Catalog of selected courses

BIO Biochemistry/Cell biology

Lectures: 24 h - Tutorials: 8 h - Preceptorship: 8 h - Laboratory sessions: 38 h
ObjectifsBasic concepts of biochemistry, molecular and cellular biology and current challenges in these disciplines. Introduction to the major classes of biomolecules (sugars, lipids, nucleic acids and proteins), biological catalysis, signal transduction, energy transformation, information storage and replication by genes, and how genes code for RNAs (transcription) which in turn code for proteins (translation). Introduction to the concept of mechanotransduction and its implication for tissue engineering.

Syllabus
Basic concepts of biochemistry, molecular and cellular biology and current challenges in these disciplines. Introduction to the major classes of biomolecules (sugars, lipids, nucleic acids and proteins), biological catalysis, signal transduction, energy transformation, information storage and replication by genes, and how genes code for RNAs (transcription) which in turn code for proteins (translation). Introduction to the concept of mechanotransduction and its implication for tissue engineering.
TutorialsBioinformatics: data banks, DNA and protein sequence analysis.
PreceptorshipArticle analysis: central dogma of molecular biology / membranes / cell and its environment / biotechnology.
Laboratory sessionsCloning and expression of green fluorescent protein (GFP).

Requirements
None.

Evaluation mechanism
Course: written exam (course questions + article analysis). TP report of experiments.

Teaching coordinator : Pascale Dupuis-Williams, Andrew Griffiths, Yann Verdier
Term : core curriculum
Number of hours : 78
ECTS Credits : 6
Last Modification : Wednesday 31 May 2017

BTM Molecular biotechnology

Lectures: 12 h - Tutorials: 5 h
ObjectivesUnderstanding of state-of-the art methods in biotechnology and their application for fundamental and applied research.

SyllabusThe lectures will cover state-of-the-art recombinant DNA techniques, including:
amplification
cloning
synthesis
sequencing (including next-generation sequencing)

mutagenesis (directed and random)
recombination
targeted genome editing (e.g. using CRISPR/Cas9)
overexpression of recombinant proteins
screening and selection
directed evolution
These techniques will be exemplified by presenting a number of important applications of molecular biotechnology:
protein engineering for fundamental studies and industrial applications of enzymes
protein engineering for therapeutic applications (e.g. therapeutic antibodies)
engineering of diagnostic systems
engineering of vaccines
TutorialsAssistance with group projects to prepare a short educational course (Powerpoint) to be presented to the rest of the class (15 min presentation + 5 min for questions).

Requirements
Basic knowledge of biochemistry/molecular biology.

Evaluation mechanism
Two hour written exam (70% of marks) + group project (30% of marks).

Teaching coordinator : Andrew Griffiths
Term : biotechnologies option
Number of hours : 17
ECTS Credits : 2
Last Modification : Monday 12 June 2017

EVO The evolution of biological complexity

Lectures: 6 h
ObjectivesThe course aims to introduce student to a fundamental set of ideas and theoretical concepts central to the evolution of life and the emergence of complexity. The goal is to spark interest and open eyes to the possibility of studying some of life's greatest mysteries.

SyllabusIn a short series of lectures, students will be introduced to ideas surrounding the emergence of life from non-life and its is sunsequent evolution. The course will begin by defining what life is (and its time-line), what evolution is (and how it works), and particularly the requirements for evolution by natural selection. We will consider energetics and how biochemistry might arise naturally from geochemistry. Particular importance will be given to how chemical gradients are coupled to the synthesis of biomolecules and how this might have all begun. Following evolution of cells, we will proceed to consider likely steps leading to emergence of the eukaryotic cell along with the energetic advantages that accrue to this cellular type. Finally, we will consider major evolutionary transitions with particular attention given to how multicellular life might have evolved from unicellular forms.

Requirements
Biology, biochemistry.

Evaluation mechanism
One essay of no more than 1,000 words (in French or English).

Term : core curriculum
Number of hours : 6
ECTS Credits : 1
Last Modification : Tuesday 29 August 2017

PHY Physiology

Lectures: 14 h - Preceptorship: 6 h - Laboratory sessions: 30 h
ObjectivesThe main objective of the course and the associated lab sessions is to present basic notions of physiology (such as homeostasis, neuro-endocrine signaling, retroaction), building up on the molecular and cell biology covered during the first year. The temporal dimension of the organism, conferred by biological clocks that rhythm our days and nights, will be briefly described. It will be developed further in the module "Le temps" of the 2nd PSL exchange week.

SyllabusGeneral organization of the lectures:
Physiology : from molecule to organism in its environment
Introduction to intercellular signaling
An example of neuro-endocrine pathway : from the retina to the synthesis of melatonin (the "night hormone")
Introduction to the cardio-vascular system
Sleep, a physiological state in search of a function

Preceptorship Study of scientific articles on the following themes:
Study of cerebral function through the use of novel technologies (ontogenetic, voltage-sensitive dye imaging, ultrafast ultrasound imaging).
Underlying mechanisms of sleep
Neuroscience article in relationship with NMR
Laboratory sessionsStudy of the human heart through ECG. This double lab session (7.5h) involves both simulation and experimental work.
Study of the regulation of glycemia (involves both simulation and experimental work)
Study of arterial blood pressure (experimental work)
Two methods to study hearing deficiencies : acoustic oto-emissions and auditory evoked potentials (experimental work)
Neurosciences : membrane properties, channels and neuronal activation (simulation)
Brain machine interfaces (experimental work)

Teaching coordinator : AndrÃ© Klarsfeld, Sophie Pezet, Thierry Gallopin
Term : core curriculum

Number of hours : 50
ECTS Credits : 4
Last Modification : Thursday 02 March 2017