td>Course Structure</td><td colspan="4">The course will be organized in Topics organized as detailed below:
1- key-notes that establish the main underlying theme and/or a recorded lectures (ppt presentations with audio commentary)
2- support material to deepen the knowledge of the topic (i.e. reference to specific book chapters available on-line - link to websites)
3- student's activities that can involve different tasks (e.g a paper to discuss, problem solving, self-evaluation quiz) depending on the topic. Reports of activities will be submitted by students over scheduled deadlines.
4. chat sessions to directly interact with teachers/tutors and discuss specific themes related to the topics</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Basic knowledges of developmental biology and cell/molecular biology of the nervous system.</td></tr>
<tr><td>Course Requirements</td><td colspan="4">Internet connection</td></tr>
<tr><td>Required text</td><td colspan="4">None</td></tr>
<tr><td>Recommended Texts & Other Readings</td><td colspan="4">Development of the Nervous System – Dan H. Sanes Thomas A. Reh William A. Harris – 3rd Edition – Elsevier
Developmental Biology, Thent Edition Scott F. Gilbert - Sinauer Associates, Incorporated, 2013</td></tr>
<tr><td>Online Resources</td><td colspan="4">http://php.med.unsw.edu.au/embryology/index.php?title=Neural_System_Development
http://www.ncbi.nlm.nih.gov/books/NBK9983/</td></tr>
</table>

Evaluation and Grading	Students evaluation is based on continuous evaluations of the task submitted during the course (50%) and on a final exam (50%) based on material covered in lectures, assigned readings, and online activities.

Euro-Mediterranean Master in Neuroscience and Biotechnology: Year 2

YEAR	Semester	Name	Type	ECTS	Partner in charge
2	3	**Economy** Intellectual property, Patent, Quality procedures Biotechnology and Regional Economy	Core Course	3	**USEK USJ**
		Regulations, laws and Bioethics Public policy, Laws on ethics, Animal experimentation, Biosafety	Core Course	3	**USEK USJ**
		Drug development Procedures for drug approval Economical aspects	Core Course	3	
		Elective courses : one specialization track, made of 3-4 teaching units, has to be chosen out of 4 possibilities			
		Track 1 - Molecular and cellular Neuroscience			
		Plasticity and cell communication Synaptic plasticity, Neuron-glia interaction, Membrane receptors, Trafficking	Elective Course	**9**	**UB UNICE**
		Neurogenesis, Stem cells and transplantation Neural progenitors, Migration, Differentiation, Apoptosis	Elective Course	**6**	**AU**
		Neuroendocrinology and neurobiology of food intake Basics of Neuroendocrinology Neuropeptidergic transmission Hypothalamic regulations	Elective Course	**6**	**JUK**
		Track 2 - Integrative and system biology			
		From sensation to perception Focus on 2 main examples: Somatosensory and Visual perception (Transduction, coding, elaboration of the sensation, representation, integration).	Elective Course	**6**	**UCA UV**
		From perception to action Neuronal pathways: Cortex, subcortical pathways, spinal cord, effectors	Elective Course	**6**	**AMU**
		Integrative physiology Focus on biological Rhythms	Elective Course	**6**	**UNISTRA**
		Computational neuroscience and neural network	Elective Course	**3**	**AMU**
		Track 3 - Medical neuroscience and neuroimaging			
		Morphofunctional Neuroimaging Topographical and Functional anatomy of the brain using in vivo 3D fMRI and Tractography Interindividual variability in healthy subjects and in patients with chromosomal aberrations.	Elective Course	**9**	**USJ**
		Pathophysiology of neurological diseases Epilepy, Stroke, TBI and forensic, Inflammation, Genetic and developmental disorders.	Elective Course	**6**	**USJ**
		Diagnostic and therapeutic tools development Biophysics of Imaging techniques Neurostimulation Interventional neuroradiology Radiosurgery	Elective Course	**6**	**USJ**
		Total semester 3		**30**	
	4	**Long training period**	Core activity	**30**	**All partners**
		Total semester 4		**30**	
TOTAL YEAR 1 and YEAR 2				**120**	

<table>
<tr><td>Module</td><td colspan="5">ECONOMY</td></tr>
<tr><td>Module coordinator</td><td colspan="5">JEAN TAMRAZ</td></tr>
<tr><td>Course name</td><td colspan="5"></td></tr>
<tr><td>Course teacher</td><td colspan="4">CAROLE DOUEIRY-VERNE, LEONEL MATAR, JEAN TAMRAZ</td><td>ECTS</td></tr>
<tr><td>Year</td><td colspan="4">2ND</td><td rowspan="2">3</td></tr>
<tr><td>Semester</td><td colspan="4">3RD</td></tr>
<tr><td rowspan="3">Workload</td><td>Total nb of hours</td><td colspan="4">Nb of hours</td></tr>
<tr><td rowspan="2">94</td><td>Lecture</td><td>Seminar</td><td>Practical Course/Lab work</td><td>Personal work</td></tr>
<tr><td>12 hrs</td><td>7 hrs</td><td></td><td>75 hrs</td></tr>
<tr><td>Course Description</td><td colspan="5">Section 1
European Research Area: strategy and perspectives (J. TAMRAZ – USJ)
Section 2
The current challenges of globalization (L. MATAR - USJ)
Section 3
Globalization, innovation and sustainable development (L. MATAR - USJ)
Section 4
Biotechnology and Research (L. MATAR - USJ)
Section 5
Management of research and innovation (J. TAMRAZ - USJ)
Section 6
Biotechnology Watch : Impact on health and social benefits (J. TAMRAZ - USJ)
Section 7
Business Ethics & Corruption - 1 & 2 - (C. DOUEIRY-VERNE - USJ)</td></tr>
<tr><td>Aims and Outcomes</td><td colspan="5">After course completion student should improve their knowledge regarding the international economic environment in the light of the globalization. In order to be competitive students should be aware of the business issue and research management, taking into consideration the ethics aspects.</td></tr>
<tr><td>Course Structure</td><td colspan="5">The course is delivered face to face using lectures including interactive tasks</td></tr>
<tr><td>Prerequisite</td><td colspan="5">Completed courses: basic sciences (Licence in biological science and/or medicine or pharmacy first 3 yrs completed at least)</td></tr>
<tr><td>Course Requirements</td><td colspan="5">Internet connection, video projection</td></tr>
<tr><td>Required text</td><td colspan="5">Conference slides and related material</td></tr>
<tr><td>Recommended Texts & Other Readings</td><td colspan="5">Specific or review articles and reference books are proposed</td></tr>
<tr><td>Online Resources</td><td colspan="5">Dedicated moodle plateform (Bordeaux)</td></tr>
<tr><td>Evaluation and Grading</td><td colspan="5">Final exam on the moodle platform, including QCM and QROCM questions</td></tr>
</table>

<table>
<tr><td>Module</td><td colspan="5">REGULATIONS, LAWS AND BIOETHICS</td></tr>
<tr><td>Module coordinator</td><td colspan="5">JEAN TAMRAZ</td></tr>
<tr><td>Course name</td><td colspan="5"></td></tr>
<tr><td>Course teacher</td><td colspan="4">TATYANA NOVOSSIOLOVA, SAMI RICHA, MICHEL SCHEUER, JEAN TAMRAZ</td><td>ECTS</td></tr>
<tr><td>Year</td><td colspan="4">2ND</td><td rowspan="2">3</td></tr>
<tr><td>Semester</td><td colspan="4">3RD</td></tr>
<tr><td rowspan="3">Workload</td><td>Total nb of hours</td><td colspan="4">Nb of hours</td></tr>
<tr><td rowspan="2">94</td><td>Lecture</td><td>Seminar</td><td>Practical Course/Lab work</td><td>Personal work</td></tr>
<tr><td>12 hrs</td><td>7 hrs</td><td></td><td>75 hrs</td></tr>
<tr><td>Course Description</td><td colspan="5">Section 1
Ethics of research involving Human beings and freedom of the researcher (M. SCHEUER - USJ)
Section 2
Biomedical & Health research: Ethics & Principle of precaution (J. TAMRAZ - USJ)
Section 3
Neuroimaging: ethical issues and medicolegal aspects (J. TAMRAZ - USJ)
Section 4
Communication with patient's families suffering from mental diseases (S. RICHA - USJ)
Section 5
Introduction to Biosecurity and Dual use (T. Novossiolova - LNCV)
Section 6
Military Applications of Neuroscience: Past, Present and Future (T. Novossiolova LNCV)
Section 7
The CBW Non-Proliferation regime (T. Novossiolova - LNCV)</td></tr>
<tr><td>Aims and Outcomes</td><td colspan="5">Student should take into consideration major present ethical issues in neuroscience</td></tr>
<tr><td>Course Structure</td><td colspan="5">The course is delivered presentially using lectures including interactive tasks</td></tr>
<tr><td>Prerequisite</td><td colspan="5">Completed courses: basic sciences (Licence in biological science and/or medicine or pharmacy first 3 yrs completed at least)</td></tr>
<tr><td>Course Requirements</td><td colspan="5">Internet connection, video projection</td></tr>
<tr><td>Required text</td><td colspan="5">Conference slides and related material</td></tr>
<tr><td>Recommended Texts & Other Readings</td><td colspan="5">Specific or review articles and reference books are proposed</td></tr>
</table>

Online Resources	Dedicated moodle plateform (Bordeaux)
Evaluation and Grading	Final exam on the moodle platform, including QCM and QROCM questions

<table>
<tr><td>Module</td><td colspan="5">DRUG DEVELOPMENT</td></tr>
<tr><td>Module coordinator</td><td colspan="5">CHRISTIAN MESENGE & MOHAMED GAD</td></tr>
<tr><td>Course name</td><td colspan="5">DRUG DEVELOPMENT</td></tr>
<tr><td>Course teacher</td><td colspan="4">CHRISTIAN MESENGE & MOHAMED GAD</td><td>ECTS</td></tr>
<tr><td>Year</td><td colspan="4">2ND</td><td rowspan="2">3</td></tr>
<tr><td>Semester</td><td colspan="4">3RD</td></tr>
<tr><td rowspan="3">Workload</td><td>Total nb of hours</td><td colspan="4">Nb of hours</td></tr>
<tr><td rowspan="2">75</td><td>Lecture</td><td>Seminar</td><td>Practical Course/Lab work</td><td>Personal work</td></tr>
<tr><td>15</td><td>5</td><td>10</td><td>45</td></tr>
<tr><td>Course Description</td><td colspan="5">Drug development process: from preclinical research to drug registration, bioethics in clinical research and pharmacovigilance</td></tr>
<tr><td>Aims and Outcomes</td><td colspan="5">After course completion student is able to understand the different phases of the drug development, good clinical practices, bioethic issues with clinical research. The student understands the place of the pharmaceutical industry in the international economy and the possible roles (jobs) offered in the pharmaceutical industry.</td></tr>
<tr><td>Course Structure</td><td colspan="5">The course is available on line in French and in English. Two seminars in videoconference. The students must prepare a clinical research protocol on an imaginary but scientifically sounded drug on a neurological condition and present it as a team work.</td></tr>
<tr><td>Prerequisite</td><td colspan="5">NA</td></tr>
<tr><td>Course Requirements</td><td colspan="5">Internet connection and if possible access to a videoconference platform</td></tr>
<tr><td>Required text</td><td colspan="5">For this rapidly evolving field we mainly use on line resources</td></tr>
<tr><td>Recommended Texts & Other Readings</td><td colspan="5">For this rapidly evolving field we mainly use on line resources</td></tr>
<tr><td>Online Resources</td><td colspan="5">http://www.e-masters.univ-bordeaux.fr/pluginfile.php/4953/mod_resource/content/1/RD_Brochure_2013.pdf
http://www.fda.gov/ScienceResearch/SpecialTopics/RunningClinicalTrials/ucm134476.htm
https://www.swissmedic.ch/zulassungen/00153/index.html?lang=fr
http://europa.eu/about-eu/agencies/regulatory_agencies_bodies/policy_agencies/ema/index_fr.htm
http://ansm.sante.fr/</td></tr>
<tr><td>Evaluation and Grading</td><td colspan="5">Team work
Each clinical research team of students has to prepare a protocol of clinical research. They have to work as a project team. They are requested to present the protocol as a PowerPoint presentation, to discuss critical point with an ethic committee (made by other students) and finally answer general question from the professor.
Criteria of evaluation:
-Rational of the proposed study
-Relevance of the proposed disease (epidemiology)
- Quality of the slides
- Quality of the presentation
-Answers to the questions (on all the aspects of the courses of drug development)</td></tr>
</table>

<table>
<tr><td>Module</td><td colspan="5">PLASTICITY & CELL COMMUNICATION</td></tr>
<tr><td>Module coordinator</td><td colspan="5">MARC LANDRY</td></tr>
<tr><td>Course name</td><td colspan="5">RECEPTORS, TRANSDUCTION, SIGNALLING
GLIAL CELLS AND GLIOTRANSMISSION
SYNAPTIC PLASTICITY</td></tr>
<tr><td>Course teacher</td><td colspan="4">MARC LANDRY
PASCAL FOSSAT
JACQUES NOËL
SHERINE ABDEL SALAM
KARINE MASSE</td><td>ECTS</td></tr>
<tr><td>Year</td><td colspan="4">2ND</td><td rowspan="2">9</td></tr>
<tr><td>Semester</td><td colspan="4">3RD (TRACK 1: CELLULAR AND MOLECULAR NEUROSCIENCE)</td></tr>
<tr><td rowspan="3">Workload</td><td>Total nb of hours</td><td colspan="4">Nb of hours</td></tr>
<tr><td rowspan="2">226</td><td>Lecture</td><td>Seminar</td><td>Practical Course/Lab work</td><td>Personal work (including e-learning)</td></tr>
<tr><td>40</td><td>6</td><td></td><td>180</td></tr>
<tr><td>Course Description</td><td colspan="5">Introduction to Neuronal plasticity
G-protein coupled receptors
Growth factors and tyrosine kinase receptors
Ionotropic receptors and their trafficking
Purinergic signalling
Cytoskeleton-associated signalling
Glial cells and repertoire of gliotransmitters
Astrocyte activation
Astrocyte and synaptic transmission
Astrocytes and synaptic memory
Molecular mechanisms of synaptic plasticity, long-term potentiation and long-term depression</td></tr>
<tr><td>Aims and Outcomes</td><td colspan="5">Understand molecular mechanisms of neurotransmission and gliotransmission
Have an overview on intracellular signalling
Understand molecular mechanisms of synaptic plasticity
Develop a critical analysis of complex data sets on neurotransmission
Propose experimental strategy to tackle questions related to neurotransmission</td></tr>
<tr><td>Course Structure</td><td colspan="5">Videoconferences
Recorded courses
Interactive activities on the Moodle platform (quiz, wiki, chat, forum)
Group work for article analysis
Group work and flipped classroom</td></tr>
<tr><td>Prerequisite</td><td colspan="5">Master 1, basics in cellular neurobiology</td></tr>
<tr><td>Course Requirements</td><td colspan="5">Access to the Master Moodle platform</td></tr>
<tr><td>Required text</td><td colspan="5"></td></tr>
<tr><td>Recommended Texts & Other Readings</td><td colspan="5">Articles and reviews proposed in the dedicated course section on Moodle</td></tr>
</table>

Online Resources	Master Moodle platform
Evaluation and Grading	Method of calculating the final grade/method of learning outcomes verification

<table>
<tr><td>Module</td><td colspan="5">TRACK ONE – MOLECULAR – EMN (EX-ISIS) MASTER PROGRAM</td></tr>
<tr><td>Module coordinator</td><td colspan="5">PROF. AHMAD RAAFAT BASSIOUNY</td></tr>
<tr><td>Course name</td><td colspan="5">NEUROGENESIS, STEM CELL & TRANSPLANTATION</td></tr>
<tr><td>Course teacher</td><td colspan="4">PROF. AHMAD RAAFAT BASSIOUNY</td><td>ECTS</td></tr>
<tr><td>Year</td><td colspan="4">2</td><td rowspan="2">6</td></tr>
<tr><td>Semester</td><td colspan="4">3 (TRACK 1)</td></tr>
<tr><td rowspan="3">Workload</td><td>Total nb of hours</td><td colspan="4">Nb of hours</td></tr>
<tr><td rowspan="2">130</td><td>Lecture</td><td>Seminar</td><td>Practical Course/Lab work</td><td>Personal work</td></tr>
<tr><td>weekly</td><td></td><td>NO</td><td>Assigned presentation</td></tr>
<tr><td>Course Description</td><td colspan="5">Students will be exposed to the discovery of Adult Neurogenesis. Neural stem cells, neurogenesis in adult olfactory system, adult hippocampal neurogenesis, regulation and function of neurogenesis, applications of neurogenesis in medicine.</td></tr>
<tr><td>Aims and Outcomes</td><td colspan="5">To obtain an advance understanding of neurogenesis in the adults. Students are expected to acquire knowledge and understanding of the basic biology of embryonic and tissue-specific stem cells, the potential application of stem cell for the treatment of human diseases.</td></tr>
<tr><td>Course Structure</td><td colspan="5">Details of how the course will be delivered: lectures/practical course/seminars/lab work/Realization of independently performed tasks by student etc.</td></tr>
<tr><td>Prerequisite</td><td colspan="5">Undergraduate completed biology courses- graduate student</td></tr>
<tr><td>Course Requirements</td><td colspan="5">Internet connection/access to specified recourses or web sites etc.</td></tr>
<tr><td>Required text</td><td colspan="5">Research articles; lecture notes; powerpoint presentations;</td></tr>
<tr><td>Recommended Texts & Other Readings</td><td colspan="5">1. Research articles; lecture notes; powerpoint presentations; 2. Adult Neurogenesis; G. Kempermann, OUP; ISBN: 978-019-517971-2</td></tr>
<tr><td>Online Resources</td><td colspan="5">1: Lecture, 2: Question-Answer, 3: Case-study</td></tr>
<tr><td>Evaluation and Grading</td><td colspan="5">Student Presentations and 1 Final</td></tr>
</table>

<table>
<tr><td>Module</td><td colspan="5">NEUROENDOCRINOLOGY AND NEUROBIOLOGY OF FOOD INTAKE</td></tr>
<tr><td>Module coordinator</td><td colspan="5">ANNA BLASIAK</td></tr>
<tr><td>Course name</td><td colspan="5">NEUROENDOCRINOLOGY AND NEUROBIOLOGY OF FOOD INTAKE</td></tr>
<tr><td>Course teacher</td><td colspan="4">ANNA BLASIAK</td><td>ECTS</td></tr>
<tr><td>Year</td><td colspan="4">2</td><td rowspan="2">6</td></tr>
<tr><td>Semester</td><td colspan="4">3 / TRACK 1</td></tr>
<tr><td rowspan="3">Workload</td><td>Total nb of hours</td><td colspan="4">Nb of hours</td></tr>
<tr><td rowspan="2">150</td><td>Lecture</td><td>Seminar</td><td>Practical Course/Lab work</td><td>Personal work</td></tr>
<tr><td>25</td><td>5</td><td>0</td><td>120</td></tr>
<tr><td>Course Description</td><td colspan="5">Basics of Neuroendocrinology
Neuropeptidergic transmission
Hypothalamic regulations
Example of an integrated neuroendocrine regulation: the control of food intake
• CNS Control of Food Intake and Energy Balance
• Metabolic Signals in the Control of Food Intake
• Gastrointestinal Signaling in the Control of Food Intake
• Interactions Between Enteric Microbiota, Central and Enteric Nervous Systems
• Rewarding and Motivating Effects of Food
• Stress and Food Intake
• Food Intake Disorders</td></tr>
<tr><td>Aims and Outcomes</td><td colspan="5">After course completion student :
• Has the knowledge of neuropeptide synthesis, transport, secretion and mechanisms of action
• Has a general representation of neuroendocrine functions
• Knows hypothalamic functions
• Has the knowledge about neuronal control of food intake.
• Knows brain circuits and neurotransmitters involved in reward based food intake.
• Understand different role and origin of homeostatic and ‘emergency response circuits’ in the control of feeding.
• Is able to describe major causes of food intake disorders, their neurobiological underpinnings and accepted treatments.</td></tr>
<tr><td>Course Structure</td><td colspan="5">Videoconferences
Recorded courses
Group work for article analysis
Group work and flipped classroom</td></tr>
<tr><td>Prerequisite</td><td colspan="5">Basics of neurophysiology and cellular neurobiology</td></tr>
<tr><td>Course Requirements</td><td colspan="5">Internet connection</td></tr>
<tr><td>Required text</td><td colspan="5">Required resources will be made available during the course duration</td></tr>
<tr><td>Recommended Texts & Other Readings</td><td colspan="5">Relevant manuscripts, opinion articles and reviews will be proposed in the dedicated course section on Moodle</td></tr>
<tr><td>Online Resources</td><td colspan="5">Dedicated Moodle platform</td></tr>
<tr><td>Evaluation and Grading</td><td colspan="5">Continuous evaluation : article presentation and/or quizz (40%)
Final exam (60%)</td></tr>
</table>

<table>
<tr><td>Module</td><td colspan="5">FUNCTIONAL AND INTEGRATIVE NEUROSCIENCE</td></tr>
<tr><td>Module coordinator</td><td colspan="5">FRANCISCO OLUCHA BORDONAU</td></tr>
<tr><td>Course name</td><td colspan="5">FROM SENSATION TO PERCEPTION</td></tr>
<tr><td>Course teacher</td><td colspan="4">FRANCISCO OLUCHA BORDONAU
SAADIA BAMOHAMMED
MOHAMMED BENNIS
CARMINA MONTOLIU
JULIO SANJUAN</td><td>ECTS</td></tr>
<tr><td>Year</td><td colspan="4">2ND</td><td rowspan="2">6</td></tr>
<tr><td>Semester</td><td colspan="4">1ST</td></tr>
<tr><td rowspan="3">Workload</td><td>Total nb of hours</td><td colspan="4">Nb of hours</td></tr>
<tr><td rowspan="2">150</td><td>Lecture</td><td>Seminar</td><td>Practical Course/Lab work</td><td>Personal work</td></tr>
<tr><td>7</td><td>7</td><td>10</td><td>126</td></tr>
<tr><td>Course Description</td><td colspan="5">The course is aimed at study the processing of incoming information from where it is produced, the sensory organs to where it is perceived and emotionally coloured (the cortical level).
Basic processing of sensory information will be studied on the following topics
Transduction
Coding
Elaboration
Representation
Emotion and memory
Hallucination</td></tr>
<tr><td>Aims and Outcomes</td><td colspan="5">Students will learn
1) the basic processes of sensory elaboration common to different modalities
2) the basic mechanisms of processing
3) to differentiate each process at each step
4) to identify the structures in which processing is taking place</td></tr>
<tr><td>Course Structure</td><td colspan="5">The course is organized in 6 tracks and each track is opened every week until completion of the course.
For each tract an opening session is delivered by visioconference in which a basic explanation of the topic is delivered. Also some documents are available for the students and a set of activities to work these basic concepts. The activities are closed at the end of each week and evaluated.
At the end of the course a general evaluation process is delivered.</td></tr>
<tr><td>Prerequisite</td><td colspan="5">No prerequisites</td></tr>
<tr><td>Course Requirements</td><td colspan="5">Internet connection</td></tr>
<tr><td>Required text</td><td colspan="5">Documents are delivered in the plateform</td></tr>
<tr><td>Recommended Texts & Other Readings</td><td colspan="5">Neuroscience, Fifth Edition 5th Edition by Dale Purves Elsevier
Principles of Neural Science, Fifth Edition (Principles of Neural Science (Kandel))
Eric R. Kandel
Fundamental Neuroscience for Basic and Clinical Applications: by Duane E. Haines</td></tr>
</table>

Online Resources	http://www.e-masters.univ-bordeaux.fr/login/index.php
Evaluation and Grading	50% of the grade is the final exam 50% is the average of the activities along the course

<table>
<tr><td>Module</td><td colspan="5">FROM PERCEPTION TO ACTION</td></tr>
<tr><td>Module coordinator</td><td colspan="5">LAURENCE CASINI (AMU)</td></tr>
<tr><td>Course name</td><td colspan="5">FROM PERCEPTION TO ACTION</td></tr>
<tr><td>Course teacher</td><td colspan="4">LAURENCE CASINI (AMU), DRISS BOUSSAOUD (AMU), FRANCK VIDAL (AMU)</td><td>ECTS</td></tr>
<tr><td>Year</td><td colspan="4">MASTER 2 (2ND YEAR)</td><td rowspan="2">6</td></tr>
<tr><td>Semester</td><td colspan="4">3</td></tr>
<tr><td rowspan="3">Workload</td><td>Total nb of hours</td><td colspan="4">Nb of hours</td></tr>
<tr><td rowspan="2">120</td><td>Lecture</td><td>Seminar</td><td>Practical Course/Lab work</td><td>Personal work</td></tr>
<tr><td>30</td><td></td><td>10</td><td>90</td></tr>
<tr><td>Course Description</td><td colspan="5">This course is about how we control our actions in response to stimuli. It contains :
-1/ the presentation of the brain circuits of action planning and execution
-2/ the brain mechanisms of sensori-motor learning, neuroplasticity and neuro-repair
-3/ mechanisms and neural basis controlling decision
-4/ mechanisms and neural basis of action monitoring</td></tr>
<tr><td>Aims and Outcomes</td><td colspan="5">After course completion student has the knowledge about brain mechanisms of sensori-motor learning and neural basis of processes linking stimuli to actions. They know the difference between motor planning, motor program and motor execution. They are able to define processes involved in response decision for automatic stimulus-response associations versus controlled stimulus-response associations, as well as to define processes involved in reactive versus proactive action monitoring. They are able to illustrate their knowledge from data coming from different brain imagery technics and also from neural pathologies.</td></tr>
<tr><td>Course Structure</td><td colspan="5">Course will be delivered through lectures given by video-conferences and written documents available on the “moodle” platform. One practical work will also be required as well as analyses of scientific articles given by teachers.</td></tr>
<tr><td>Prerequisite</td><td colspan="5">Completed courses/ Animal Experiment Licence etc.</td></tr>
<tr><td>Course Requirements</td><td colspan="5">Internet connection and access to the ISIS platform is necessary.</td></tr>
<tr><td>Required text</td><td colspan="5"></td></tr>
<tr><td>Recommended Texts & Other Readings</td><td colspan="5">Several scientific articles will be given by teachers during the course.</td></tr>
<tr><td>Online Resources</td><td colspan="5"></td></tr>
<tr><td>Evaluation and Grading</td><td colspan="5">Students will be required to perform several pieces of homework (at least 3) including analysis of articles and answers to questions about the lectures. In addition, they will have to carry out practical work. They will obtain a grade for each piece of work and the final grade will be a weighted average of these grades.</td></tr>
</table>

<table>
<tr><td>Module</td><td colspan="5">INTEGRATIVE PHYSIOLOGY, FOCUS ON BIOLOGICAL RHYTHMS</td></tr>
<tr><td>Module coordinator</td><td colspan="5">PATRICK VUILLEZ, UNIVERSITY OF STRASBOURG</td></tr>
<tr><td>Course name</td><td colspan="5">INTEGRATIVE PHYSIOLOGY, FOCUS ON BIOLOGICAL RHYTHMS</td></tr>
<tr><td>Course teacher</td><td colspan="4">PATRICK VUILLEZ, UNIVERSITY OF STRASBOURG</td><td>ECTS</td></tr>
<tr><td>Year</td><td colspan="4">2ND</td><td rowspan="2">6</td></tr>
<tr><td>Semester</td><td colspan="4">S3, TRACK 2</td></tr>
<tr><td rowspan="3">Workload</td><td>Total nb of hours</td><td colspan="4">Nb of hours</td></tr>
<tr><td rowspan="2">128</td><td>Lecture</td><td>Seminar</td><td>Practical Course/Lab work</td><td>Personal work</td></tr>
<tr><td>28</td><td>4</td><td></td><td>96</td></tr>
<tr><td>Course Description</td><td colspan="5">Specific vocabulary, protocols and methods in the domain of rhythms. Properties of circadian rhythms.
A master clock in the suprachiasmatic nuclei. Clock genes. Secondary oscillators and the multioscillatory system. Zeitgebers/synchronization. Melanopsin and photosensitive ganglionic cells of the retina. Feeding. Rhythms and metabolism. Outputs/distribution by nervous and endocrine cues.
Photoperiodism and seasonal reproduction. Plasticity and seasonality, involvement of sexual steroids.
Circadian time disorders. Chronobiology of psychiatric illnesses</td></tr>
<tr><td>Aims and Outcomes</td><td colspan="5">After course completion, student will
- be sustainably aware that the temporal dimension and the daily rhythms are components of living organisms as important as their anatomy.
- be able to design specific protocols and analyze data in order to take into account rhythmicity in his own research field (neuroscience, physiology, or any biological domain).
- know the organization of a mammal as a multioscillatory circadian system, from the molecular aspects of endogenous rhythms to the nervous and endocrine physiological regulation of the organism in its environment.
- know that pathologies are often linked to circadian time disorders, from mice to human and from metabolism to psychiatric illnesses.
- realize the vital importance of seasonal rhythms in many species and know some mechanisms involved.</td></tr>
<tr><td>Course Structure</td><td colspan="5">The course will be entirely online.
Lectures consist in different types of files weekly uploaded on Moodle. The level of difficulties is progressive (from “let’s start with a simple game”, to “what you have to know this week” and “try to go further by yourself on this subject”…). All along a document, personal thoughts are often solicited before to be asked to go further and to see the answer. A few entire lectures consist in “flipped class”. Personal work is always stimulated (“build your own glossary”…) and sometimes mandatory (different types of exercise and homework). Collaboration between students is encouraged (“upload your profile for the other students: I’m good and I can help you in the field of…, I’m weak and need your help in the field…”). Some lectures will be delivered as recorded video conferences from specialist colleagues. Two x 2h seminar are planned for discussion and questions/ answers (complementary to Moodle forum).</td></tr>
<tr><td>Prerequisite</td><td colspan="5">No prerequisite in chronobiology. Biology bachelor level in neuroanatomy, general physiology and/or cell biology are preferable to easily follow this course (at least 1 or 2 of these fields to avoid additional personal work).</td></tr>
<tr><td>Course Requirements</td><td colspan="5">Internet connection. Access to a video conference room (or personal material).</td></tr>
<tr><td>Required text</td><td colspan="5">In order to guide the students and to build the course with them, starting with no knowledge in chronobiology, the texts or other resources will be progressively given.</td></tr>
<tr><td>Recommended Texts & Other Readings</td><td colspan="5">However, for the impatient students, one of these books for example:
Introducing Biological Rhythms: A Primer on the Temporal Organization of Life, with Implications for Health, Society, Reproduction, and the Natural Environment. Willard L. Koukkar, Robert B. Sothern.
Springer-Verlag NY Inc. 678 pages ISBN-10: 1402036914. ISBN-13: 978-1402036910</td></tr>
</table>

	Rhythms of Life: The Biological Clocks That Control the Daily Lives of Every Living Thing. Russell G. Foster and Leon Kreitzman. Yale University Press. 276 pages. ISBN-10: 0300109695. ISBN-13: 978-0300109696 Chronobiology: Biological Timekeeping. Jay C. Dunlap, Jennifer J. Loros and Patricia J. DeCoursey. Sinauer Associates Inc. 382 pages. ISBN-10: 0878933964. ISBN-13: 978-0878933969 Circadian Physiology. Roberto Refinetti. CRC Press. 688 pages. ISBN-10: 0849322332. ISBN-13: 978-0849322334
Online Resources	and: https://www.youtube.com/watch?v=qOXQgyjRm0I https://www.youtube.com/watch?v=Pp6rfOr_LRg ... Open Access Journal of Circadian Rhythms. http://www.jcircadianrhythms.com/
Evaluation and Grading	Several personal works at home mentioned above give rise to a mark (including one by assessment of students by students) + a final 2h written examination. The coefficient of the different marks is determined by the time required to corresponding homework. The French system is used: rating from 0 to 20. (from 0: no worse, 10: just enough, 20: could not expect better work). But it can be adapted.

<table>
<tr><td>Module</td><td colspan="5">INTEGRATIVE AND SYSTEM BIOLOGY</td></tr>
<tr><td>Module coordinator</td><td colspan="5">L. PEZARD</td></tr>
<tr><td>Course name</td><td colspan="5">COMPUTATIONAL NEUROSCIENCE AND NEURAL NETWORK</td></tr>
<tr><td>Course teacher</td><td colspan="4">R. KHALIL
L. PEZARD</td><td>ECTS</td></tr>
<tr><td>Year</td><td colspan="4">SECOND</td><td rowspan="2">3</td></tr>
<tr><td>Semester</td><td colspan="4">S3</td></tr>
<tr><td rowspan="3">Workload</td><td>Total nb of hours</td><td colspan="4">Nb of hours</td></tr>
<tr><td rowspan="2">70h</td><td>Lecture</td><td>Seminar</td><td>Practical Course/Lab work</td><td>Personal work</td></tr>
<tr><td>15h</td><td></td><td>15h</td><td>40h</td></tr>
<tr><td>Course Description</td><td colspan="5">This course introduces the main topics of the computational neurosciences and neuronal network models. Lectures give the theoretical foundations of the topic. They are completed by computer simulations of a specific neuronal network.</td></tr>
<tr><td>Aims and Outcomes</td><td colspan="5">After course completion student has the knowledge about the major themes of neuronal modelling. S/he is able to implement computer simulations using a dedicated software.</td></tr>
<tr><td>Course Structure</td><td colspan="5">Details of how the course will be delivered: lectures/practical course/seminars/lab work/Realization of independently performed tasks by student etc.

The lectures will comprise the main following topics:
• Biophysics: from ionic channels to Hodgkin and Huxley model
• Neuronal models and the geometry of excitability
• Neuronal networks and simulators
• Coding and information processing

The practical course comprise 3 tutorials with the Brian neuronal simuator

Practical tutorials and final computer project are independent task performed by the students with the help of teacher through forum and interactive plateforme.</td></tr>
<tr><td>Prerequisite</td><td colspan="5">Completed courses/Animal Experiment Licence etc.

• Computer knowledge (software installation)</td></tr>
<tr><td>Course Requirements</td><td colspan="5">Internet connection/access to specified recourses or web sites etc.

• Internet connection
• Computer with Python language installed</td></tr>
<tr><td>Required text</td><td colspan="5">Gerstner W. and Kistler, W. (2002) Spiking Neuron Models. Single Neurons, Populations, Plasticity. Cambridge University Press.</td></tr>
<tr><td>Recommended Texts & Other Readings</td><td colspan="5">There are several books that complement the content of the course:

• Sterratt, D., Graham, B., Gillies, A. and Willshaw, D. (2011) Principles of Computational</td></tr>
</table>

	Modelling in Neuroscience. Cambridge University Press. • Dayan P. and Abbott, L. F. (2001) Theroretical Neuroscience - Computational and Mathematical Modeling of Neural Systems. The MIT Press. • Ermentrout G.B. and Terman, D.H. (2010) Mathematical Foundations of Neurosciences. Springer • Koch C. (1999) Biophysics of Computation. Information Processing in Single Neurons. Oxford University Press • Izhikevich E. M. (2007) Dynamical Systems in Neuroscience. The Geometry of Excitability and Bursting. The MIT Press.
Online Resources	"Spiking Neuron Models" can be found on the web following the url: http://icwww.epfl.ch/~gerstner/SPNM/SPNM.html The Computational Neuroscience page of Scholarpedia: http://www.scholarpedia.org/article/Category:Computational_neuroscience The Brian neuronal suimulator: http://briansimulator.org/
Evaluation and Grading	Method of calculating the final grade/method of learning outcomes verification Course examination 33% Computer project: 66% (tutorials 1/3 and final project 2/3)

<table>
<tr><td>Module</td><td colspan="5">MORPHOFUNCTIONAL NEUROIMAGING</td></tr>
<tr><td>Module coordinator</td><td colspan="5">JEAN TAMRAZ</td></tr>
<tr><td>Course name</td><td colspan="5"></td></tr>
<tr><td>Course teacher</td><td colspan="4">JEAN TAMRAZ</td><td>ECTS</td></tr>
<tr><td>Year</td><td colspan="4">2ND</td><td rowspan="2">9</td></tr>
<tr><td>Semester</td><td colspan="4">3RD</td></tr>
<tr><td rowspan="3">Workload</td><td>Total nb of hours</td><td colspan="4">Nb of hours</td></tr>
<tr><td rowspan="2">254</td><td>Lecture</td><td>Seminar</td><td>Practical Course/Lab work</td><td>Personal work</td></tr>
<tr><td>36 hrs</td><td>18 hrs</td><td></td><td>200 hrs</td></tr>
<tr><td>Course Description</td><td colspan="5">Section 1 : Cephalic reference lines suitable for brain neuroimaging
Historical overview of cross-sectional brain anatomy (J. TAMRAZ - USJ)
Cephalic reference lines suitable for morphofunctional neuroimaging (J. TAMRAZ - USJ)
Section 2 : Gross morphology and fissural patterns of the brain
Cytoarchitecture and brain mapping, cortical development and classification of brain sulcation (J. TAMRAZ - USJ)
Sulcal and gyral pattern of brain cortex: the lateral, mesial and basal aspects of the hemisphere (J. TAMRAZ - USJ)
Section 3 : Central region and sensorimotor cortex
Morphology and sulcal anatomy of the central region and the frontal lobe (J. TAMRAZ - USJ)
Topographical and morphofunctional NI of the central region (J. TAMRAZ - USJ)
Section 4 : Perisylvian opercula and cognitive regions
Morphology and sulcal anatomy of the perisylvian region (J. TAMRAZ - USJ)
Topographical and morphofunctional NI of the anterior speech region (J. TAMRAZ - USJ)
Topographical and morphofunctional NI of the posterior speech region (J. TAMRAZ - USJ)
Section 5 : Mesial temporal region and Basal forebrain
Morphology and sulcal anatomy of the limbic lobe (J. TAMRAZ - USJ)
Cortical anatomy and NI of the limbic lobe and the mesial temporal region (J. TAMRAZ - USJ)
Morphological and topographical anatomy and NI of the basal forebrain (J. TAMRAZ - USJ)</td></tr>
<tr><td>Aims and Outcomes</td><td colspan="5">Acquire and deepen knowledge in a perspective of fundamental and clinical research, in the fields of brain morphology, morphometry and functional neuroimaging of the brain. After course completion the student acquire the knowledge about brain cortex architecture, sulcal and gyral interindividual variations as well as in functional brain mapping.</td></tr>
<tr><td>Course Structure</td><td colspan="5">The course is delivered presentially using lectures including interactive tasks on dedicated imaging workstations</td></tr>
<tr><td>Prerequisite</td><td colspan="5">Completed courses: basic sciences (Licence in biological science and/or medicine or pharmacy first 3 yrs completed at least)</td></tr>
<tr><td>Course Requirements</td><td colspan="5">Internet connection/access to specified recourses or web sites</td></tr>
<tr><td>Required text</td><td colspan="5">Conference slides and related material</td></tr>
<tr><td>Recommended Texts & Other Readings</td><td colspan="5">Specific or review articles and reference books are proposed</td></tr>
</table>

Online Resources	Dedicated moodle plateform (Bordeaux)
Evaluation and Grading	Final exam on the moodle platform, including QCM and QROCM questions

<table>
<tr><td>Module</td><td colspan="5">PATHOPHYSIOLOGY OF NEUROLOGICAL DISEASES</td></tr>
<tr><td>Module coordinator</td><td colspan="5">JEAN TAMRAZ</td></tr>
<tr><td>Course name</td><td colspan="5">ADNAN AWADA, NASSIM FARES, SAMI RICHA, SANDRA SABBAGH, JEAN TAMRAZ</td></tr>
<tr><td>Course teacher</td><td colspan="4"></td><td>ECTS</td></tr>
<tr><td>Year</td><td colspan="4">2ND</td><td rowspan="2">6</td></tr>
<tr><td>Semester</td><td colspan="4">3RD</td></tr>
<tr><td rowspan="3">Workload</td><td>Total nb of hours</td><td colspan="4">Nb of hours</td></tr>
<tr><td rowspan="2">195</td><td>Lecture</td><td>Seminar</td><td>Practical Course/Lab work</td><td>Personal work</td></tr>
<tr><td>27 hrs</td><td>18 hrs</td><td></td><td>150 hrs</td></tr>
<tr><td>Course Description</td><td colspan="5">Section 1 : Neurogenetics and mental deficiency
Autism spectum of disorders (S. RICHA, MD, PhD - USJ)
Classification and pathophysiology of genetic metabolic diseases (S. SABBAGH, MD - USJ)
Mitochondrial diseases: pathophysiology and clinical features (A. AWADA, MD - USJ)
Developmental skull and brain anomalies in mental retardation (J. TAMRAZ, MD, PhD - USJ)
Neuroimaging in neurogenetics and mental retardation (J. TAMRAZ, MD, PhD - USJ)

Section 2 : Neurodegeneration and cognitive impairement
Dementia 1: definitions, causes and clinical presentations (A. AWADA, MD - USJ)
Dementia 2: Alzheimer's disease : pathology and pathophysiology (A. AWADA, MD - USJ)
Dementia 3: Lewy body and Fronto-temporal dementias : pathology and pathophysiology (A. AWADA, MD - USJ)
Neuroimaging in dementia : an overview (J. TAMRAZ, MD, PhD - USJ)

Section 3 : Epilepsy
Pathophysiology of seizures and epilepsies (A. AWADA, MD - USJ)
Pathology and NI of epileptogenic lesions, cortical dysplasias and MTS (J. TAMRAZ, MD, PhD - USJ)
Pathology and NI of epileptogenic tumors and tumorlike conditions (J. TAMRAZ, MD, PhD - USJ)

Section 4 : Ischemia
Pathophysiology of the neurovascular unit: cerebral hypoxia & ischemia (N. FARES, PhD - USJ)
Oxidative stress and blood-brain barrier permeability (N. FARES, PhD - USJ)
Synaptic plasticity and oxidative stress (N. FARES, PhD - USJ)
Microglia biology in health and disease of the CNS (N. FARES, PhD - USJ)
Patch clamp: principles and field of applications in studying cerebral protein channels (N. FARES, PhD - USJ)

Section 5: Inflammation
Pathophysiology and cellular mechanisms of multiple sclerosis (A. AWADA, MD - USJ)
Pathology & NI of multiple sclerosis (J. TAMRAZ, MD, PhD - USJ)</td></tr>
<tr><td>Aims and Outcomes</td><td colspan="5">nts will be able to acquire and deepen the relevant knowledge oriented in a perspective of fundamental and clinical research in pathophysiology and neuroimaging of major disorders of the central nervous system, including: mental retardation, cognitive degenerative disorders, epilepsy, disease of white matter and cerebral ischemia.</td></tr>
<tr><td>Course Structure</td><td colspan="5">The course is delivered presentially using lectures including interactive tasks</td></tr>
<tr><td>Prerequisite</td><td colspan="5">Completed courses: basic sciences (Licence in biological science and/or medicine or pharmacy first 3 yrs completed at least)</td></tr>
<tr><td>Course Requirements</td><td colspan="5">Internet connection, video projection</td></tr>
</table>

Required text	Conference slides
Recommended Texts & Other Readings	Specific or review articles and reference books are proposed
Online Resources	Dedicated moodle platform (Bordeaux)
Evaluation and Grading	Final exam on the moodle platform, including QCM and QROCM questions

<table>
<tr><td>Module</td><td colspan="5">DIAGNOSTIC AND THERAPEUTIC TOOLS DEVELOPMENT</td></tr>
<tr><td>Module coordinator</td><td colspan="5">JEAN TAMRAZ</td></tr>
<tr><td>Course name</td><td colspan="5"></td></tr>
<tr><td>Course teacher</td><td colspan="4">AYMAN ASSI, ADNAN AWADA, JAD BAROUKY, GABY KREICHATI, ELIE NASR, SAMI SLABA, JEAN TAMRAZ</td><td>ECTS</td></tr>
<tr><td>Year</td><td colspan="4">2ND</td><td rowspan="2">6</td></tr>
<tr><td>Semester</td><td colspan="4">3RD</td></tr>
<tr><td rowspan="3">Workload</td><td>Total nb of hours</td><td colspan="4">Nb of hours</td></tr>
<tr><td rowspan="2">195</td><td>Lecture</td><td>Seminar</td><td>Practical Course/Lab work</td><td>Personal work</td></tr>
<tr><td>27 hrs</td><td>18 hrs</td><td></td><td>150 hrs</td></tr>
<tr><td>Course Description</td><td colspan="5">Section 1 : Fundamental of multimodal neuroimaging
A- Fundamentals of multimodal neuroimaging
Basic principles of imaging (XR, CT, US, MR) (A. ASSI, PhD - USJ)
Basic principles of SPECT and PET (J. BAROUKY, PhD - USJ)
Basic principles of image processing (A. ASSI, PhD - USJ)
B- Stance and Gait
Biomechanics and 3D modeling of the spine using EOS (A. ASSI, PhD - USJ)
Sagittal balance of the spine (G. KREICHATI, MD - USJ)
Gait analysis: technical aspects & CP gait disorders (A. ASSI, PhD - USJ)
Disorders of gait (A. AWADA, MD - USJ)
Section 2 : Electroneurophysiology
Electro-neuro-myography (A. AWADA, MD - USJ)
Evoked potentials (A. AWADA, MD - USJ)
EEG and Video-EEG (A. AWADA, MD - USJ)
Section 3 : Functional and interventional neuroimaging
A- Functional neuroimaging
Clinical applications of functional neuroimaging (f.MRI, SPECT, PET) (J. TAMRAZ, MD, PhD - USJ)
Fundamentals and clinical indications of MRS in neuroscience (J. TAMRAZ, MD, PhD - USJ)
White matter core architecture and tractography (J. TAMRAZ, MD, PhD - USJ)
Brain mapping NI techniques suitable for neurosurgical planning (J. TAMRAZ, MD, PhD - USJ)
Therapeutic neuroimaging
Intracranial stereotactic radiosurgery (E. NASR, MD - USJ)
Exploration neurovasculaire: anatomie et imagerie (S. SLABA, MD, MS - USJ)
Interventional neuroradiology and neuroangiography, part I (S. SLABA, MD, MS - USJ)
Interventional neuroradiology and neuroangiography, part II (S. SLABA, MD, MS - USJ)</td></tr>
<tr><td>Aims and Outcomes</td><td colspan="5">Students will be able to acquire and develop the relevant knowledge from the perspective of fundamental and clinical research in biotechnology, particularly in technical diagnostic and therapeutic applications of the future, namely: functional neuroimaging and brain activation, stance and gait disorders, interventional neuroradiology, neuronavigation and radiosurgery.</td></tr>
<tr><td>Course Structure</td><td colspan="5">The course is delivered presentially using lectures including interactive tasks on related imaging devices</td></tr>
<tr><td>Prerequisite</td><td colspan="5">Completed courses: basic sciences (Licence in biological science and/or medicine or pharmacy first 3 yrs completed at least)</td></tr>
<tr><td>Course Requirements</td><td colspan="5">Internet connection, video projection</td></tr>
<tr><td>Required text</td><td colspan="5">Conference slides and related material</td></tr>
</table>

Recommended Texts & Other Readings	Specific or review articles and reference books are proposed
Online Resources	Dedicated moodle plateform (Bordeaux)
Evaluation and Grading	Final exam on the moodle platform, including QCM and QROCM questions

EMN-Online Grading Scale

The ECTS grading scale is based on the class percentile of a student in a given assessment as shown in the following table.

It indicates how he/she performed relative to other students in the same class.

The marks are then converted into the local systems.

Grade	best/next	Definition
A	10 %	outstanding performance with only minor errors
B	25 %	above the average standard but with some errors
C	30 %	generally sound work with a number of notable errors
D	25 %	fair but with significant shortcomings
E	10 %	performance meets the minimum criteria
F		Fail