Master's Program (MSc) in Life Sciences and Health
M1 – International track – France
Site Evry
Student’s handbook
2024-2025

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Program

Groups	Compensation	Type	Teaching unit name	ECTS	Period
Group 1: Core courses	No	Compulsory fo all	Core courses : Genes, proteins and cells	10	Semestre 1
			Transdisciplinary project	2,5	
Group 2: Major	No	Compulsory fo all	Systems Biology I	2,5	
			Introduction to biotherapies (⚠Semester 2;Tuesday PM)	2,5	
			Masteriales	2,5	
		Electives for 10 ECTS	Biosignaling	5	
			Methods in neuroscience	5	
			Workshop on model organisms	5	
		Electives for 2.5 ECTS	Workshop on model organisms 1	2,5	
			Cellular economics	2,5	
			Synthetic Biology (⚠ Semester 2; Thursday PM)	2,5	
Group 3: Minor	Yes *with bloc 1 &2 but not with bloc 4*	Electives for 12,5 ECTS	Animal transgenesis	2,5	Semestre 2
			Current Questions in Evolution	5	
			Development in questions	5	
			Epigenetics	2,5	
			Functional genomics and precision medicine	2,5	
			Immuno-pathophysiology	2,5	
			Integrative microbiology	2,5	
			Systems Biology II (⚠ Semester 1, Q1.2)	2,5	
			Sustainable development in Life Sciences and Health	2,5	
			Neurobiology of Integrated Systems	5	
Group 4: Research training	No	Compulsory fo all	Scientific project	5	
			Internship	10	
Group 5: Optional Training		Optional	Optional Internship	0	
			Intercultural communication	2,5	
			EUGLOH events	Depends on the type of activity	
			Français Langue Etrangère	0	

Only block 3 is compensable (by block 1 or block 2 but not by block 4). Blocks 1, 2, 4 are not compensable, they must be acquired. The teaching units within a block compensate each other with a threshold of 7/20, except for the "internship" which must be acquired (final grade above 10/20).

Planning

Each teaching unit will have a specific schedule associated to it. For your organization, expect classes to start around 8:30 am and end around 6 pm.

Secretariat

Aurélie Boucharin (Dekoninck)
Université d'Evry Val d'Essonne
Bâtiment IBGBI 1er étage (Bureau 136)
23, boulevard de France
91037 EVRY Cedex
Tel : 01 64 85 34 13/Thursday and Friday: 06 29 15 68 63
aurelie.dekoninck@univ-evry.fr

GROUP 1 : CORE COURSES

Semester 1

Core courses: Genes, proteins and cells

ECTS
10

Key words
Genetics, Genomics, Epigenetics, Cell Biology, Biochemistry, Cell signaling

Teaching content

Organization:
The course is organized over an 8-week period during the first semester. It is based on active learning which includes reverse approaches and problem-based activities. The time spent in class is dedicated to interactive sessions with teachers, conferences from experts in given fields, debates, methodological trainings and tutorials. Students will also be invited to provide working reports on individual or group projects elaborated autonomously before classes.
Learning sequences are elaborated over the study of 2 to 3 research articles recently published in international peer-reviewed journals. It is a question-based process the goal of which is to highlight unknown theoretical or practical contents, and to acquire what is needed to fully appreciate the information presented in the articles. The expected learning outcomes of the course are profiled in advanced and their completion monitored throughout time.
The evaluation procedure combines a continuous assessment (reports, presentations, classroom response systems, etc..) with a final written exam.

Content:
The core course addresses key concepts and challenges in the following basic fields of Life Sciences and Health: Genetics and Genomics Cellular Biology Biochemistry and Cell Signaling It aims to instill a solid and broad-based background in prominent areas in Life Sciences and Health while developing the student's ability to integrate and share scientific information, to express their ideas and to formulate questions whether verbally or in writing with clarity and logic.
Completion of the course is a pre-requisite to entry a wide-range of Master 2 programs offered by the Master of Life Science and Health - Paris-Saclay University.

Expected outcomes

Competences and skills acquired:
Students will be able to:
-demonstrate a good understanding of fundamental facts, major concepts and challenges in prominent areas of Life Sciences and Health
-understand issues pertaining to ethics and scientific integrity in science
-develop a strong knowledge of the scientific method and experimental procedures commonly used in Life Sciences and Health
-follow computational ways of understanding biological systems
-identify and use a variety of information sources
-to integrate and share scientific information
-communicate clearly ideas, and information via appropriate means
-show competence in appropriate personal and team working skills

-develop transversal skills such as autonomous learning, adaptability and resilience (problem solving)

Teaching distribution

Lecture : 51,5h, Directed study : 28,5h, Practical class: 25h, Project: 15h

Bibliography and recommended readings

Students are strongly invited to go through the MIT OpenCourseWare: " Fundamentals of Biology" before the course.
https://ocw.mit.edu/courses/biology/7-01sc-fundamentals-of-biology-fall-2011/
A specific bibliography will be provided during the course.

Evaluation

Continuous assessment and written final exam.
Session 1: 0,7 CC + 0,3 EE
Session 2: 0,3 CC + 0,7 EE (CC renewed from session 1)
CC: continuous assessment
EE: written exam

Contact:

Odile Bronchain: odile.bronchain@universite-paris-saclay.fr

Location:

ORSAY

Schedule:

Can be find here

Core Courses: Transdisciplinary project

ECTS
2.5

Key words
Genetics, Genomics, Epigenetics, Cell Biology, Biochemistry, Cell signaling

Teaching content

The transdisciplinary project aims to produce new knowledge or insight transcending disciplinary boundaries. The different disciplinary fields covered in this teaching unit include those of the common learning base (Core courses : Genes, proteins and cells):
-Biochemistry
-Cell signaling
-Cellular Biology
-Genomics/Genetics/Epigenetics
The transdisciplinary project aims to bring rigor, care and imagination in a collaborative production of knowledge through a project-based approach.

Expected outcomes:

-Synthesize, update and transfer scientific knowledge
-Refine understanding through discussion and explanation
-Give and receive feedback on performance
-Use of communication tools (mediatization of knowledge)
-Popularize general concepts (dissemination of knowledge)
-Develop skills specific to collaborative efforts (sharing perspectives, taking responsibilities, delegate roles motivate and help one another).

Contact:
Odile Bronchain: odile.bronchain@universite-paris-saclay.fr

Location:
ORSAY

GROUP 2 : MAJOR

Masteriales

ECTS
2.5

Key words
Collective research project, Bioinformatics, Genomics

Teaching content

Organisation:
From the first days of the start of the academic year, the "Masteriales" will take place over 48 consecutive hours during which students will be divided into teams (e.g. quadrinomes). At the end of these two days, an oral presentation of the project and some concrete achievements will have to be made in front of a multidisciplinary teaching team and possibly an assembly of scientists, representatives of the private sector, specialists in communication and financiers. Students will be required to complete a research tender dossier (eg simplified research grant format) which will be sent one week later to the head of the unit.

Content:
The concept of "Masteriales" aims to have students in small groups design an innovative thematic and/or technological research project in a limited time (48h) and to present it in an argumentative manner in front of a jury of academic and private scientists. At the end of their presentations, students must respond to a call for research (eg, simplified ANR type). Taking place from the first days of the start of the academic year, this annual edition of "Masteriales" allows a better group cohesion, a possible disinhibition and a confidence-building of the students. They also discover some of the difficulties inherent in designing research projects.

Expected outcomes
At the end of this course, students will be able to:
a) to define an innovative scientific project
b) manage teamwork and divide tasks
c) to synthesize information for oral and written restitution
d) to present clearly and forcefully a team project
e) complete a research funding application.

Teaching distribution
Lecture: 2h, Directed study: 30h

Evaluation
Oral (EO) and written (EE) reports of a final multi-disciplinary project.
Session 1: F=0,5 EO + 0,5 EE

Contact:
Sylvain Fisson: sylvain.fisson@univ-evry.fr
Odile Bronchain: odile.bronchain@universite-paris-saclay.fr

Systems Biology I

ECTS
2.5

Teaching content

Integrative approaches are key steps in the thorough exploitation of omics data and their translation into knowledge. In this module, students will have courses on the architecture and the machinery of the cell, and on the genome and epigenome organization. They will learn how to combine predictive and experimental approaches to decode the genomic information through the structural and functional annotation of genomes. The integration and the querying of heterogeneous data imply to perfectly know their origin in order to take into consideration their quality, relevance and confidence levels. The understanding of this approach is the basis of holistic analyses for systems biology. Students will see different methods to produce transcriptome, ORFeome, proteome and interactome resources and how to integrate them in modeling approaches to have new insights on cellular processes.

Expected outcomes

On completion of the course students should be able to :
The students should have a good understanding of the challenges posed by integration of omics data. They should be able to understand and summarize a scientific paper in the field.

Teaching distribution

CM : 16h, TD : 9h

Contact:

Rigaill Guillem - guillem.rigaill@inra.fr

Location:

EVRY

Introduction to biotherapies

ECTS
2.5

Organization
Teaching distribution 1-Part related to Cancer 3 hours of Lectures and 3 hours of Tutorials 2- Stem Cell Technology and Regenerative Medicine: 5 hours of lectures, 2 hours of tutorials and 12 hours of practical work 25 hours.

Content
1- CANCER
I. Introduction to gene and cell therapies
II. Gene therapy:
A. Objectives and applications
B. Tools for gene transfer: introduction to viral and non-viral vectors
C. The approaches of the anti-cancer gene therapy
III. Cell therapy:
A. Objectives and applications: immunotherapies
B. The approaches in anticancer immunotherapies
2- STEM CELL TECHNOLOGY AND REGENERATIVE MEDICINE
I. From stem cells to tissue and organ bioengineering
A.Sources of stem cell
B.Scaffolds
C.Artificial tissue and Organoids
II. Applications of stem cells to regenerative medicine.
A.Definition and characteristics of pluripotent stem cells (PSC)
B.Differentiation of PSC into epidermal cells
C.Implementation of epidermis cell therapy approach from PSC
Practical Work: Osteogenic and adipogenic differentiation of mesenchymal stem cell in vitro.

Expected outcomes
After the course the students will be able to:
- Describe the immunotherapy or gene therapy or cell therapy in cancer
- Describe the applications of stem cells and scaffolds in tissue engineering
- Develop good laboratory practices for cells culture
- Read scientific articles and critically discuss results and conclusions.
- Demonstrate concision and precision in scientific writing.

Teaching distribution
Lecture : 8h, Practical class : 12h, Directed study : 5h

Prerequisites
Requires initial training in Immunology and cell biology.

Contact
Guenou Hind - hind.guenoujeria@univ-evry.fr

Location
Evry

Biosignaling

ECTS
5

Organisation
The course (50h) will begin with formal English classes (8h) which will provide students with written and oral skills for constructing and presenting a short, collaborative research proposal. The proposal will be based on one of the topics developed during the series of seminars delivered by invited speakers (16h). Each collaborative proposal will be peer-evaluated by designated reviewers who will lead the discussion period following oral presentation of the project during the directed study sessions (approximately 16h). The remaining course time will be dedicated to preparing the written proposal and the oral presentation.

Content
OAV1
Analyse, interpret and mobilize certain concepts in biology through active participation in group discussions on diverse themes including, second messenger systems, cell-cell communication, behaviour …
OAV2
Show proof of problem solving ability, creativity, critical thinking, a capacity for team work and scientific writing skills through the conception and redaction of a collaborative research project
Describe the state of the art, identify the scientific question(s), conceive experimental paradigms, predict experimental outcomes and justify their importance to the field
OAV3
Deploy public speaking skills, perfected or acquired during the course, in a formal presentation of a research project
Expose and defend a collaborative research project employing presentation skills (optimised slide content, correct phraseology, sign-posting, directive argumentation)
OAV4
Evaluate, criticize and justify scientific arguments
Organize and lead discussions on research projects written and orally presented by peers.

Teaching distribution
Lecture: 24h, Directed study: 16h, Project: 10h

Prerequisites
Given that the teaching unit is entirely in English, students are required to attest to a B2 level to participate. Placement tests will be conducted by the language department in early September.

Conctact
Heather McLean: heather.mclean@universite-paris-saclay.fr

Methods in Neuroscience

ECTS
5

Teaching content

Organization:
40h practical sessions + 10h tutorial sessions.
During practical sessions, students will be divided in two groups: in one group teaching will be given in French and in the other one in English.
Students will work in small groups to prepare short scientific reports on subjects related to some practical sessions.

Content:
Practical sessions include:
-Psychophysiology in humans (olfaction sensitivity & body posture)
-Behaviour analysis in mice (test of anxiety, spatial learning and memory), nematodes (olfaction and locomotion) and Drosophila (locomotion).
-Neuroanatomy (mouse)
-Visual evoked potentials (Human)
-Patch clamp recordings of neuronal firing (mouse, rat)
-Analysis of insulin signaling pathway by Western blot (mouse).

Prerequisites:
A strong background in Neuroscience is not necessary to successfully follow the teaching unit. However, some basic concepts on neuronal excitability and animal behavior will be appreciated.

Bibliography:
Neurosciences: Exploring the brain. Bear, Connors, Paradiso. Editions Pradel.

Contact:
Micaela Galante: micaela.galante@universite-paris-saclay.fr

Laboratory rotation / Workshop on model organisms

ECTS
5 or 2.5

Organisation:

The 5 ECTS version is constituted of two one-week internships, each in a different lab on a different organism. In some cases, a single 2 weeks project in one lab may be offered.
For the 2.5 ECTS version: One week in a Paris-Saclay laboratory.

Teaching content

Working on multicellular whole organisms is often hard to realize in the environment of a classical Lab course. This workshop, in the context of a research lab on campus, is meant to allow you to address biological issues in adults or embryos, in a normal or pathological context, using the specific approaches that apply to xenopus, zebrafish, nematode, mouse, drosophila, podospora and arabidopsis.
This course will allow you to get more familiar with sophisticated imaging approaches (3D imaging, confocal microscopy, time lapse,...), as well as genetics and DNA/RNA tools that allow tissue/cell specific and temporal modulation of gene expression.

Contact
Laurent Théodore: laurent.theodore@universite-paris-saclay.fr
Odile Bronchain : odile.bronchain@universite-paris-saclay.fr

Cellular economics

ECTS
2.5

Teaching content

Organization:
The course module is organized in 15h of lectures and 10h of tutorials to introduce knowledge and methodological tools.

Content:
In recent years the dynamics of biological systems has been increasingly described using concepts and terminology borrowed from economics: cells face trade-offs between different strategies for survival; metabolism can be viewed as a resource allocation problem; biomolecules can be associated with a “value” within the free energy “market” of the cell, etc. These concepts indicate the emergence of a new way of thinking about problems in biology.
In this course, we will explore biological questions that can be addressed using concepts of resource allocation, efficiency and optimality on (1) genome-scale cellular metabolism, (2) gene expression and protein synthesis, (3) cellular fitness and (4) game theory in cellular and multicellular biology.

Expected outcomes:
At the end of the course, students will be able to:
•Explain the principles of cellular economics and resource allocation in living systems
•Analyze simple growth strategies of living systems in a competitive environment
•Describe simple models and identify their advantages and limitations.

Prerequisites:
Several first semester optional modules are highly recommended: Systems Biology I Systems Biology II.

Bibliography:
Recent and past scientific articles, to explain the fundamentals and scientific advances in game theory, cellular resource allocation, cellular fitness, growth strategies etc. For instance, relevant publications are: •Shifts in growth strategies reflect tradeoffs in cellular economics. Molenaar D, van Berlo R, de Ridder D, Teusink B. ; Mol Syst Biol. 2009 •Mechanistic links between cellular trade-offs, gene expression, and growth. Weiße AY, Oyarzún DA, Danos V, Swain PS. ; Proc Natl Acad Sci U S A. 2015 •Plant height and evolutionary games. DS Falster and M Westoby; TRENDS in Ecology and

Contact:
Jules Matthieu: matthieu.jules@agroparistech.fr

Location :
Jouy-en-Josas

Synthetic Biology

ECTS
2.5

Key words
orthogonal systems, genome engineering, metabolic engineering, synthetic biology, regulatory circuits

Teaching content
The aim of this module is to give students perspectives in Synthetic Biology, a field where novel biological and biologically based parts, devices and systems are (re)designed and constructed to perform new functions that do not exist in nature.

Expected outcomes
At the end of the course, students will be able to:
- Explain the strategies employed in the field of metabolic engineering for the production of sustainable biobased compounds
- Analyse simple synthetic regulatory circuits
- Explain the principles of genome engineering techniques and illustrate the synthetic genomics approaches
- Describe several orthogonal systems and analyse their advantages and limitations

Thus, students will have a strategic vision on how to progress in the field of synthetic biology: from the extraction of innovative knowledge from the available biological data to the transformation of the data into new rational and useful knowledge.

Teaching distribution
Lecture: 16h, Directed study: 9h

Bibliography and recommended readings
Paul S Freemont (Editor) and Richard I Kitney (Editor). Synthetic Biology: A Primer. Imperial College Press, 2012. Daniel G. Gibson (Editor), Clyde A. Hutchison (III) (Editor), Hamilton Othanel Smith (Editor) and J. Craig Venter (Editor). Synthetic Biology: Tools for Engineering Biological Systems. Cold Spring Harbor Laboratory Press, 2017. Christina Smolke (Editor), Sang Yup Lee (Series Editor), Jens Nielsen (Series Editor) and Gregory Stephanopoulos (Series Editor). Synthetic Biology: Parts, Devices and Applications. Wiley-Blackwell, 2018.

Contact
Popescu Ioana - ioana.popescu@univ-evry.fr

Location
Evry

GROUP 3 : MINOR

Electives Courses

Semester 2

Animal transgenesis

ECTS
2.5

Teaching content

Lectures (16h)
I. Introduction to animal transgenesis
II. Design of a transgene
III. Techniques for transgene introduction into a target animal
IV. Molecular tools for genome editing
V. Applications of transgenesis in research and agriculture
VI. How to conserve a transgenic line (example with mouse)

Tutorials (9h)
Analysis of scientific papers concerning the main course topics.

Prerequisites
To understand the “Animal Transgenesis” specificities linked to reproductive mode and review the techniques used for different species.
To give an overview of different methods of genome modification and control of gene expression offered by current molecular biology tools. Students are expected to have a strong background in molecular biology and physiology, including animal reproduction, cell and organ functions, molecular signaling, RNA, DNA and protein structure and functions… notions of microbiology, vegetal biology and organic chemistry will be required too.

Teaching distribution
Lecture: 16h, Directed study : 9h

Bibliography and recommended readings
Applications of animal transgenesis in research: - Li, Zhou. Construction of luciferase reporter gene vector for human MUC5AC gene promoter and analysis of its transcriptional activity. Zhong Nan Da Xue Xue Bao Yi Xue Ban. 2010 Aug;35(8):792-9. - Kautzman et al. Xkr8 Modulates Bipolar Cell Number in the Mouse Retina. Front Neurosci. 2018 Dec 3;12:876.

Contact
Janek Hyzewicz: janek.hyzewicz@univ-evry.fr

Location
Evry

Current Questions in Evolution

ECTS
5

Key words
biodiversity, tree of life, Evo-Devo, origin of life, Evolution

Teaching content

This course offers a broad vision of Evolution by exploring “the tree of life”. It is organised around a set of conferences given by specialists. It will be introduced by an historian of Science who will discuss the progression of scientific ideas in the field of Evolution. The course begins with the origin of life and then, large groups of organisms (eukaryotes, bacteria and archaea), as well as viruses will be presented. The conferences will also be an opportunity to address various fundamental evolutionary processes such as endosymbiosis, global changes, impact of new pandemics, etc... The boundaries of our current knowledge will be addressed.
This course is intended for all students in Biology, regardless their master’s speciality, as well as for students who are at the interface between Biology and other disciplines such as Physics, Chemistry, Mathematics, Physics and Computer Sciences. The goal is to provide all Master-1 students with a general culture in Evolution. This course will also be available to PhD students depending on available places.

Organization
The course is organized over an 8-week period at a rate of one day per week.

Teaching distribution
50h lecture (CM)

Prerequisites
This course is intended for all students in Biology, regardless their master’s speciality, as well as for students who are at the interface between Biology and other disciplines such as Physics, Chemistry, Mathematics, Physics and Computer Sciences. The goal is to provide all Master-1 students with a general culture in Evolution. This course will also be available to PhD students depending on available places.

Contacts:
Aurélie Hua-Van: aurelie.hua-van@universite-paris-saclay.fr
Emmanuelle Baudry: emmanuelle.baudry@universite-paris-saclay.fr

Location:
Orsay

Development in questions

ECTS
5

Key words
Developmental genetics – Scientific methodology – Active learning

Organization:
The course is based on active learning. Students will be invited to work autonomously on individual or group projects before classes, using provided training documents. The time spent in class is dedicated to interactive sessions with teachers (work presentation; debate; methodological training; tutoring activities). The course is organized into 3 periods or blocks that allow for progressive achievement of learning objectives: Block 1: Problematics and concepts in developmental biology. Block 2: Tools and methods in developmental genetics. Block 3: Exploitation of concepts and methods to explore developmental processes at different scales (tissue/organ or cellular level) and in different contexts (embryonic development, regeneration, modeling of human pathologies, evolutionary processes).

Content:
To integrate multi-scale approaches in the organism through developmental genetics problematics. The knowledge acquired in this course will be an asset for further studies in different M2 programs, whether or not the student chooses to pursue in the developmental biology field.

Expected outcomes
At the end of the course the student should be able to:
- Formulate central concepts and problematics in developmental biology.
- Interpret, question and criticize scientific data in the field of developmental biology.
- Identify the appropriate methodology (genetic tools & technics) required for studying developmental processes at different scales and in various model organisms.
- Autonomously read, understand and criticize developmental genetics articles.
- Identify, extract and present (by oral or writing) relevant information from articles on developmental genetics.
- Perceive the relevance of developmental biology knowledge beyond the discipline itself.

Teaching distribution
Lecture: 24h, Directed study : 26h

Bibliography and recommended readings
“Developmental Biology” from Gilbert can be consulted for bases in the discipline. A specific bibliography will be provided during the course.

Prerequisites
Specific articles will be provided during the course. Basic concepts of developmental genetics can be consulted in "Developmental Biology" from Scott F. Gilbert (Eleventh Edition) or in "Principles of Development" by Lewis Wolpert (Oxford University Press).

Contact:
Morgane Locker: morgane.locker@universite-paris-saclay.fr

Location
Orsay

Epigenetics

ECTS
2.5

Key words
Structural heredity, Epigenetics, Architecture and nuclear compartmentalization, Cellular/epigenetic memory, cancer & development, Polycomb/Trithorax complexes, 3D chromatin organization, Chromatin modifications

Organization

This course, will combine a series of :
-Lectures (chromatin epigenetics, nuclear 3D-organization, cytoplasmic inheritance, X-chromosome inactivation…)
-Tutorials (epigenomics, prions, X-chromosome inactivation, chromosome conformation capture,…)
-Conferences presented in the form of lectures by researchers
The course is organized over 8 weeks (half day/week), including lectures (9 hours), tutorials (5 x 2 hours) and conferences/lectures (3 x 2 hours). During tutorials students will be divided in 2 groups, one in English one in French. Students will choose their group at the beginning of the course.

Content
During this course, the following topics will be discussed:
- How epigenetic mechanisms impact on gene expression controls, how they structure the 3D compaction of the genome and how they can be altered in human pathologies, like cancers.
- How several layers of epigenetic mechanisms are integrated during development, using the example of X-chromosome inactivation
- How epigenetic memory is set-up during differentiation and erased (stem cells (re)programming)
- How epigenetic traits can be transmitted based on self-templating structural inheritance, using the example of prions.
- Additional examples of integrated epigenetic mechanisms, at the organism or population levels, will be presented by invited researchers. Two examples in the past years: The cast and sexual polyphenisms in honey bees and aphids; The impact of nutrition on metabolic diseases and cancers

Expected outcomes
At the end of this course, the students should be able to
(1) Name, describe and discuss the different epigenetics layers impacting on gene expression levels
(2) Analyze and interpret epigenetic and epigenomic figures
(3) Portray and detail few integrated examples of epigenetic inheritances.

Prerequisites
L3 levels in cell biology (cellular and nuclear structure), genetics (mendelian inheritance) and molecular biology (gene regulation) are requested. In addition, notions of genomics, high-throughput sequencing methods and epigenetic mechanisms developed in the Master 1 core course should be understood and comprehended.

Teaching distribution
Lecture : 15h, Directed study : 10h

Bibliography and recommended readings
Books available at Paris Saclay libraries: - Epigenetics by C. David Allis, Marie-Laure Caparros, Thomas Jenuwein and Danny Reinberg - Epigenetics, Nuclear Organization and Gene Function with Implications of Epigenetic Regulation and Genetic Architecture for Human Development and Health by Lucchesi and John C.
Web links : - EpiGensSys European Network Website: http://www.epigenesys.eu/fr/ - Edith Heard's lectures at the Collège de France (in French): https://www.college-de-france.fr/site/en-edith-heard/_course.htm.

Contact
Moindrot Benoit - benoit.moindrot@universite-paris-saclay.fr

Location :
Orsay

Functional genomics and precision medicine

ECTS
2.5

Organization
The course consists in lectures, analysis of genomic studies based on several publications during tutorials and illustrations by research seminars given by Genopole® campus and Gustave Roussy Cancer center experts that will highlight the contribution of these global approaches to the understanding of cellular processes and human complex diseases. Oral presentations of scientific research will be held by the students in a seminar format during the course.

Content
This course provides a thorough knowledge of genome-wide studies from experimental design to integrative data analysis: Explore genomic variations in both health and disease to understand gene function and regulation of expression, decipher pathogenesis mechanisms, identify therapeutic opportunities and treatments in the context of precision medicine.

Expected outcomes
-Enumerate and differentiate large-scale sequencing technology driven-approaches at different levels, i.e. genomics, transcriptomics, epigenetic landscapes.
-Determine which technology to use among a broad spectrum of functional genomics methods to address specific biological questions
-Precise the main classification methods œfor patient stratification and identification of co-regulated genes
-Interpret results of large-scale experimental datasets in a scientifically stringent manner
-Critically examine research publications dealing with functional genomics
-Understand how to identify altered signaling pathways, biological process and biomarkers from genes list by functional annotation tools,
-Specify the advantages of single-cell approaches regarding the dynamic of transcriptome, tissue complexity or polyclonal sample content.

Teaching distribution
Lecture: 16h, Directed study : 9h

Bibliography and recommended readings
Molecular Biology of the Cell: Alberts, Johnson, Lewis, Raff, Roberts, Walter Scientific articles and review on recent concepts and advances in Applied genomics.

Contacts
Debily Marie-Anne - marieanne.debily@univ-evry.fr

Location :
Evry

Immuno-pathophysiology

ECTS
2.5

Organization:
Students will be divided into teams (e.g. trinomials). They will have to choose a scientific article and a review proposed by the teachers and present orally, with the help of PowerPoint support, the content of the article by explaining the relevance of the question asked and the experimental strategy implemented. Spot checks may be conducted during the various working sessions.

Expected outcomes
At the end of this course, students will be able to:
a) describe the components of the immune system (molecules, cells, tissues and organs) as well as the underlying mechanisms associated with its dysfunction
b) to argue about the role played by the immune system in different types of vaccination strategies, as well as during tissue transplants
c) to clarify the role of immunosurveillance of the immune system limiting the emergence of cancers
d) to analyze, interpret and describe the results presented in scientific articles.

Teaching distribution
Lecture : 16h, Directed study : 9h

Bibliography and recommended readings
Books on immunology and immunobiology (e.g. ASSIM books, Janis Kuby, Ivan Roitt, David Male, Charles Janeway). Recent and old scientific articles, to explain the fundamentals and the scientific advances.

Prerequisites
Upstream of this course, students should have acquired the basic bases of Immunology, in particular by having followed the unit "Physiology of the Immune System" (UEVE) or another unit of fundamental immunology (M1 and/or Licence-Bachelor). In particular, students should be able to identify the main cells and molecules involved in immune responses. They should also be able to describe the main physiological mechanisms of innate and adaptive immunity.

Contact
FISSON Sylvain - sylvain.fisson@univ-evry.fr

Location
Evry

Integrative Microbiology

ECTS
2.5

Organization
Conferences: 10 hours Tutorial classes; Supervision/project tutoring 10 hours Personal work: at least 10 hours Oral examination and report.

Content
The purpose of this teaching unit is to propose to students to explore a scientific question in Microbiology in an integrated way, both in terms of scale of analysis (from the molecule to the ecosystem) and methodologies or applications.
The students will carry out a personal project framed around a given aspect that they have chosen and that will be part of a general theme common to the whole class. Thus, collectively, the multiple facets of a current issue around an infectious agent will be taken into consideration, from the physiology and pathogenesis of the agent, to the interactions it maintains with the microbial communities and/or the host, to the practical implications of this knowledge in health or biotechnology. For example, Clostridium difficile infection may be a topic that can generate personal projects based on microbial interactions within intestinal microbiota (dysbiosis, bacteriophages), epidemiology (hypervirulent strains, recurrent infections) and therapeutic strategies. In connection with the problem addressed, students will be trained to use metagenomic data to compare the composition of the microbiota under standard conditions or following disturbances induced by antibiotic treatments and pathogen development.

Prerequisites
Knowledge base in General Microbiology, Genetics, Molecular and Cell Biology, Biochemistry Open for Paris-Saclay International track.

Bibliography
Scientific papers and books in the field of Microbiology, documents on eCampus platform.

Contact:
Soutourina Olga - olga.soutourina@universite-paris-saclay.fr

Location
Orsay – Gif sur Yvette

Systems Biology II

ECTS
2.5

Teaching content
Global analyses (omics) currently generate large datasets that do not capture the complexity of living systems. Systems Biology is an approach where omics data are integrated and exploited (compared) through mathematical models of biological systems or sub-systems. The complexity of biological systems and the diversity of issues to be considered require the use of different types of modelling.
In this course, students will explore a number of mathematical approaches to tackle biological issues through the integration of "omics" data. The mathematical approaches include the methods known as constraint-based modeling, i.e. flux balance analysis, resource balance analysis, but also tools specific to the analysis of dynamic systems and Boolean systems.

Expected outcomes
On completion of the course students will be able to :
•understand and explain the challenges of using constraint-based modeling approaches to describe cellular behaviors
•summarize and present a scientific paper in the field.

Teaching distribution
CM : 16h, TD : 9h

Bibliography and recommended readings
Recent and past scientific articles, to explain the fundamentals and scientific advances in systems biology. Two general references on these approaches: Systems Biology [Textbook], E. Klipp et al, Wiley-Blackwell, 2011. Metabolic engineering in the post genomic era, ed. B.N. Kholodenko, H.V. Westerhoff, Taylor & Francis, 2004.

Prerequisites
The ability to use Matlab will be an asset but is not a prerequisite..

Contacts:
Jules Matthieu : matthieu.jules@agroparistech.fr
Anne Goelzer: anne.goelzer@inra.fr

Location
Jouy-en-Josas

Neurobiology of Integrated Systems (NIS)

ECTS
5

Objectives

Describe and formalise the fundamentals of sensory perception
Mobilise and resituate knowledge of how the nervous system translates, integrates and codes diverse sensory stimuli. Examples from vertebrate and non-vertebrate models will illustrate the following senses: audition, touch, olfaction and vision.

Elaborate on the role of different neural networks underlying complex behaviours
Analyse and interpret experimental results to illustrate the role of certain brain structures in locomotion, motor learning and emotional cognition, with emphasis on the cerebellum.

Resituate acquired knowledge of the fundamental cellular and molecular mechanisms in neurobiology and neurochemistry involved in memory and decision-making in normal and pathological conditions

Evaluate scientific publications pertaining to recent advances in themes addressed in the course
Mobilising knowledge acquired from lectures and assigned readings, students will analyse, interpret and argument selected scientific articles. Students will be capable to lead a discussion pertaining to the article(s), balancing constructive criticism and valorisation of experimental results their interpretation.

Pre-requisites

- Basic knowledge of cellular neurobiology (3rd year undergraduate level)
- Introductive level of functional neuroanatomy (3rd year undergraduate level)

Reading List

Students at the Master 1 level should have acquired basic knowledge on how the nervous system functions (see pre-requisites above). To refresh and / or consolidate the fundamentals, the following books may be useful.

English
Principles of Neuroscience by Kandel, Schwartz, Jessell, Siegelbaum and Hudspeth. McGraw-Hill Education - Europe
Neuroscience: Exploring the Brain by Bear, Paradiso, Conners. Lippincott Williams & Wilki.
Neuroscience(s) by Purves, Augustine, Fitzpatrick, Hall, Lamantia and White. Editions DeBoeck (French) or Sinauer Associates Inc (English)

French
Physiologie du Neurone. Tritsch, Chesnoy-Marchais, Feltz. Editions Doin
For basics in sensory systems:
Neurosciences : A la découverte du Cerveau. Bear, Connors, Paradiso. Editions Pradel

Practical organisation

The teaching unit is composed of lectures (35h) and directed studies sessions (10h) designed to complement the themes illustrated in the lectures. Directed studies sessions are devoted to the analysis of scientific articles, and can take different forms ranging from a small-group presentation to a collective analysis and round-table discussion. A major goal of directed studies sessions is to adopt and practice a critical thinking approach to scientific reading. The oral component of these sessions will contribute to the development and fine-tuning of scientific communication skills through collective and participative discussions.

Contact

McLean Heather - heather.mclean@universite-paris-saclay.fr.

Location:

Orsay

Sustainable development in Life Sciences and Health

ECTS
2.5

TEACHERS: Edouard Dossetto

SUMMARY:
Raising awareness about the ecological transition has become imperative in all sectors of activity, particularly those at the intersection of the environment and health. Beyond the challenges of decarbonization—a major goal across all sectors of the economy—these sectors are at the heart of numerous issues related to the transition (adaptation to climate change, biodiversity collapse, pollution, etc.) as both impacted and impacting industries. Understanding the levers for ecological transition in the pharmaceutical, biological, or health sectors, knowing how to implement an environmentally responsible strategy within one's company, or adopting an eco-design approach in research enriches this vital field for human societies, which itself vitally depends on our ecosystems.

KEYWORDS
Ecological transition; Decarbonation; Adaptation; Biodiversity; Ecodesign; Circular economy; Ecoresponsible care

COURSE OBJECTIVES
- Offer an integrated vision of the challenges of sustainable development and ecological transition in the healthcare and pharmaceutical sectors
- Refine critical thinking on transition solutions in these sectors
- Be able to develop a project or evaluate it in terms of environmental criteria (carbon footprint, biodiversity impact, pollution, sustainability reporting).
- Develop interdisciplinary cooperation and cross-disciplinary skills to meet the challenges of transition in their field of expertise.

COURSE PREREQUISITES
- General awareness of the challenges of transition (through the Bachelor's degree course, for example)
- Understand the main challenges and objectives of sustainable development (carbon neutrality by 2050, 1.5°C, protecting 30% of ecosystems, etc.).

GROUP 4 : RESEARCH TRAINING

Scientific project

ECTS
5

Key words
Bibliographic research / research project development

Organization
The Scientific Project is organized over a period of 8 weeks at a rate of one day per week spent in the host laboratory. This period is devoted to discussions between the student and his supervisor, the reflection and a bibliographic work to define the internship project. The student will present a bibliographic synthesis of the topic and the problematic of his internship project in a written report.

Content
The Scientific Project is a groundwork for the laboratory internship. It consists of a thoughtful work based on bibliographic researches and on discussions with the internship's supervisor.
It aims at clarifying the general scientific context and the state of knowledge. It allows highlighting the scientific questions that will be addressed during the internship, the experimental models chosen and the workflow of experiences that will be conducted. The whole is synthesized in a written report.

Expected outcomes
At the end of this training, the student will be able to:
- define a biological problem
- acquire, analyze and synthesize data from the literature
- formulate scientific hypotheses
- build a coherent scientific approach
- write a research project.

Contact
Sébastien Bloyer : sebastien.bloyer@universite-paris-saclay.fr
Marie-Hélène Cuif : marie-helene.cuif@universite-paris-saclay.fr

Internship

ECTS
10

Key words
research internship / laboratory experiments

Organization
During the first semester, the students have to find a host laboratory. To this end they must write a CV, consult the internship offers and contact research teams of their choice for an interview. The internship is tied up to the “Scientific project” teaching unit, during which the scientific context and the experimental approaches suitable to address the biological questions will be defined. The internship spans 8-weeks in an academic laboratory or in a R&D department within a company, in France or abroad. At the end of the internship, the students complete a research report and an oral presentation, to highlight the biological questions raised, the experimental designs and to present and discuss their results.

Content
The internship allows students to get familiar with various experimental approaches as well as the daily activities of a research team.
During the internship, the students participate in an ongoing research project under the guidance of laboratory staff scientists or engineers. They attend lab meetings and conferences. They are introduced to the hygiene and safety rules. They acquire and analyze experimental data. They have to synthetize their results in the form of a written report and an oral defense.

Expected outcomes
At the end of this teaching unit, the student will be able to:
- apply to research teams
- integrate a research team and participate in its activities
- follow Health and Safety rules
- to carry out a scientific experiment and integrate the controls required for its interpretation.
- write a laboratory notebook
- analyze critically the results obtained
- synthesize and present a scientific research process and the results obtained in oral and written form.

Contact
Sébastien Bloyer : sebastien.bloyer@universite-paris-saclay.fr
Marie-Hélène Cuif : marie-helene.cuif@universite-paris-saclay.fr

Group 5: Optional Training

Optional internship

Organization

The optional internship can take place at any time during the year (From September to August) in an academic laboratory or in a R&D department within a company, in France or abroad provided that the internship does not interfere with the academic schedule. The duration of the internship is to be established between the student and his tutor, and is subjected to an official Internship Agreement.

Content :

Optional internships allow students to gain experience in new fields and professional activities and refine their final goals and career plans.
An internship allows students to get familiar with various experimental approaches as well as the daily activities of a research team.
During the internship, the students participate in an ongoing research project under the guidance of laboratory staff scientists or engineers. They attend lab meetings and conferences. They are introduced to the hygiene and safety rules. They acquire and analyze experimental data. They have to synthetize their results in the form of a written report and an oral defense.
At the end of this teaching unit, the student will be able to:
- apply to research teams
- integrate a research team and participate in its activities
- follow Health and Safety rules
- to carry out a scientific experiment and integrate the controls required for its interpretation.
- write a laboratory notebook
- analyze critically the results obtained
- synthesize and present a scientific research process and the results obtained in oral and written form.

Contact

Odile Bronchain, Laurent Théodore

Intercultural communication

Teaching content

Content :
This course aims at raising intercultural awareness and learning to communicate across cultures through exploring the visible and hidden aspects of culture, cultural similarities and differences in the participating student groups from 3 European universities: U. Paris-Saclay (France), U. Szeged (Hungary), U. Ludwig Maximilian (Germany). The main objective of such intercultural exchanges is not necessarily to make a list of the components of a specific culture, but to encourage an enquiring questioning attitude in order to promote tolerance, acceptance and respect for cultural diversity, to provide students with skills that will enable them to cooperate across cultures. Such skills have become essential in today's globalized world. Participating students will receive a certificate of Intercultural awareness according to the Common European Framework of Reference for Languages. The course consists of 20 hrs of theoretical background courses and 6 hours of online interaction in smaller groups with students from the 3 participating universities.

Contact

Csilla Ducrocq : csilla.ducrocq@universite-paris-saclay.fr

EUGLOH events

Teaching content

Content :

Ludwig-Maximilian University Munich (Germany), Lund University (Sweden), University of Porto (Portugal), University of Szeged (Hungary) and Université Paris-Saclay have joined forces to create a pilot European University, driven by European values and committed to higher education and training on challenges related to global health and well-being.
Within EUGLOH, the five universities share the ambition to combine their expertise and resources to offer the best education and training to their students and thereby become a world-class higher education alliance, based on the excellence of their teaching and cutting-edge research and equipment.
EUGLOH's visions and objectives are:
• Training the future generations of European innovators, practitioners, experts and leaders serving all sectors of the society, ready to face interdisciplinary societal challenges related to Global Health
• Becoming a world-class higher education alliance focused on Global Health and well-being challenges
• Promoting European values, such as solidarity, equality of opportunities, inclusiveness, respect for human rights and full access to welfare
• Setting the foundation of a common European health area
• Building a European campus with a high level of integration sustained by joint procedures and structures
• Boosting attractiveness and competitiveness of European higher education, research and innovation

Contact

Odile Bronchain

Brochure

Alliance for Global Health

Français Langue Etrangère

Teaching content

This optional teaching unit is subjected to registration fees (50 euros per semester).

Contact
contact-fle.langues@universite-paris-saclay.fr.

Only for those who want to take French lessons….

Rules governing Master's studies at Université Paris-Saclay

Rules for the M1 - International track

Lectures are grouped into 4 blocs:
Bloc n° 1: Core courses
Bloc n° 2: Compulsory courses
Bloc n° 3: Electives
Bloc n° 4: Research training

Only block 3 is compensable (by block 1 or block 2 but not by block 4). Blocks 1, 2, 4 are not compensable, they must be acquired. The teaching units within a block compensate each other with a threshold of 7/20, except for the "internship" which must be acquired (final grade above 10/20).

Missing a course or an exam:

If you cannot attend your courses or exams (for instance because you are sick), ask for a certificate / justification. In this case, you will be placed in "justified absence" for the evaluation(s) that you may have during this period. Otherwise, you will be penalized (for instance 0/20 if you had an evaluation that day).

MUST BE DONE

Your proof of absence must reach your secretariat as soon as you return to the university and at the latest within 2 working days of the end of your period of absence. *It is also nice to warn your teachers and supervisors….*