International Biology Course

Presentation and Objectives

The International Biology course is a selective course that offers a bilingual general training in biology, supplemented by courses in physics, mathematics, chemistry and statistics. It is taught and assessed in English for 75% of its content. The scientific programme is modelled on that of the Life Sciences portal for the first year and on that of the Biology course for the second year. For the third year, students are strongly encouraged to spend one or two semesters on international exchange programmes that allow them to validate the UGA Life Science degree with part of the courses taken abroad. Alternatively, students can join the Biology or Ecosphere programmes of the Life Sciences degree in the 3rd year, which are taught in French.

In the continuity of the high school science program, the first year of the International Biology course offers general training in biology at all scales (from the molecule to the ecosystem), complemented by courses in physics, mathematics, computer science, chemistry, statistics, earth sciences, and English. The objective of this first year is to consolidate the basic scientific knowledge acquired in high school. During the second year, the students acquire fundamental, theoretical and practical knowledge in all disciplines of biology and have the opportunity to deepen their knowledge in one or more disciplinary areas owing to optional teaching units. The International Biology course also provides a solid training in scientific English thanks to subject-specific courses taught in English and advanced courses in English offered each semester, in order to prepare for IELTS certification.

Admission

Candidates for the International Biology course are selected for entry into the first year on the basis of their high school grades: in particular, a good level of biology and chemistry is expected, as well as basic mathematics and physics, not to mention good written and oral expression skills in french as well as in English.

Each year, 32 places are available. Decisions on admission to the course are communicated via the Parcoursup portal.

Targeted skills

The targeted skills are disciplinary knowledge in Life Sciences, including all disciplines of biology (biochemistry, molecular biology, genetics, microbiology, animal physiology, plant physiology, ecology) completed by knowledge in biostatistics and chemistry. The training provided in English also aims at an excellent mastery of communication in English. At the end of the course, students will be able to

- Build an experimental protocol with rigour and autonomy
- Apply an experimental protocol in compliance with health and safety rules
- Communicate scientific data in French and English
- Carry out a bibliographic synthesis and a scientific watch
- Work independently and in collaboration

1st year programme

Semester 1	Semester 2
BIO131 – Biochemistry 1: The biomolecular constituents of the cell	BIO231 – Cell Biology
CHI131 - Structure of the matter	BIO232 - Biology of organisms
STE133 - Issues and risks in Geosciences INF135 - Computer science for life sciences	CHI233 – General Chemistry
MAT133 - Basic mathematical tools for the natural sciences	MAT236 - Introduction to mathematical biology and population dynamics
PHY135 - Electrical and transport phenomena	PHY236 – Instrumental optics
MEP101 - Méthodes expérimentales pluridisciplinaires en Chimie et Biochimie	MEP231 – Method. Exp. in cell biology /biochemistry or MEP232 – Method. Exp. in organism biology
UET1 - Formation bureautique et Internet + Enseignement transversal au choix	UET2 - Processus d'exploration professionnelle 1 + PAN 1

2nd year programme

Semester 3	Semester 4
BIO331 - Cell Biology 2	BIO439 - Biochemistry 2: Enzymology and Metabolism
BIO332 - Genetics	BIO432 - Physiology
CHI335 - Chemical thermodynamics and kinetics	BIO403 - Écologie
STA331 - Statistical methods for biology	CHI430 - Aqueous solutions in biology
BIO303 - Communications nerveuse/hormonale ou BIO304 - Valorisation des ressources végétales ou BIO305 - Interactions bactéries/hôtes	BIO434 - Experimental project in biology ou BIO407 - Questions d'actualité en biologie
IELTS/ PEP2	PAN431

BIO131 – Biochemistry 1: The biomolecular constituents of the cell

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Course, Semester: L1-International Biology, Semester 1

Number of credits: 6

Course directors:

- Jérôme Dupuy, jerome.dupuy@univ-grenoble-alpes.fr
- Mickaël Cherrier, mickael.cherrier@univ-grenoble-alpes.fr

Teaching staff: Véronique Rossi, Corinne Mercier, Jean-Marie Bourhis

Teaching content: 21h lectures (14 sessions of 1h30) ; 27h tutorial (9 sessions of 3h) ; 8h practical sessions (2 sessions of 4h) ; 3h of tutorials for practical work preparation (2 sessions of 1h30).

Language of instruction: English

Entry requirement: Scientific knowledge at Baccalaureate level.

Core or optional course: Core

Objectves:

- To know the nature, the structure and the physicochemical properties of biomolecules
- Identify a biomolecule from its chemical formula
- To know the techniques of analysis of biomolecules
- To master the basic techniques of analysis of proteins and nucleic acids

Course decription:

The different topics covered in the lectures concern nucleic acids (DNA, RNA), proteins, carbohydrates and lipids. In each case their structures, properties and in vivo assemblies will be presented to the students, all in relation to their different biological roles.

During the tutorial sessions, students will work on different exercises allowing them to detail and deepen the notions discussed in class. In addition, a significant part of the tutorials will be devoted to important reminders on concentration calculations and spectrophotometry.

During the practical sessions, students are introduced to laboratory materials and techniques by carrying out two electrophoresis, one of nucleic acids and the other of proteins.

Description of BIO131

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Lectures:

I. « MOLECULES THAT SUPPORT HEREDITY » Biochemistry of nucleic acids
(4 classes of 1.5 hours each, i.e. 6 hours)

A. Introduction/Overview
B. Basic components/nucleic acid structure:
   a. Nucleotides
   b. DNA: pairing, polarity, 3D structure, chromosome organisation
   c. RNA : structure, types, fonctions
   d. Properties of nucleic acids: denaturation, spectrophotometric assay
C. From structure to function... The ABC's: General principles of replication/transcription/translation
D. Introduction to DNA manipulation (recombinant DNA): cloning, plasmids, restriction enzymes

II. Proteins: the tools of the cell (4 classes of 1.5h, 6h)

A. Introduction
   a. Structure / Fonction relationship-Nucleotides
   b. Atomes of biochemistry
   c. Polarisation
   d. Chemical functions of proteins
B. From amino acids to proteins
   a. Amino acids : basic acids, structure, classification, biological roles
   b. Peptides : peptide bond, polypeptides, titratable functions, biological functions
   c. Protein structure : Iary, IIary, IIIary, IVary
   d. Protein denaturation
   e. Examples of proteins
C. Methods for studying proteins
   a. Purification techniques according to size, charge, affinity, solubility
   b. Analysis techniques: spectrometry, sequencing, electrophoresis
D. Example of protein purification and characterisation

III. Carbohydrates

A. Introduction
   a. Generalities
   b. Carbohydrates role: energy metabolism, structural element
   c. Nomenclature of carbohydrates
B. Simple carbohydrates:
   a. Reminder of the spatial conformation of carbon molecules
   b. Structure of monosaccharides: biochemistry, Fischer representation, stereoisomerism
   c. Cyclic structure of oses: representations of the cyclic form
   d. Genesis of individual oses
   e. Chemical properties of oses: phosphorylation, oxidation reduction

f. Oses separation methods: thin layer chromatography

C. Diholosides (disacchrarides)
   a. The O-osidic bond
   b. The main natural disaccharides: reducing, non-reducing disaccharides
   C. Identification of the C's involved in the osidic bond by permethylation

D. Polysaccharides or polyholosides
   a. Reserve polyosides: starch, glycogens
   b. Structural polyosides: cellulose, chitins

E. Glycoconjugates or heterosides

IV- Lipids

A. Introduction
   a. Analytical definition
   b. Biochemical definition
   c. Rôle of lipids

B. Fatty acids
   a. Definition
   b. The main fatty acids: saturated, unsaturated, particularity
   c. Physical and chemical properties of fatty acids

C. Simple lipids
   a. Glycerides: glycerol, glycerides, chemical properties/function of triglycerides
   b. Steroids: cholesterol, steroid hormones, bile acids and salts, vitamin D
   c. Cerides

D. Complex lipids
   a. Phospholipids: phosphatidic acid, phosphatidic acid ester
   b. Sphingolipids

E. Specific lipids
   a. Glycolipids
   b. Terpenes

F. Cellular membranes
   a. Membrane lipids
   b. Membrane proteins

Tutorials:

During the tutorials, students will work on different exercises that will allow them to detail and deepen the concepts covered in the course. In addition, a significant part of the tutorials will be devoted to important reminders on concentration calculations and spectrometry.

Practical work:

During the practical sessions, students are introduced to laboratory materials and techniques by carrying out two electrophoreses, one of nucleic acids and the other of proteins.

CHI131 – Atomic Structure and Bonding

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Course, Semester: L1-International Biology, Semester 1

Number of credits: 6

Course directors:

- Atomic Structure and Bonding: Mark E. Casida, mark.casida@univ-grenoble-alpes.fr
- Crystal Structure: Isabelle Gautier-Luneau, isabelle.gautier-luneau@univ-grenoble-alpes.fr

Teaching staff: 'Atomic Structure and Bonding'', Mark E. Casida (lectures and tutorials) and Yohann Moreau (tutorials) ; ''Crystal Structure'', Mark E. Casida (tutorials and labs) and Yohann Moreau (tutorials and labs)

Teaching content: 18h lectures; 33h tutorials; 6h lab (Crystal Structure).

Language of instruction: English

Entry requirement: High School level physical chemistry, isotopes, molar mass, Avogadro's number, periodic table, Lewis dot structures, vectors, geometry. The notion of imaginary and complex numbers is helpful but not essential.

Core or optional course: Core

Objectives:

- Understand the quantum mechanical description of electrons in orbitals and how this is used in chemistry to build up the periodic table and describe chemical bonding in molecules.
- Represent molecules using Lewis dot structures and three dimensional hashed-wedge representations. Understand and be able to use resonance structures. Know how to predict molecular structure for inorganic molecules consisting of atoms around a central atom and for organic molecules of all sorts.
- Understand and be able to make use of cubic lattice structures for metallic and ionic crystals, including such notions as the atomic packing factor, density, atomic radii (metallic, covalent, ionic, van der Waals), coordination number, coordination polyhedron, and associated calculations.

Course description:

Modern chemistry is a physical science and, as such, is ultimately based upon basic mathematical and physical principles. This first semester concentrates on the basic physical chemistry of electrons in atoms, molecular bonding and structure, and crystal structure. First, the basic notions of quantum mechanics and structure of the atom is introduced with emphasis on the energies and shapes of the atomic orbitals. This is used to build up the periodic table and to understand trends in the physical and chemical properties of elements. Then, it concentrates on the structure and bonding of diatomic and polyatomic molecules beginning with Lewis dot structures and the valence-shell electron pair repulsion (VSEPR) model for predicting geometries. The quantum mechanical description of bonding is explored via molecular orbital theory. Then this is followed by valence-bond (i.e., hybridization theory) for describing bonding in polyatomic molecules. Finally intermolecular forces are discussed with the aim of understanding trends in boiling points, melting points, and solubilities.

In parallel, the crystal structure part of the course treats the key mathematics needed to understand metallic and ionic crystals. For reasons of simplicity, only cubic lattices and the hexagonal closest packed (HCP) lattices are considered.

Description of CHI131

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Lectures:

Atomic Structure and Chemical Bonding (15h):

I. Classical Physics

A. Kinetic and potential energy of particles
B. Wave theory

II. Birth of Quantum Mechanics

A. Breakdown of the classical theory
  a. black body radiation
  b. photoelectric effect
  c. emission spectroscopy
B. Old quantum theory
  a. de Broglie wavelength and the discovery of the wave nature of electrons
  b. Bohr's semi-classical theory of electrons in atoms

III. Spetroscopy

A. Ionization
B. Absorption
C. Emission

IV. Schrödinger Equation

A. Heuristic demonstration
B. Quantum numbers and the form of the various atomic orbitals of one-electron atoms

V. Polyatomic Atoms and the Periodic Table

A. Mendeleev and chemical trends
B. Electronic configurations
  a. Aufbau principle
  b. Pauli exclusion principle
  c. Madelung's rule
  d. Hund's rule and concept of pairing energy
  e. core, semi-core, valence electrons
C. Trends
  a. screening and effective charge
  b. notions of ionization potential, electron affinity, electronegativity
  c. notion of the size of an atom
  d. global trends in the above properties
  e. additional features resulting from half-filled and filled subshells

VI. Lewis Dot Structures

A. Octet rule
B. Resonance structures and resonance hybrids
C. Hypervalence

VII. Valence Shell Electron Repulsion

A. Principle
B. Structure names
C. Dipole moments

VIII. Molecular Orbital Theory

A. Approximations
 a. Born-Oppenheimer
 b. Orbital
 c. Neglect of electron repulsions
B. Overlaps and covalent bonding
C. Construction of MO diagrams
 a. H2(n+) and bond order indices (BOI)
 b. HF and nonbonding orbitals
 c. Homonuclear diatomics, especially N2 and O2, paramagnetism

IX. Valence-Bond Theory

A. sp^3
B. sp^2 and cis/trans isomerizatrion
C. sp and the structure of allene

X. Intermolecular Forces

A. Classification
 a. van der Waals (Keesom, Debye, London)
 b. Hydrogen bondingÀ
 c. Ion-molecule
B. Trends in melting and boiling points
C. Solubility

Crystal Structure (3h):

I. Introduction

A. What is a crystal ?
B. Crystal families
C. Bravais lattices
D. Notion of generating vectors
E. Crystal = Lattice + Basis

II. Crystal Properties

A. Atom count
B. Atomic packing factor
C. Coordination number and coordination polyhedron
D. Density

III. Metallic Crystals

Study of simple cubic (SC), body-centered cubic (BCC), and face-centered cubic (FCC). Understand the relation between FCC and hexagonal closest packing (HCP). For each crystal type be able to

A. Describe the unit cell
B. find the coordination number and coordination polyhedron
C. find the direction in which atoms touch and use this to deduce the relation between the atomic radius and the lattice parameter
D. Calculate the lattice parameter
E. Find and count the number of different types of interstitial lattice sites

IV. Ionic Crystals

These are like just filling the interstitial sites of a metallic lattice with another type of atom!

A. CsCl-type crystals
B. NaCl-type crystals
C. ZnS-type crystals
D. CaF_2-type crystals

Tutorials:

Students are expected to prepare ahead of time for the discussion sections. During these discussion sections, the students will work on different exercises allowing them to consolidate and deepen the ideas seen in lecture. In the crystal part of the course, they will also be working with physical models of crystals.

Practical works:

The labs are computer labs where the students will be able to use physical and computer models to further explore notions which might otherwise be more difficult to assimilate. There will be a write-up to turn in at the end of each lab and there will be a test.

Bibliography

There is a fairly complete set of course notes that serve as a book for the course. This may be complemented by videos and reading from the internet

STE 133 – Issues and risks in Geosciences

Back

Course, semester: L1-International Biology, Semester1

Number of credits: 3

Course directors:

- Jerome Nomade, jerome.nomade@univ-grenoble-alpes.fr
- Julia de Sigoyer, julia.de-sigoyer@univ-grenoble-alpes.fr

Teaching staff: Pierre Beck, Delphine Six, Matthias Bernet, Emmanuel Lemeur, Jean-Pierre Vandervaere, Eric Quirico, Emeline Mauffroy, Jérôme Nomade

Teaching content: 15h lectures (10 sessions) ; 12h tutorials (4 sessions)

Language of instruction: English

Entry requirements:

Middle and High School Earth Science basics (depending on options)

Core or optional course: Core

Objectives:

- Know the issues and risks related to Earth Sciences in the 21st century
- To master these themes scientifically at an "academic" level in order to appreciate the related societal issues.
- Know how to argue on the themes and issues related to geosciences.

Course description:

This is an introductory course in Earth Sciences. The notions taught concern the Earth in the solar system, water on the surface of the planet Earth, the climate system and earthquakes. The notions taught in class will be reinforced during the TD sessions including analysis of experimental results, analysis of documents and the use of numerical simulation tools.

Description of STE133

Back

Lectures:

I. The Earth in the solar system. 3 lectures (or 2).

A. Introduction: the place of the solar system in the universe.
B. The solar system and its characteristics (Sun/planets/satellites)
C. Small bodies in the solar system (presentation)
D. Meteorites: the key to understanding our planetary environment?
E. Ongoing missions (depending on current events)

II. Earth and water. 2 lectures

A. Introduction: water needs and resources, water conflicts
B. Water balance at the Earth's surface: internal/external water, reservoirs, water cycle
C. Water transfer mechanisms: watershed, precipitation, runoff, infiltration, groundwater, rivers
D. Some current issues: global resources and management, drinking water, rivers and floods

III. Earth's climate system and cryosphere. 2 lectures (or 3)

A. What determines the Earth's climate
B. The different climates on Earth
C. What climate today, yesterday and tomorrow
D. Cryosphere and glaciers

IV. Earth and earthquakes. 2 lectures (or 3)

A. Introduction: internal structure of the Earth and plate tectonics
B. Seismic waves in the Earth
C. Seismograms and seismology
D. Rock deformation
E. Faults and earthquakes
F. The different types of earthquake
G. Intensity, magnitude, energy
H. Seismic risk and hazard

Tutorials:

The tutorial sessions consist of application exercises of the notions seen in class, on the analysis of experimental results and on the study of documents. Each session is dedicated to a major theme:

- Solar system
- Hydrology: experiments with an analogical model of watershed and infiltration
- Glaciers and Climate
- Earthquakes and seismic risks: use of digital tools

Students are required to do some preparatory work on the lectures and on the software and methods used, and reports may be requested.

INF135 – Computer science applied to life sciences

Back

Course-Semester: **L1-International Biology,** semester 1

Number of credits: 3

Course directors:

- Lydie du Bousquet : lydie.du-bousquet@univ-grenoble-alpes.fr
- Anne Letreguilly : anne.letreguilly@univ-grenoble-alpes.fr

Teaching staff:

Teaching content: 15 h lectures/tutorials (10 sessions); 15 h lab (10 sessions)

Language of instruction: English

Entry requirement: Basic computer skills: sending an e-mail, surfing the Internet, writing a text and saving it in a file, managing and filing files; no programming prerequisites

Core or optional course: Core

Objectives:

- Develop the skills to analyse a problem and propose a solution in the form of an algorithm
- Understand the possibilities offered by programming
- Knowing how to express a solution in the words of a computer scientist (to have it coded by a computer scientist)
- To know how the basics of computers, networks and information coding work in order to be able to use different software intelligently and to manage the storage and transfer of files.

Course description:

This is an introduction to the digital tools used in Life Sciences. Students will be introduced to computer vocabulary and the formulation of algorithms to solve problems in biology. This learning will be implemented during practical work sessions on computers.

Description of INF135

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Lectures/tutorials:

The lessons are given in the form of lectures/tutorials mixing course concepts and application exercises with general culture lessons to be prepared and in interaction with the teacher.

I. Introduction to digital environments, notion of programs and algorithms (week 1)

II. Variables and iterations, application to calculations of numerical sequences (weeks 2 and 3)

III. Nested Iterations (week 4)

IV. Parameterisation of algorithms (weeks 5 and 6)

V. Iteration with a "while" (week 7)

VI. Functions (weeks 8 and 9)

VII. Revisions

Practical work:

The practical sessions are carried out in pairs in the computer room. They deal with:

A- Introduction to digital environments: Software in an Office Suite, Macros and formulas in a spreadsheet)
B- Variables and "for" iterations (weeks 2 and 3)
C- Nested iterations (week 4)
D- Parameterisation of algorithms (weeks 5 and 6)
E- Iteration with a while (week 7)
F- Fonctions (weeks 8 and 9)

MAT133 : Basic mathematical tools for life sciences

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Course, semester: L1-International Biology, semester 1

Number of credits : 3

Course director:

- Hervé Pajot, herve.pajot@univ-grenoble-alpes.fr

Teaching staff:

Teaching content: 30 h of lectures/tutorials (20 sessions of 1h30)

Teaching language: English

Entry requirement: Basic mathematics from secondary school and high school.

Core or optional course: Core

Objectives:

- Knowing the basics of mathematics
- Master the mathematical tools used in life sciences

Course description:

This is a reminder of the concepts taught in secondary school to ensure that students have the mathematical tools they need to continue their training in life sciences. The teaching will focus on practical and computational aspNumber of credits rather than theoretical ones. It will cover the notions of logic, fractions, powers, percentages, usual functions, vectors and matrices as well as systems of linear equations. These notions will be very useful for the mathematics course offered in the second semester, which introduces mathematical biology and the study of population dynamics, but also for all the other courses (biology, chemistry, physics, statistics, computer science, etc.) of the Licence.

Description of MAT133

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Lectures/tutorials:

The teaching is done in a lecture/tutorial format with 32 students.

I. Logic, examples of reasoning

II. Fractions, powers, percentages

III. Generalities on functions, usual functions

IV. Derivation, function studies, extrema

V. Usual primitives, integration

VI. Suites

VII. Vectors and matrices

A. Method 1: By solving a system
B. Method 2: By solving systems
C. Method 3: By the comatrix
D. Method 4: By Gaussian pivot

VIII. Functions of several variables, partial derivatives

IX. Part-time and exam topics

PHY135 – Electrical and transport phenomena

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Course, semester: L1-International Biology, Semester 1

Number of credits: 3

Course directors:

- Vincent Renard, Vincent.renard@cea.fr
- Julia Meyer, julia.meyer@univ-grenoble-alpes.fr

Teaching staff: Alexanian Yann ; Aubergier Nathan ; Alfonso-Moro Maria ; Barnier Samuel ; Bresque Léa ; David Anthony ; Delphin Aurélien ; Fontaine Come ; Geoffroy Olivier ; Quillet Quentin ; Kassem Hussein ; Lacoste Anna ; Lamolinairie Julien ; Nurizzo Martin ; Pachot Clouard Mathilde ; Payerne Constantin ; Pourret Alexandre ; Renard Vincent

Teaching content: 12h lectures (8 sessions); 12h tutorials (8 sessions) ; 8h lab (2 sessions).

Language of instruction: English

Entry requirements: Mathematics: vector manipulation, Physics: equations of motion

Core or optional course: Core

Objectives:

- Use vectors to model a problem involving forces. Extend this skill to other vector quantities (the field in particular)
- To master the concepts of electrostatics (force, field, potential) and the first manipulations of the relationship between the field and the potential (experimental study in laboratory sessions).
- To know the basic concepts of transport and diffusion.
- Know how to write a practical work report (scientific report with introduction, protocol, raw data, analysis, discussion and conclusion).

Course description:

In the first part of the semester, the concepts of electricity (electric force, electric field, electric energy and electric potential) are introduced with emphasis on the historical and practical reasons for these concepts. They are applied to problems related to chemistry and biology in order to illustrate how and when to use these concepts. For example, electrical energy will be used to determine the conformations of molecules, whereas forces will be more appropriate for the study of motion.
The second part of the semester is dedicated to the study of the movements of charges under the effect of an electric field. The objective here is to understand electrophoresis in detail. The diffusion phenomena at work in this experiment are also described.

Description of PHY135

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Lectures:

I. The electric charge (1.5 h)

A. History and definition
B. Charge carriers / elementary charge
C. Charge retention
D. Method of generating charges

II. The electric force (1.5 h)

A. Coulomb's Law discovered and stated
B. Vector definition
C. Principle of superposition

III. The electric field (1.5 h)

A. Definition: General case, Electric field in the vicinity of a point charge, Uniform electric field
B. Principle of superposition
C. Representation of the electric field: Vector field, Field lines

IV. The electrical potential energy (1.5 h)

A. Work of a force: Constant force for a linear displacement, Properties, General case
B. Electrical potential energy: system of two point charges, system of n charges, electrical interaction energy between two charge systems
C. Electrical connection

V. The electrical potential (1.5 h)

A. Definitions: General case, Potential in the vicinity of a point charge, Principle of superposition, Potential in the vicinity of a spherical charge distribution, Potential difference - electric voltage
B. Representation: Equipotentials
C. Potential field relationship: Gradient, Interpretation, Graphical estimation of the gradient

VI. Dipoles and intermolecular interactions (1.5 h)

A. A. Dipole: Definition, Dipole Moment, Dipole Potential, Dipole in an Electric Field
B. B. Dipoles in molecules: Permanent dipoles, Induced dipoles
C. C. Intermolecular forces: Ionic bonding, Ion-permanent dipole bonding, Permanent dipole-permanent dipole bonding, Van der Waals forces

VII. Electrical transport under a permanent electric field (1.5 h)

A. Creation of a uniform electric field
B. Movement of an electric charge in a vacuum

Movement of an electric charge in a fluid: Frictional force, limiting speed

VIII. Brownian motion (1.5 h)

A. Thermal agitation
B. Brownian motion / Diffusion
C. Relationship between transport and diffusion: Drude model, Relationship between transport and diffusion coefficients, Stockes' law

Tutorials:

The tutorial sessions are application exercises where we reason on examples taken from chemistry or life sciences. There is no collective correction on the board, the teacher guides the students. At each session, exercises are proposed to practice. The corrections are available at the end of the week.

Tutorial 1 and 2: Electrical forces in NaCl and between 2 dipoles
Tutorial 3: Electric field in the vicinity of a dipole, two ions
Tutorial 4: Electrical bonding between groups of charges, the H-bond in DNA
Tutorial 5: Electrical potential
Tutorial 6: Dipoles and α-helix
Tutorial 7: Diffusion in water and air, Gas exchange in the lungs, Diffusion and migration of K+ ion in water, Diffusion in a cell
Tutorial 8: An electrical charge between two electrodes, Electrophoresis of DNA fragments

Practical work:

The practical work is the subject of preparatory work and the writing of a report in the form of a noted scientific report. The techniques studied concern the measurement of equipotentials and diffusion lengths.
Lab1: Field/potential relationship.
Lab2: Diffusion.

MEP101 – Méthodes Expérimentales en Chimie et Biochimie

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Parcours, Semestre : L1-Science du Vivant, L1-Biologie International, S1

Nombre d'ECTS : 3

Responsable(s) pédagogique(s) de l'UE :

- Isabelle Girault, isabelle.girault@univ-grenoble-alpes.fr
- Aurélien Deniaud, aurelien.deniaud@cea.fr

Équipe pédagogique : Isabelle Girault, Aurélien Deniaud, Cédric d'Ham, Chantal Gondran, Claire Wajeman, Muriel Jourdan, Adrien Antkowiak, Emmanuelle Planus, Mélissa Degardin, Saioa Cobo, Alice Kanazawa.

Volume Horaire : 1,5 h CM (1 séance) ; 12 h TD (8 séances) ; 14 h TP (3 séances + 1 séance d'examen en autonomie).

Langue d'enseignement : Français

Pré-requis de cette UE : Notions de niveau lycée : Concentration, dilution, spectrophotométrie (loi de Beer-Lambert, dosage par étalonnage), équilibres acide-base, titrage pH-métrique.

UE obligatoire ou à choix : Obligatoire.

Objectifs pédagogiques de cette UE :

- Savoir manipuler les matériels usuels de laboratoire.
- Connaître quelques techniques expérimentales de base en chimie et biochimie :
  - Préparer des solutions de concentration exacte (dissolution, dilution)
  - Mettre en œuvre des dosages et des titrages
  - Faire des mesures au spectrophotomètre, au pH-mètre
  - Comprendre le principe de la chromatographie échangeuse d'ions
- Évaluer quand il est nécessaire ou superflu de travailler avec exactitude
- Savoir traiter des résultats expérimentaux :
  - Tracer et exploiter un graphique XY
  - Gérer l'erreur de manipulation : erreurs systématiques, données aberrantes
  - Evaluer l'exactitude d'un résultat : calculer une incertitude, comparer à une référence
- Consigner et structurer les données d'un TP dans un cahier de laboratoire

Présentation de cette UE :

Il s'agit d'une UE d'initiation à la démarche expérimentale dans le domaine de la chimie et de la biochimie. Elle est centrée sur des séances de travaux pratiques durant lesquelles les étudiants seront amenés à réaliser des expériences suite à un travail de préparation en séances de TD. Il s'agira en particulier de préparer des solutions chimiques, de réaliser des dosages par spectrophotométrie et des titrages acido-basique. Tout au long du semestre, les étudiants seront sensibilisés à la bonne tenue d'un cahier de laboratoire.

Descriptif de MEP101

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Cours Magistraux :

Un seul CM au démarrage de l'UE

I. Présentation générale du fonctionnement de l'UE

II. Règles de bonne pratique de laboratoire

III. Introduction à la mesure et aux incertitudes.

Travaux Dirigés :

Les enseignements sont organisés en trois séquences, chacune centrée sur une séance de travaux pratiques (cf ci-dessous). Les notions de cours sont travaillées en amont de la séquence par l'étudiant en autonomie à partir du fascicule de l'UE. Une ou deux séances TD permettent de préparer le TP qui sera suivi par une dernière séance de TD permettant la finalisation de l'exploitation des données collectées en TP.

Travaux Pratiques :

Tout au long de l'UE, le travail expérimental est consigné dans un cahier de laboratoire.
Séquence 1 : Spectrophotométrie, analyse de colorants alimentaires, utilisation et exploitation de gammes étalons.
Séquence 2 : Préparation de solutions par dilution et dissolution. Calcul d'incertitudes (méthodes type A et type B)
Séquence 3 : Titrage acide/base d'acides aminés donc travail sur des di- et tri-acides.

En fin de semestre les étudiants seront évalués lors d'un examen pratique de 2h en monôme sur une expérience inspirée d'un des TP réalisés.

BIO231 – Cell Biology- Part 1

Back

Course, semester: L1-International Biology, Semester 2

Number of credits: 6

Course director:

- Corinne MERCIER, corinne.mercier@univ-grenoble-alpes.fr

Teaching staff: Denis ROUSSEAU, Thomas HINDRE

Teaching content: 22.5h of lectures (15 sessions); 34.5h of tutorials (23 sessions).

Teaching language: English

Entry requirements: Bio131, to know the structures and properties of the biomolecules that make up life

Core or optional: Core

Objectives:

- To know the major characteristics of eukaryotic- (both animal and plant-) *versus* prokaryotic cells and their compartments (if it does applies);
- To understand the cell functioning in a dynamic and integrated manner including specific mechanisms such as protein synthesis and traffic, the mitosis process integrated in the cell cycle;
- To know the principle of the main steps of common techniques used for the observation of cells.

Course description:

This is a course that provides the basics of cell biology. They concern in particular the structure of eukaryotic cells (animal or vegetable) or prokaryotic cells and the associated methods of observation, the mode of division of these cells, the principal stages of the biosynthetic pathways of the organic molecules and their sub-cellular localization, as well as the basic principles of cellular metabolism.

The students work on exercises that allow them to detail and deepen the notions covered in class, in particular through the analysis of experimental results and the creation of synthesis diagrams. Throughout the semester, interaction between students is favoured by working in groups and/or in front of the class.

Description of BIO231

Back

Lectures :

I/ Introduction to light microscopy (1.5h)

History; magnification; resolution; the various components of a light microscope; contrast; fluorescence; (immuno)histochemistry

II/ Introduction to electron microscopy (1.5h)

History; principle of electron microscopy; the main components of an electron microscope; sample preparation; examples of transmission electron microscopy micrographs; how to legend a micrograph; immunoelectron microscopy; scanning electron microscopy

III/ Molecular components of a cell (1.5h)

various types of cells: animal, plant, prokaryotic cells, (viruses)

IV/ Cell compartments and metabolism (6h)

Cell energy, cell compartments, photosynthesis and cell respiration, glucose oxidation, catabolism, biosynthesis of cell components, cell transport, transcription, translation, vesicle transport, secretion, endocytosis, cytoskeleton, cell cycle, mitosis, meiosis.

VI/ Cell differentiation, extracellular environment in multicellular organisms (6h)

cell wall in plants, algae, fungi, bacteria and Archaea; extracellular matrix in animal cells; cell cooperation: animal tissues and organs, cell junctions, plant tissues; example of cell and tissue cooperation: the intestine

VII/ Prokaryotic cells (4.5h)

diversity; identification criteria and taxonomy in bacteria (size, morphology, staining, metabolic characters, genetic characters); prokaryotic cells in their environment; interactions between prokaryotic cells and their host; structure of prokaryotic cells and Archaea (plasma membrane, envelope, cell wall, transport mechanisms); prokaryotic genomes (bacterial nucleoid, genome replication, cell binary fission); expression of prokaryotic genomes (operons, RNA polymerase, ribosomes, transcription-translation coupling); prokaryotic metabolism (anabolism/catabolism, nutritional types, culture media, prototrophic/auxotrophic growth, growth curve, diauxic growth

Tutorials:

Application exercises that are related to the lectures and include the analysis of experimental results. Students, by groups of 5-7 persons, prepare the session, and send their preparation to their teacher, who will come back to the major points during the tutorial session in order to improve the precision and the quality of figure descriptions and the answers in general.

BIO232– Biology of Organisms and Evolution

Back

Course, Semester: L1-International Biology, Semester 2

Number of credits: 6

Course directors:

- Rolland Douzet : rolland.douzet@univ-grenoble-alpes.fr
- Annie Ray: annie.ray@univ-grenoble-alpes.fr

Teaching staff: Stéphane Bec, Florian Boucher, Rolland Douzet, Mathieu Loubiat, Corinne Mercier, Annie Ray, Sophie Sroda, Jean Gabriel Valay.

Teaching content: Lectures 39h (26 sessions); Tutorials 16h (11 sessions)

Language of instruction: English

Entry requirements: Basic knowledge of cell biology from the high school curriculum is an advantage, but not absolutely necessary.

Core or optional: Compulsory

Objectives:

- To provide a solid foundation on the diversity of the animal and plant worlds at the scale of organisms and species.
- Introduction to biodiversity through the study of the major organisational plans of living beings (animals and plants), their diversity and the evolutionary mechanisms that led to this diversity.
- Relation between morphological, anatomical and histological diversity and adaptation to the environment of organisms.
- Role of evolution and its mechanisms in this adaptation.
- Acquisition of the basic knowledge, notions and concepts necessary to pursue studies in biology in the broadest sense.

Course description:
This course covers the basics of the biology of animal and plant organisms, as well as the main principles of the evolution of these organisms. The topics covered include the functional organisation and reproduction of higher plants (angiosperms), the major organisational plans of the animal kingdom, the general principles and mechanisms of biological evolution and environmental adaptations as a source of biodiversity.

Description of BIO232

Back

Lectures:

Plant Biology

I. Introduction: Germination, parts of the plant. Reminders.

II. The stem (4.5h)

A. The apical meristem and its functioning
B. Anatomy of the stem
C. Morpho-anatomical and adaptive variations
D. The woody stem: meristems and secondary tissues

III. The root (3h)

A. The root meristem and its functioning
B. Root anatomy and histology
C. Morpho-anatomical and adaptive variations

IV. The leaf (3h)

A. Origin and morphological diversity of the leaf
B. Phyllotaxis
C. Morpho-anatomical and adaptive variations

V. Reproduction (3h)

A. The angiosperm flower
B. The development cycle of an angiosperm
C. Germination and everything starts again...

Evolution : The main principles and general mechanisms of biological evolution. Genesis of biodiversity.

I. Evolution: a biological reality (4.5h)

A. Evolution: the genesis of a theory.
B. Evidence of evolution

II. Classifying: making the diversity of life intelligible (4.5h)

A. A brief history of classifications
B. Building a classification

III. Species and speciation: the genesis of biodiversity (4.5h)

A. The concept of species
B. Speciation: the appearance of species
C. Speciation and evolution

Animal Biology:

I. The single-cell heterotrophic state (1.5h)

A. Biology of Paramecia.
B. Plasmodium, an example of a single-celled parasite.

II. The diblastic state (Sponges - Cnidaria) (1.5h)

III. Annelids (1.5h)

IV. Plathelminthes (1.5h)

V. Molluscs (1.5h)

VI. Arthropods (3h)

VII. Urochordates – Cephalochordates (1.5h)

VIII. Vertebrates (1.5h)

Tutorials:

In Evolution (6h): Construction of phylogenetic and phenetic trees, comparison of approaches. Reading phylogenetic trees.

In Animal Biology (9h)

Work on the notions of the life cycle of an animal, types of post-embryonic development, host-parasite interactions, mimicry, structure-function relationship of an organ (the skin of Vertebrates), adaptation and natural selection using examples of species of Cnidaria, Plathelminthes, Molluscs, InsNumber of credits and Vertebrates.

The work is done in blocks and one piece of work per block is handed in.

CHI233 – General Chemistry

Back

Course, semester: L1-International Biology, semester 2

Number of credits: 6

Course directors:

- Sébastien Carret, sebastien.carret@univ-grenoble-alpes.fr
- Mark casida, mark.casida@univ-grenoble-alpes.fr

Teaching staff:

Teaching content: 22.5h lectures (15 sessions) ; 21h tutorials (14 sessions) ; 4h lab (1 session).

Language of instruction: English

Entry requirements: Notions covered in EU CHI101 of the first semester: structure of matter, electronic configuration, evolution of properties in the periodic table, VSEPR, intermolecular forces.

Core or optional course: Core

Objectives:

- The student will be able to write a redox or acid-base balance equation and calculate the pH of a simple solution (strong acid, strong base and buffer solution).
- Know and know how to apply the theory of the crystalline field to an octahedral or tetrahedral complex.
- Master and apply different representations of molecules (Cram, perspective, Newman, Fischer, topological) and know how to characterise the different types of isomerism.
- Master the basics of reactivity in organic chemistry: electronic effNumber of credits, mechanism writing, nucleophilic substitution and elimination.

Course description:

This course focuses on the molecule and the first notions of reactivity. It deals with hybridisation and representations of molecules by detailing the different classes of isomers, but also mesomerism and the electronic effNumber of credits of groups. A part of the course will also be devoted to coordination complexes, including their stereochemistry, crystal field theory and ligand exchange. Finally, after a quick presentation of the main chemical functions and nomenclature rules, a last chapter will be dedicated to intermolecular interactions and reactivity in chemistry with more precisely the study of substitution and elimination reactions.

The tutorial sessions will be mainly devoted to application exercises in order to use and apply the notions seen in lectures. One practical session will consist of manipulating molecular models.

Description of CHI233

Back

Lectures:

I. Acid/base reaction, redox reaction (high school reminder) (≈ 6 h)

A. Presentation and definition of a chemical reaction, an equilibrium, reaction progress.
B. Acid-base and redox reactions: writing and balancing a reaction, half-equation, oxidation number (or degrees), calculating the pH of the following cases: strong acid, strong base and buffer solution.

II. Coordination complexes (≈ 4.5 h)

A. Presentation of a coordination complex. Formula and nomenclature. Cis-trans and fac-mer isomers of an octahedral complex
B. Electronic configuration of a metal cation and crystal field theory: OM diagram for an octahedral complex in the case of a weak and strong field (presentation of the spectrochemical series)
C. Magnetic moment and colour of a coordination complex

III. Representation of molecules in 3D: presentation of conformations, configurations, isomeric definitions (≈ 4.5 h)

A. Definitions of isomers, stereoisomers, constitutive isomers, conformers.
B. Hybridisation (reminder first semester): sp3, sp2, sp, consequence on geometry.
C. Topological, Cram, Newman, Fischer, Haworth (fair presentation) and perspective representations.
D. Definitions: chiral molecule, elements of stereoisomerism, optical activity, enantiomers, diastereomers and Meso compound.
E. CIP rule and applications. D and L for sugar and amino acids. Configuration of Z and E double bonds.
F. Presentation of the nomenclature rules and the main functional groups.

IV. Electronic effects and introduction to reactivity in organic chemistry (≈ 8 h)

A. Reminder of the definition of polarity, polarizability and dipole moment (reminder of first semester).
B. Application of electronic effects to the stability of reaction intermediates (and on acidity)
C. Definition transition state, reaction intermediate, activation energy, exothermic and endothermic reaction
D. Definitions Nucleophile, electrophile. Writing mechanisms with reaction arrows.
E. Halogenoalkanes (R-X): Substitution reactions: Definition, SN2 nucleophilic substitution (Walden inversion). SN1 and carbocation. Elimination reactions: Definition, E2 (antiperiplanar presentation). E1 and carbocation.

Tutorials:

The tutorials will be mainly devoted to application exercises in order to use and apply the notions seen in the lectures. The modalities include E-learning and self-assessment via the Moodle platform.

Practical work:

A practical session will be devoted to the manipulation of molecular models in order to assimilate the notions of chirality and isomerism.

MAT236 – Introduction to Mathematical Biology and Population Dynamics

Back

Course-semester: L1-international biology – semester 2

Number of credits: 3

Course director:

- Zindine Djadli, zindine.djadli@univ-grenoble-alpes.fr

Teaching staff: The lecturers (except for the head of the course) change every year.

Teaching content: 8 h lecture/tutorial + 22 h tutorials (in total, 20 sessions of 1h30).

Language of instruction: English

Entry requirements: Notions of the high school program seen in the first semester in MAT103, concerning numerical sequences, derivatives and primitives of functions, and matrix calculus in dimension 2.

Core or optional: Core

Objectives:

- Present some basic tools for the modeller and the (informed) user of mathematical models
- Recall the principles, limits and contributions of a modelling approach in the life sciences
- Study simple deterministic models of population dynamics
- Develop quantitative tools for the analysis of 1D and 2D linear models
- Develop qualitative tools for the analysis of general 1D models
- Apply these tools to concrete situations concerning the evolution of animal, plant or bacterial populations, the kinetics of chemical reactions, genetics, genomics considered at the cellular and molecular levels, the propagation of the SARS-Cov2 virus, etc.
- Finally, emphasise that "The most that can be expected from any model is that it can supply a useful approximation to reality: All models are wrong; some models are useful" (George Box, in Science and Statistics, Journal of the American Statistical Association, 1976).

Course description:

The aim of the course is to become familiar with some basic tools for the modeller and the informed user of mathematical models in the life sciences, limited to simple deterministic models of population dynamics and their applications.

Description of MAT236

Back

Lectures/tutorials:

The teaching of MAT236 advances simultaneously lectures and tutorials.

We will successively focus on discrete time models, linear models (which biologists call Malthus models) or affine models, in dimension 1 then in dimension 2. The case of dimension 2 will allow us to recall and use the tools of linear algebra seen in the first semester in MAT103, concerning matrices of size 2x2. We will then develop efficient and relatively simple tools to determine the qualitative behaviour of many non-linear models, still in discrete time, but in dimension 1 only (the situation in higher dimension being much more complicated, as soon as dimension 2, and out of reach for this course).

Then we will approach the study of models in continuous time, which, benefiting from all the power of differential calculus, will turn out to be paradoxically simpler in many aspNumber of credits than in discrete time. Once again, we will completely solve linear (Malthus) and affine models in dimension 1, then in dimension 2. We will adapt to continuous time the qualitative tools developed for discrete time, which will allow us to treat relatively easily all non-linear models in dimension 1 (including logistic or Verhulst models) and all linear or affine models in dimension 2.

The mathematical bases necessary for the study of the models considered will be recalled as and when necessary, and the major part of the sessions will be devoted to the resolution of numerous exercises based on concrete situations encountered in ecology, demography, genetics, epidemiology, pharmacology, and medicine in general, among others.

Modalities: preparatory work at home (facilitated by the handing in of short essays of exercises, corrected during the semester), most of the work is done in class.

A complete handout (with course reminders, exercise sheets and examination papers) is distributed at the beginning of the semester and made available on Chamilo.

PHY236 – Instrumental optics

Back

Course-semester: L1-international biology, Semester 2

Number of credits: 3

Course director: Holger Klein, holger.klein@univ-grenoble-alpes.fr

Teaching staff:

Teaching content: 15h lecture/tutorial (10 sessions), 14h lab (3.5 sessions).

Language of instruction: English

Entry requirements: Mathematics: basics of scientific numerical calculation (manipulation of fractions, powers of 10, change of units), algebraic quantities, vectors, trigonometry; Physics: basics of geometric optics and measurement

Core or optional: Core

Objectives:

- To know the principles of geometrical optics (refraction, lenses, associations) and wave optics (diffraction, polarisation) and to know how to apply them in practical examples of instruments, in the context of imaging (vision, sensors, microscopes) and polarimetry
- Analyse a concrete situation based on a small number of fundamental principles.
- Deduce precise numerical values or orders of magnitude from a literal calculation or a graphical construction, knowing how to adapt the units to the orders of magnitude and uses, as well as the significant figures to the precision.
- Develop an experimental approach to make a measurement or validate a model
- Carry out an experimental set-up, make measurements and use them, taking into account their accuracy
- Present experimental results in writing (keep a laboratory notebook and write a structured summary report)

Course description:

This module aims to introduce the use of light as a means of investigating matter, based on useful applications in biology, chemistry and earth sciences. The aim is to apply fundamental principles to predict the behaviour of a system and to acquire the basic notions necessary to understand essential phenomena in many scientific fields. The topics covered include geometric optics and optical phenomena, optical and image acquisition instruments and their limitations, and polarisation.

The theoretical notions taught in the form of lectures and tutorials will be further developed during practical work sessions carried out in pairs.

Description of PHY236

Back

Lectures/tutorials:

I. Geometric optics and optical phenomena (5 sessions)

II. Optical instruments, image acquisition and their limitations (3 sessions)

III. Polarisation (2 sessions)

Practical works:

TP1: construction of a microscope model (geometrical optics on an optical bench)
TP2: use of a microscope and image acquisition
TP3: phenomena related to polarisation; carrying out a polarimetric assay
TP4 : individual examination of TP of 2 hours

The evaluation is based on the preparatory work and the reports (concerning one experiment of the practical course). The practical exercises are carried out in pairs.

MEP231 – Experimental methods in cell biology and biochemistry

Back

Course, Semester: L1-International Biology, Semestre 2

Number of credits: 3

Course director:

- Muriel Jacquier Sarlin, muriel.jacquier-sarlin@univ-grenoble-alpes.fr>

Teaching staff: Emmanuelle Tillet, Eve de Rosny, Muriel Jacquier Sarlin, Sakina Torch, David Cobessi

Teachng content: 9h Tutorials (6 sessions) ; 21h Lab (6 sessions).

Language of instruction: English

Entry requirements: Protein and Nucleic Acid Biochemistry (BIO131), Basic Cell Biology (BIO231)

Core or optional course: Optional

Objectives:

- To master the basic experimental methods in cell biology and biochemistry
- Mobilise and consolidate acquired knowledge in biochemistry, cell biology and organism biology
- Improve skills in presenting results
- To appropriate the principle of each experiment, in order to be able to place it in another biological context

Course description:

This is a mainly experimental course which allows the mobilisation and implementation of knowledge acquired in biochemistry (BIO101) and cell biology (BIO201). It is organised in the form of six alternating sessions of preparatory lectures and six sessions of practical work. The topics covered are related to the biochemistry of proteins (purification, analysis of quaternary structures, dialysis) and nucleic acids (identification of mutations, restriction map) as well as to cell biology (osmosis, concept of isolated cells and tissues, cell division).

Description of MEP231

Back

The course consists of practical sessions preceded by a preparatory practical session on 6 different topics:

A. Purification of immunoglobulin from serum by affinity chromatography
B. Analysis of an immunoglobulin purification and determination of their quaternary structure
C. Search for a mutation in the Hyper protein gene by determination of its restriction map
D. Selective permeability through artificial (dialysis) or biological (plasma membrane) membranes
E. Cell division in prokaryotes and eukaryotes
F. Cells and tissues

Tutorials:

The students will use the digital platform LabNbook to prepare the practical sessions. For each session, students will be reminded of the theoretical notions associated with the lab (preparatory work corrected during the session) and will work in groups of four on i) the definition of the objectives of the lab, ii) the operating mode, iii) the anticipation of the results expected during the lab.

Practical work:

The experiments are carried out in pairs and a report is written at the end of each session.
The techniques used are : Purification of proteins by affinity chromatography; SDS-PAGE gel electrophoresis; restriction enzyme digestion of plasmid DNA and agarose gel analysis; equilibrium dialysis; bacterial cultures; preparations, staining and observation of cells and tissues by light microscopy; field selection and observation drawings

Educational resources: UGA video podcasts: The technique box - use of a pipette, affinity chromatography, SDS-PAGE electrophoresis, dialysis, principle of a cloning and TP with plasmid DNA.

MEP232 – Experimental methods in organism biology

Back

Course, semester: L1-International Biology, Semester 2

Number of credits: 3

Course leaders:

- Rolland Douzet : rolland.douzet@univ-grenoble-alpes.fr
- Sabrina Boulet : sabrina.boulet@univ-grenoble-alpes.fr

Teaching staff: Fabienne Agasse, Sabrina Boulet, Annie Ray, Sophie Sroda, Stéphane Bec, Rolland Douzet, Olivier Lerouxel

Teaching content: 30 h lab (9 sessions)

Language of instruction: English

Entry requirements: Knowledge of the biology of organisms from the high school and 1st year university (BIO232).

Core or optional course: optional

Objectives:

- To observe and dissect an animal.
- To observe the organisation of an animal and understand its adaptations to its environment and way of life.
- Associate some of the characters observed with the systematic position of the species
- To be able to draw the animal studied after dissection
- Make and stain plant histological sections.
- Use image capture tools and associated computer tools (image processing software).
- Identify the different plant tissues, the different plant organs. Relating them to the systematic position of plants.
- Use of the photonic microscope.

Course description:

This is an experimental course in the Biology of animal and plant organisms, the objective of which is the acquisition, through direct observation, of the knowledge on the functional organisation of animal and plant organisms provided in the BIO202 course. It also aims to train students in the techniques of dissection, histological sections and staining and microscopic observation. It consists of the study of the way of life and the functioning of 4 animals belonging to different phyla as well as histological and anatomical studies of organs of higher plants.

Back

Description of MEP232

The Animal Biology practicals consist of the study of the life style and functioning of 4 different animals belonging to different phyla. This study is based on the external and internal observation of the animals before and after dissection. Each practical session is associated with the submission of a noted observation drawing. Each session requires a preparatory reading of the handout in order to know the overall course of the session and the basic notions associated with it (classification for example).

The plant biology practical exercises are centred on the observation of histological sections of higher plant organs under photonic microscopy, some of which are made by the students during the session. These observations are accompanied by the taking of digital pictures by the students, which are used in the writing of a report. Each practical session gives rise to the writing of a report which is firstly self-evaluated by the student and then cross-evaluated by the teacher in a second phase thanks to the use of self-evaluation grids.

BIO331 – Cell Biology 2

Back

Course, Semester: L2-International Biology, Semester 3

Number of credits: 6

Course director:

- Claire Vourc'h, claire.vourch@univ-grenoble-alpes.fr

Teaching staff: Virginie Faure, Fabienne Agasse, Fabienne Hans, Thomas Hindre, Claire Vourc'h, Mohamed Benharouga, Michel Pabion, Emmanuelle Planus, Eric Estève, Rémy Sadoul, Adrien Antkowiak, Marina Gromova, Fayçal Boussouar (+ environ 8 vacataires).

Teaching content: 30h lectures (20 sessions) ; 15h tutorials (6 sessions) ; 14h lab (4 sessions).

Language of instruction: English

Entry requirements: Knowledge of the biomolecular constituents of the cell (BIO131), basics of cell biology (BIO231)

Core or optional course: Core

Objectives:

Knowledge:

- Acquire the fundamental knowledge of cell biology and know how to use the vocabulary specific to cell biology
- Be aware of the hygiene and safety conditions necessary for biological experiments
- To know the good practices of manipulation in cell culture

Skills:

- Know how to use the experimental equipment (phase contrast photonic microscope, spectrophotometer, pipettes, bulbs, small centrifuge, vortex, hood)
- Know how to remove adherent cells from their support
- Know how to make an observation drawing and an electronography analysis
- Know how to draw a graph from experimental measurements
- Know how to make dilutions in cascade
- Master the techniques of cell fractionation (preparation of a concentration gradient, centrifugation, homogenisation)
- Understand and apply the concepts of labelling with antibodies directed against proteins immobilised on nitrocellulose membranes
- Be able to present, describe, interpret, argue and conclude on experimental results using appropriate scientific vocabulary and with correct and rigorous written and oral expression
- Use creativity to develop tools for revising the concepts of cell biology seen in class
- Work in groups and in pairs (develop communication, diplomacy and listening skills, accountability)
- Anticipate the sessions of TD and TP and know how to organise their work

Course description:

This course aims at the acquisition of a good knowledge of the functioning of eukaryotic and prokaryotic cells, which deals with all the major cellular functions (replication, transcription, translation, cytoskeleton, cell cycle, cell-environment interaction) and the experimental methods which allow their analysis.

The work of acquiring this knowledge in the TD session is carried out by interactive pedagogical methods (preparatory work, island work, oral presentation) in the form of actions that the students must carry out throughout the semester: oral retransmission of knowledge, application exercise, elaboration of MCQs, analysis of scientific figures, elaboration of a pedagogical creativity project.

In practical work, the student will have a first introduction to the experimental approaches of differential centrifugation, cell culture and luminescent immunolabelling.

Description of BIO331

Back

Lectures:

I. Methods for exploring the cell (3h)

A. Photonic microscopy: brightfield, darkfield and fluorescence microscopy
B. Electron microscopy: transmission and scanning microscopy
C. Models in biology: cell line, spheroids, bacteria, yeast, worms, drosophila, plants, xenopus, fish, mouse, organoids
D. Cell fractionation: differential and density gradient centrifugation
E. Analysis of cell extracts: electrophoresis, western blot, southern blot, northern blot, ELISA, flow cytometry, protein complex analysis, mass spectrometry

II. From DNA to RNA (6h)

A. Chromatin organisation: pearl necklace, solenoid, chromosome territories, mitotic chromosome, relationship between chromatin structure and gene expression
B. Replication: mechanisms, telomere replication, kinetics of replication during S-phase, visualisation of replication
C. Transcription: actors of transcription, regulation of transcription, co- and post-transcriptional maturation of mRNAs, the nucleolus

III. The cell cycle (1.5h)

A. Identification of the different phases of the cell cycle: in the embryo, in the animal cell
B. Control of cell cycle progression: coordination by the cyclin-dependent kinase complex, growth factors and cyclin regulation, cell cycle checkpoints and DNA damage
C. General characteristics of mitosis and meiosis: stages of mitosis and role of cohesins and condensins, comparison between meiosis and mitosis, meiosis in vertebrates: spermatogenesis and spermiogenesis

IV. From RNA to protein and its intra and intercellular transport (7.5h)

A. Translation: generalities, actors of translation, mechanisms of translation
B. Protein maturation and intracellular trafficking: protein addressing in eukaryotes and prokaryotes, protein maturation: protein folding and post-translational modification
C. Cellular protein turnover: lysosomal pathway, ubiquitin proteasome pathway, Ca2+ dependent degradation: calpains
D. The principle of vesicular trafficking: actors of vesicular trafficking, mechanisms of vesicle formation and sorting of proteins to be transported

V. Structure cellulaire et interaction cellule-environnement (7.5h)

A. The plasma membrane: general characteristics, lipid bilayer, membrane proteins
B. Cell signalling: general principles, intracellular receptors, transmembrane receptors
C. The cytoskeleton and cell movement: intermediate filaments: microtubules, actin filaments
D. Extracellular matrix and cell interactions: composition of the extracellular matrix, characteristics of cell interactions

VI. Eukaryotes and prokaryotes: similarities and differences (4.5h)

A. Prokaryote and diversity of life (0.5h): prokaryote and tree of life, specificity of the prokaryote cell (organization, size, morphology)
B. The bacterial envelope (0.5h): plasma membrane and phospholipids, Gram-positive-Gram-negative, Peptidoglycan (chemical nature, synthesis, antibiotic target), Gram-negative outer membrane and the lipopolysaccharide
C. The bacterial cytoskeleton (0.5h): actors, divisome, elongasome
D. Bacterial genetic material (0.75h): bacterial nucleoid (nature, organisation/compaction), bacterial topoisomerases, nucleoid-associated proteins, DNA topology and gene expression, plasmids (nature, horizontal transfer by conjugation)
E. Bacterial replication (0.25h): general characteristics, replisome, bacterial specificities (replication cycle, multiple initiations)
F. Gene expression in bacteria (1h): gene organization (operon, open reading frame), bacterial RNA polymerase, sigma factors and bacterial promoters, transcription initiation and transcription factors, transcription elongation and termination (Rho-dependent or independent), translation and bacterial ribosomes, transcription/translation coupling
G. External bacterial structures (0.75h): capsule, fimbriae, pili, flagellum (nature, assembly, motility and chemotaxis)
H. Bacterial sporulation and biofilms (0.25h)

Tutorials:
Nature: oral exercise to retransmit the knowledge taught in class, application exercise linked to the course, exercise in the form of MCQs, analysis of scientific figures, development of a creative teaching project
Modality: interactive pedagogy in the form of actions (preparatory work, island work, personal and group work)

Practical work:

Modality: preparatory work in the form of a flow chart, reporting back to the meeting
Techniques studied: differential centrifugation, Percoll gradient purification, cell culture, light microscopy, spectrometry, topological staining of cells by cytochemistry, filter trap (dot blot), luminescent immunostaining.

BIO332 - Genetics

Back

Course, Semester: L2-International Biology, Semester 3

Number of credits: 6

Course director:

Daniel PERAZZA daniel.perazza@univ-grenoble-alpes.fr

Teaching staff: Robert Blanvillain, Florian Boucher, Fayçal Boussouar, Bertrand Favier, Joël Gaffé, Thomas Hindré, Stéphan Lacour, Corinne Mercier, Daniel Perazza, Annie Ray, Steffen Reinbothe, Dominique Schneider

Teaching content: 28,5h lectures (19 sessions of 1.5 h) ; 21h Tutorials (14 sessions of 1.5 h) ; 12h practical sessions (3 sessions of 4 h).

Language of instruction: English

Entry requirement: Biomolecular constituents of the cell (BIO131), basics of cell biology (BIO231); Notions of genetics at scientific baccalaureate level: cell cycles (mitosis, meiosis), probabilities (product and sum of probabilities rules).

Core or optional course: Core

Objectives:

- Master the concepts of transformation, conjugation and transduction in bacteria
- Master the common segregation of alleles and phenotypes in monohybridism and polyhybridism in eukaryotes
- Know the particular segregations of alleles and phenotypes (sex-linkage, genetic interactions, genetic linkage)
- Know how to calculate a genetic distance
- Know the Hardy Weinberg rules in population genetics
- Know how to purify, digest and analyse plasmid DNA

Course description:

This is an introductory course to the concepts of genetics in prokaryotic and eukaryotic cells as well as in population genetics. In particular, it deals with the different mechanisms of horizontal gene transfer in bacteria and their use for genetic mapping. It also discusses the different types of Mendelian and non-Mendelian hybridism in eukaryotic organisms and describes examples in human genetics. Finally, it introduces the basic concepts of population genetics (Hardy-Weinberg principle, breeding regime and evolutionary forces). The acquisition of this knowledge will be worked on in practical exercises and the practical sessions will enable students to familiarise themselves with the basic techniques of bacterial genetics (transformation, selection, restriction map).

Description of BIO332

Back

Lectures:

The courses are divided into 3 disciplines and 2 revision sessions.

I. Bacterial genetics (7 lectures of de 1.5h, total 10.5h)

A. Introduction t molecular biology
B. Mutations
C. Bacterial transformation
D. Bacterial conjugation
E. Bacterial transduction
F. Antibiotics

II. Eukaryotic genetics (7 lectures of 1.5h, total 10.5h)

A. Mendelian monohybridism (reminders): meiosis, Mendel's 1st law, test crossover, combinatorics of meiosis
B. Non-mendelian segregated monohybridism: codominance and incomplete dominance, allelic series, variable expressivity and incomplete penetrance, sex-linked inheritance
C. Genetic linkage and mapping: crossover, genetic maps and physical distances, calculation of genetic distance between 2 genes, calculation of genetic distance between 3 genes (3-point test), linkage maps, mapping in haploid organisms
D. Human genetics: polymorphism and genotyping, history and principles of human identification, STR markers in forensics, allelic frequencies and human identification

III. Population genetics (3 lectures of 1.5h, total 4.5h)

A. Introduction to population genetics
B. Basic concepts of population genetics: genetic composition of populations, Hardy-Weinberg principle
C. Reproductive regime and evolutionary forces: reproductive regime, evolutionary forces

Tutorials:

Tutorials are of **CAPITAL** importance in genetics. They consist in solving application exercises and problems by reusing the notions seen in class.At each session, 2 or 3 simple exercises are to be done in advance (preparatory work) in order to free up time in the tutorial session for the solution of more complex problems. The work in groups of 4 to 5 students will be privileged in order to favour learning.

Practical work:

The practical work illustrates a part of the course of bacterial genetics (modification of the bacterial phenotype following a transformation by a GFP expression vector). The experiments will be carried out in pairs. A report will be written at the end of the course. Techniques used: purification of plasmid DNA (miniprep), DNA digestion by restriction enzymes, DNA electrophoresis on agarose gel, preparation of selective LB culture medium, bacterial transformation.

CHI335 - Chemical Thermodynamics and Kinetics for biologists

Back

Course, semester: L2-International Biology, Semester 3

Number of credits: 6

Course director:

- *Ricardo GARCIA, ricardo.garcia@univ-grenoble-alpes.fr*

Teaching staff: *Yohann MOREAU, Mark CASIDA*

Teaching content: 19.5h lectures (13 sessions) ; 30h tutorials (20 sessions) ; 8h practical (2 sessions).

Language of instruction: English

Entry requirement: High-school level math. High-school level general chemistry. CHI131. CHI231. MAT103.

Extent of reaction, chemical activities, equilibrium constant, pH of a strong acid or base.

Core or optional course: Core.

Objectives:

- Know basic concepts of chemical kinetics and be able to perform simple calculations
- Apply the law of energy conservation to chemical reactions
- Understand the concept of entropy and how it affects chemical reactions
- Be able to predict the evolution of a chemical system from its initial conditions, based on thermodynamic constants
- Be able to calculate the pH of a mixture of acids and/or bases

Course description:

This course deals with the kinetics and thermodynamics of chemical reactions in relation to biology. It deals in particular with reaction rates, enthalpies, entropy, thermodynamic cycles and goes into greater detail on the notions of acid/base. The concepts covered in the course are applied in the practical sessions via exercises and in the practical sessions through calorimetry and conductimetry experiments.

Description of CHI335

Back

Lectures:

I. Formal chemical kinetics (3h)

A. **Speed of a reaction - General** (Definitions, van't Hoff's differential law, global order, partial orders, rate constant)
B. **Kinetic laws in simple cases (order 0, 1 and 2)** (Integration of the differential law - notion of ½ reaction time)
C. **Experimental determination of the overall order and partial orders of a reaction** (Integral method, reaction time method, degeneracy of order, initial velocity method)
D. **Influence of temperature on velocity - Arrhenius' law** (Determination of the activation energy - determination of k(T2) knowing k(T1)

II. General chemical thermodynamics (14h)

A. **Introduction and basic concepts** (Objectives, System and notions of variables and state functions, transformations in thermodynamics, different types of energy exchanged during a transformation, standard state, sign conventions)
B. **First principle - Internal energy and enthalpy** (Internal energy U, Statement of the law of conservation of energy, Enthalpy H, Qv and Qp, Heat capacity, DH and DU relationship)
C. **Applications of the first principle** (Enthalpy of formation, determination of heats of reaction at constant pressure, Hess's Law, binding energy, lattice energy, variation of heats of reaction with temperature: KIrchoff relation)
D. **Second and third principles - entropy S** (Entropy S related to disorder, Statement of the second principle, notions of spontaneity of a reaction and internal production of entropy, third principle and absolute entropies, calculations of entropy during a variation of T, a change of state and during a chemical reaction, variation of DS with temperature)
E. **Free energy and enthalpy - chemical potential** (Expressions of F and G and criteria for spontaneity, free enthalpy of reaction, calculations of DrG°, Maxwell's relations, expression and properties of chemical potential, activity of a component, relationship between G and m)
F. **Chemical equilibria - Law of mass action** (Activity monomial, equilibrium constant and equilibrium conditions, prediction of the direction and limits of a reaction, equilibrium shift, influence of temperature: van't Hoff's law and its integration, phase rule and variance)

III. pH calculation (2.5h)

A. **Acid/base** (Acid/base definition, predominance diagram, acidity scale)
B. **pH calculation** (Calculation of pH of simple solutions consisting of an acid or a weak base, reaction with water)

Tutorials:

Nature : Application exercise

Modality: Preparatory work, cluster work

Practical work:

Modality: preparatory work, reporting and testing

Techniques studied: calorimetry, conductimetry

STA331: Statistics and Probability for Life Sciences

Back

Course, Semester: L2 international biology, Semester 3

Number of credits: 6

Course directors:

- Jean-François Coeurjolly, jean-francois.coeurjolly@univ-grenoble-alpes.fr
- Adeline Leclercq-Samson, adeline.leclercq-samson@univ-grenoble-alpes.fr

Teaching staff: JF Coeurjolly, A Leclercq-Samson

Teaching content : 36 h lectures/practicals (24 sessions)

Language of instruction: English

Entry requirements:

MAT103. In particular: calculus, fractions, powers and percentages, sequence of real numbers, etc.

Core or optional course: Core

Objectives:

Introduction to the basic techniques of statistical data treatment, with an emphasis on practical skills and the use of the statistical software R. At the end of the course, the students should be able to:

- Load, explore, and summarize graphically a set of data;
- Understand what is a probabilistic model, discrete or continuous;
- Perform simple computations on some basic models, in particular binomial and Gaussian;
- Identify a probabilistic model from a practical situation;
- Compute confidence interval estimates for proportions, means, and variances;
- Formulate hypotheses, compute tests statistics and p-values, interpret results and make practical decisions;
- Perform analyses of variance (anovas) under different models, and understand their outcomes;
- Adjust simple linear models, compute predicted values, test goodness-of fit by an anova;
- Use the R statistical software

Course description:

This course aims at acquiring the basics of descriptive and inferential statistics. It will deal in particular with methods of point estimation, estimation by confidence interval, and hypothesis testing in a parametric framework. The teaching in the form of lectures/DDs is completed by practical work sessions on computer aimed at familiarising students with the handling of the R software for statistics.

Description of STA331

Back

Lectures/practicals:

Practical sessions will be realized using the (free) R software. The following concepts will be presented/illustrated:

1. Data exploration: discrete and continous variables; boxplots, scat- terplots, barplots and histograms; absolute, relative, and condi- tional frequencies, contingency tables; mean, variance, standard- deviation; empirical cumulative distribution function, quantiles;
2. Probabilities: probabilistic models, binary samples, empirical fre- quency, binomial distribution, law of large numbers; density, mean and standard-deviation, cumulative distribution function, quantile function, fluctuation intervals, q-q plots, normal approximations;
3. Statistics: estimators and estimates, bias, mean quadratic error, consistence; confidence interval for an expectation, a proportion, a standard deviation; statistical testing, null hypothesis, alternative, one- and two-sided tests, threshold, second kind error, power, p- value;
4. One sample tests: testing the value of an expectation, a propor- tion, a standard deviation; testing normality (Shapiro-Wilk); test- ing goodness-of-fit (chi-squared, Kolmogorov-Smirnov);
5. Two sample tests: comparison of means, variances, proportions, distributions; association, correlation, dependence; simple linear regression, slope and intercept, point extimates and predictions; multiple linear regression, model selection.

BIO303– Communications nerveuse et hormonale, notion de régulation physiologique

Back

Parcours, Semestre : L2-Biologie, L2-Biologie International, L2-SVT, S3

Nombre d'ECTS : 3

Responsable(s) pédagogique(s) de l'UE :

- Annie Ray, annie.ray@univ-grenoble-alpes.fr

Équipe pédagogique : Fabienne Agasse, Laurence Kay, Fabien Lanté, Annie Ray

Volume Horaire : 13,5 h CM (9 séances) ; 13,5h TD (9 séances)

Langue d'enseignement : Français

Pré-requis de cette UE : propriétés physico-chimiques des biomolécules, liaisons chimiques covalentes ou faibles, fonctionnement cellulaire global, anatomie d'un Mammifère, notions de modélisation des processus biologiques (voir BIO101, BIO201, BIO202, CHI101, MAT103)

UE obligatoire ou à choix : Obligatoire en L2-SVT, à choix en L2 Biologie et Biologie International

Objectifs pédagogiques de cette UE :

- Connaitre les caractéristiques fondamentales des 2 systèmes de communication à l'échelle de l'organisme Mammifères, de l'échelle de l'organisme aux échelles cellulaire et moléculaire
- Identifier et comprendre les relations existant entre les 2 systèmes de communication
- Maitriser les notions d'homéostasie et de régulation physiologique, savoir construire une boucle de régulation physiologique dans une situation physiologique donnée - mobiliser les connaissances portant sur les voies de communication dans le cadre d'une régulation physiologique
- Connaitre l'exemple de la thermorégulation
- Différencier la notion de régulation physiologique et d'adaptation physiologique à partir de l'exemple de la thermorégulation
- Savoir schématiser des informations scientifiques à partir d'un texte

Présentation de cette UE :

Cette UE concerne les 2 modes de communication dans l'organisme des Mammifères que sont la communication nerveuse et la communication hormonale. Elle vise à faire comprendre la nécessité des régulations physiologiques pour maintenir l'homéostasie de l'organisme, à acquérir les notions de boucle de régulation et d'intégration de signaux de communication. Elle décrit en particulier le rôle de ces processus dans la thermorégulation.
Les notions dispensées en cours sont approfondies en TD sous forme d'exercices d'application ainsi que par l'analyse et la modélisation de données expérimentales.

Descriptif de BIO303

Back

Cours Magistraux :

COMMUNICATION HORMONALE (3h)

I. Caractéristiques de la communication hormonale

A. Histoire de la découverte de la communication hormonale
B. Schématisation de la séquence de communication hormonale et définition de l'hormone
C. Le système endocrine : ensemble des cellules sécrétant des hormones : Méthodes d'étude en endocrinologie-historique, organisation du système endocrine, origine embryonnaire des cellules endocrines
D. Diversité des hormones : familles d'hormones, bilan (tableau synthèse)
E. Le message hormonal et son codage : variation de concentration hormonale, de quoi dépend la concentration en hormone à l'instant t?, catabolisme et notion de demi-vie de l'hormone, intensité du message hormonal
F. Réception du message hormonal par les cellules cibles et réponse biologique : localisation des récepteurs spécifiques et mode d'action, caractéristiques de la liaison hormone-récepteur, agoniste et d'antagoniste, relation entre liaison hormone-récepteur et réponse biologique

II. Les stimuli à l'origine d'une communication hormonale et fonctions mettant en jeu la communication hormonale

A. Exemple du stress : situations/agents de stress divers, réponses/réactions de l'organisme, réaction d'alarme (catécholamines, glucocorticoïdes, sécrétion et effets), syndrome général d'adaptation
B. Vue d'ensemble des effets des différentes hormones : fonctions biologiques mettant en jeu la communication hormonale
C. Diversité des stimuli

COMMUNICATION NEURO-ENDOCRINE (fonctionnement du complexe HT-HP) (1,5h)

I. Connexions structurales et fonctionnelles entre l'hypothalamus et l'hypophyse

A. L'hypophyse: glande endocrine d'origine mixte
B. Connexions nerveuses entre l'hypothalamus et la neurohypophyse
C. Connexions vasculaires entre l'hypothalamus et l'adénohypophyse : rôle des libérines et des inhibines

II. Le fonctionnement de l'adénohypophyse et son contrôle : notion d'axe hypothalamo-hypophysaire

A. Les hormones sécrétées par l'adénohypophyse et leurs organes cibles
B. Contrôle de l'activité sécrétoire des cellules de l'adénohypophyse par les libérines/inhibines: notion d'axe hypothalamo-hypophysaire
C. Les 5 axes hypothalamo-hypophysaires
D. Bilan : caractéristiques communes aux axes HT-HP-contrôle de glandes endocrines en fonction de modifications dans l'environnement (ex : stress)

III. L'activité de la neurohypophyse

A. Les hormones sécrétées par la neurohypophyse et leurs organes cibles

IV. Un exemple de fonction contrôlée par le complexe ht-hp : la lactation

A. Organisation fonctionnelle des glandes mammaires
B. Le réflexe neuroendocrinien de sécrétion du lait
C. Le réflexe neuroendocrinien d'éjection du lait
D. Conclusion : le complexe HT-HP est le site majeur des relations système nerveux/système endocrine

COMMUNICATION NERVEUSE (4,5 h)

I. Le système nerveux

A. A quoi sert le système nerveux
B. Organisation des système nerveux : système nerveux central et périphérique, systèmes nerveux complémentaires, exemple du réflexe rotulien (myotatique)

II. Le système nerveux : constituants cellulaires

A. Vidéo « Le temps des neurones »
B. Les neurones
C. Les cellules gliales

III. La communication nerveuse

A. La synapse : historique, organisation de la synapse, les épines dendritiques, les différents types de synapses
B. La transmission synaptique : neurotransmetteur, mode de libération et principaux neurotransmetteurs
C. Modèle d'étude de la transmission synaptique : électrophysiologie, notion de potentiel de membrane
D. Mouvements ioniques et intégration : synapse excitatrice (exemple du glutamate), synapse inhibitrice (exemple du GABA), Intégration (sommation temporelle et spatiale)

IV. Modulation de la communication nerveuse par les drogues

A. Le circuit de la récompense
B. Qu'est-ce qu'une drogue ?
C. Mode d'action des drogues : sites d'action, psychostimulants, opiacés
D. La dépendance

NOTION DE REGULATION PHYSIOLOGIQUE - exemple de la thermorégulation (4,5h) L. Kay

I. Notion d'homéostasie et boucle de régulation (1,5 h)

A. Le milieu intérieur : définition, lien entre les 3 compartiments du milieu intérieur
B. Définition et origine du terme « homéostasie »: étymologie et origine (Walter B. Cannon), notion de stabilité du milieu intérieur (Claude Bernard)
C. Rôle des systèmes de l'organisme dans l'homéostasie du milieu intérieur : coopération entre des systèmes spécialisés, coordination par les systèmes nerveux et hormonal
D. L'homéostasie est essentielle à la vie indépendante : évolution et complexité des organismes, le gain de l'homéostasie - citation de Claude Bernard

E. L’homéostasie coûte cher à l’organisme : maintien des concentrations ioniques – coût de la pompe Na+/K+, autres postes de dépense énergétique pour l’homéostasie
F. Les boucles de régulation permettent de maintenir l’homéostasie : éléments constitutifs et leur rôle, équations gouvernant la relation entre la variable régulée et la variable contrôlant la régulation – modélisation, principe du rétrocontrôle négatif
G. Une boucle de régulation peut être plus ou moins complexe : boucle simple, boucles comportant plusieurs senseurs ou plusieurs effecteurs
H. Le cas des boucles de rétrocontrôle positif : principe, exemple de l’accouchement

II. Thermorégulation à court terme (2h15)

A. La température et les échanges de chaleur : processus biologiques, métabolisme, activité métabolique selon les organismes, activité métabolique et production de chaleur, production de chaleur et homéothermie, échanges de chaleur (notion de noyau et enveloppe thermiques)
B. Les mécanismes et les effecteurs de la thermorégulation : équilibre et bilan thermique, zones de thermorégulation et de neutralité thermique, rôle de l’irrigation cutanée et des extrémités dans les échanges thermiques, thermogenèse par frisson thermique, thermogenèse sans frisson – tissu adipeux brun, sudation et thermolyse par évaporation cutanée
C. La sensibilité thermique : sensations thermiques, thermorécepteurs cutanés et profonds, implication et différents types de canaux TRP
D. Les boucles de thermorégulation : des stimuli aux effecteurs, rôle de l’hypothalamus dans la thermorégulation, boucles de thermorégulation (réponse au chaud, réponse au froid, complexité des boucles de thermorégulation), limites de la thermorégulation

III. Adaptations lors de contraintes thermiques répétées (45 min)

A. Les différents types « d’adaptation » - terminologie : adaptation innée versus acquise, différence entre « acclimatation » et « acclimatement », phénomène d’habituation
B. Adaptations au froid : mise en évidence, différents types (isolatif-hypothermique), exemples chez les populations humaines (cas des Inuits, des Aborigènes, du peuple nomade de Laponie, des Amas), rôle du tissu adipeux brun/beige, rôle des hormones thyroïdiennes
C. Adaptations à la chaleur : réponse sudorale, adaptation saisonnière, adaptation permanente à la chaleur

Travaux Dirigés :

Nature : exercice d’application, analyse de données expérimentales, modélisation à partir de données expérimentales (exemple : construction de boucles de régulation, de séquence de communication hormonale)

Modalité : Travail préparatoire, travail en îlot avec rendu d’un travail commun par îlot

BIO304 – Valorisation des ressources végétales

Back

Parcours, Semestre : **L2-Biologie, L2 Biologie internationale, S3**

Nombre d'ECTS :3

Responsable(s) pédagogique(s) de l'UE :

- Olivier Lerouxel, lerouxel@cermav.cnrs.fr

Équipe pédagogique : Christel Carles, Basile Pérès, Olivier Lerouxel

Volume Horaire : *9 h CM (6 séances), 6 h TD (4 séances), 15h TP/TD (10 séances)*

Langue d'enseignement : *Français*

Pré-requis de cette UE : Constituants biomoléculaires de la cellule, bases de biologie cellulaire (voir BIO101 et BIO201)

UE obligatoire ou à choix : à choix

Objectifs pédagogiques de cette UE :

- Apprendre les grandes familles de molécules produites par les végétaux, les procédures permettant leurs valorisations ainsi que différentes applications de ces molécules dans les domaines de l'industrie ou de la santé.
- Savoir construire une séquence expérimentale permettant l'analyse de substances naturelles
- Connaitre les valorisations innovantes des dérivés de l'amidon
- Connaitre une technique d'analyse des polysaccharides complexes
- Préparer et présenter une communication scientifique (orale et par affiche)

Présentation de cette UE

Cette UE vise à faire découvrir les particularités du règne végétal, ses potentialités en termes de synthèse de molécules (chimie verte), de génétique (sélection agronomique et modification génétique) et de production énergétique (valorisation de la biomasse).
Les cours (CM et TD) consistent à introduire ces notions et les techniques associées. Ils serviront de bases à un travail des étudiants sur des exemples d'applications récentes de valorisation des ressources végétales qu'ils présenteront oralement lors des séances TD/TP.

Descriptif de BIO304

Back

Cours Magistraux :

I. Introduction : Les potentialités du monde végétal

II. Détection des O.G.M et PCR quantitative

III. Valorisation des ressources végétales : l'agriculture pour la chimie (2CM)

IV. Pharmacognosie : Substances naturelles (2CM)

Travaux dirigés / Travaux pratiques:

- Méthodologie : Savoir préparer une communication orale scientifique
- Techniques d'analyses des sucres (Composition en monosaccharides par chromatographie en phase gazeuse)
- Techniques d'analyses des sucres (caractérisation d'oligosaccharides par spectrométrie de masse MALDI-TOF)
- Procédure d'extraction et d'analyse de substances naturelles
- Thèmes variés d'exposés scientifiques (20min d'exposé, 10min de questions) préparés par les étudiants (exemple de thèmes pour 2021) :

Catégories	Sujets	Contenu
Génie végétal/ Valorisation polysaccharides	Symbiose Rhizobium-légumineuse	Dialogue moléculaire établissant la nodulation chez les légumineuses
	Agrobacterium tumefaciens et la « galle du collet »	Détails moléculaires et mécanismes d'infection par Agrobacterium
	Amidon	De la biosynthèse aux propriétés des bioplastiques
	Biocarburants	ETBE et Diester….
Santé	Les artichauts	Bienfaits et métabolites associés
	Les phytostérols	Les phytostérols dans l'alimentation : leurs effets bénéfiques sur l'organisme
	Flavonoïdes	Les bienfaits du Thé vert et des Flavonoïdes qu'il contient
	Huile d'olive	Bienfaits, propriétés et métabolites associés
Techniques	Culture *in-vitro*	Objectifs, mise en œuvre, applications
	Transgénèse végétale	Méthodes, principes, objectifs, applications
	Production de protéines recombinantes dans les plantes	Objectifs, faisabilité, génie génétique requis, applications
	Amélioration des plantes	Histoire de la domestication et évolution des techniques de sélection
Développement durable	Espèces invasives	Ex : La Renouée du Japon
	Génie Végétal	Utilisation de plantes pour la stabilisation des sols
	Eco-construction	Ex : Le chanvre
	Monoculture	Ex : Le palmier à huile

BIO305 – Interactions bactéries/hôtes

Back

Parcours, Semestre : L2-Biologie, L2-Biologie International *, S3*

Nombre d'ECTS : 3

Responsable(s) pédagogique(s) de l'UE :

- Joël Gaffé, joel.gaffe@univ-grenoble-alpes.fr

Équipe pédagogique : Joël Gaffé, Dominique Schneider, Thomas Hindré.

Volume Horaire : 12 h CM (8 séances) ; 15 h TD (10 séances).

Langue d'enseignement : Français

Pré-requis de cette UE : Bases de biologie cellulaire procaryote (voir BIO201)

UE obligatoire ou à choix : A choix.

Objectifs pédagogiques de cette UE :

- Appréhender les mécanismes d'interactions des bactéries avec leur environnement, avec elles-mêmes et avec leurs hôtes (humains, animaux, protistes, végétaux)
- Appréhender la notion de méta-organisme/holobionte via l'exemple du microbiote intestinal humain
- Connaître des mécanismes moléculaires conférant un caractère pathogène à certaines espèces bactériennes.
- Connaitre les techniques d'analyse de la régulation de l'expression génétique (KO, génétique moléculaire, PCR, électrophorèses, expression des gènes, fusions, empreinte à la DNase, gel retard, ...)
- Analyser des résultats expérimentaux
- Apprendre la synthèse critique d'articles scientifiques (hypothèses, expérimentations, interprétations)
- Apprendre la démarche et la communication scientifique, augmenter la pratique de recherche bibliographique.

Présentation de cette UE

L'objectif de l'UE est de présenter les différents types d'interactions (symbiose, commensalisme, parasitisme) entre les bactéries et les organismes eucaryotes, animaux, protistes ou végétaux, ainsi que les moyens de visualiser l'évolution de ces interactions. Les thèmes développés seront les interactions entre bactéries et avec leur environnement, le microbiote intestinal humain (caractérisation, fonction), les bactéries pathogènes du tube digestif, la symbiose bactérie/plantes et les bactéries pathogènes chez les insectes.
Les séances de TD sont consacrées à l'analyse de données expérimentales en lien avec les thèmes abordés en cours.

Descriptif de BIO305

Back

Cours Magistraux :

I. Interactions des bactéries avec leur environnement et entre elles :

A. Les systèmes de régulation à deux composantes
B. Le quorum sensing (détection de la densité cellulaire)
C. La formation de biofilms.

II. Le microbiote intestinal

A. Niche écologique et méthodes de caractérisation de la diversité génétique
B. Composition du microbiote humain
C. Dynamique du microbiote intestinal (au cours de la vie, en fonction de l'environnement)
D. Fonctions physiologiques du microbiote intestinal
E. Microbiote et dysbioses (obésité, inflammation chronique)
F. Exemples de bactéries pathogènes du tube digestif (caractéristiques, cycle de vie, déterminants génétiques et régulation de la virulence).

III. Interactions bactériennes :

A. Avec des protistes (amibes)
B. Avec des animaux (fourmis, insectes)
C. Production de toxines (mode d'action, cycle, applications)
D. Symbiose entre bactéries fixatrices d'azote et les plantes (cycle de l'azote, étapes de la symbiose, mécanismes moléculaires et génomiques).

Travaux Dirigés :

Analyse de résultats expérimentaux, analyse d'articles scientifiques, analyses et rôles des techniques majeures de génétique moléculaire.

Travail préparatoire.

BIO439 – Biochemistry II: Enzymology and Metabolism

Back

Course, Semester: L2-international biology, Semester 4

Number of credits: 6

Course directors:

- Alexandre Dawid, alexandre.dawid@univ-grenoble-alpes.fr
- Jean-Marie Bourhis, jean-marie.bourhis@ibs.fr

Teaching staff: Sylvie Armand, Christelle Breton, Olivier Lerouxel, Nicolas Tarbouriech, Bernard Priem, Steffen Reinbothe, Marc Jamin, Frank Thomas, Mickael Cherrier, Françoise Cornillon, Franck Fieschi, Nicolas Tarbouriech, Yves Markowicz

Teaching content: 19.5h lectures (13 sessions) ; 19.5h Tutorials (13 sessions) ; 12h practical sessions (3 sessions)

Language of instruction: English

Entry requirement: Biomolecular constituents of the cell (see BIO131), Thermodynamics and Chemical Kinetics for biologists (see CHI335)

Core or optional course: Core

Objectives:

- Demonstrate the ability to synthesise knowledge acquired during the course
- Demonstrate the ability to use knowledge to solve problems.
- Demonstrate the ability to use constructed reasoning, not just the restitution of knowledge
- Demonstrate the ability to manipulate
- Learn to write reports on practical work and the care taken in their presentation.

Course description:

This course aims at acquiring the basics of enzymology (catalysis, Michaelis-Menten equation, catalysis mechanisms) and metabolism (glycolysis, Krebbs cycle, bacterial metabolism). The TD sessions consist of application exercises of the notions seen in class and the preparation of the TP sessions. The practical sessions concern the learning of the manipulation and characterization of enzymes (purification, spectroscopy).

Description of BIO439

Back

Lectures:

I. Bioenergy: is a chemical reaction spontaneous?

II. Enzymology:

A. Catalysis
B. Michaelis-Menten equation
C. Concept of inhibitor
D. Post-translational modifications of proteins
E. Examples of enzymatic catalysis mechanisms

III. Proteins:

A. Structure
B. Properties
C. Different modes of regulation
D. Fonctions

IV. Metabolism:

A. Glycolysis
B. Krebs cycle

V. Métabolisme bactérien

Tutorials:

- Reminder on the calculation of concentrations, dilutions and purities
- Proteins
- Enzymology
- Bioenergetics
- Metabolism

Nature: Exercises to apply the course and prepare for the practical exercises, preparatory work required before the session.

Practical work :

- TP-1 Determination of the optimum pH of Bacillus subtilis alpha-amylase during starch hydrolysis (spectroscopy, computer processing of results)
- TP-2 Determination of the kinetic parameters Vmax and KM of alkaline phosphatase during the hydrolysis of PNPP. (spectroscopy, computer processing of results)
- TP-3 Followed by a purification of beta-lactamase (affinity purification, spectroscopy, computer processing of results)

BIO432–Physiology

Back

Course, Semester: L2-international biology, Semester 4

Number of credits: 6

Course directors:

- Olivier Lerouxel (Plant physiology), lerouxel@cermav.cnrs.fr
- Catherine Ghezzi (Animal physiology), catherine.Ghezzi@univ-grenoble-alpes.fr

Teaching staff: Stéphane Tanguy, Claire Rome, Sabrina Boulet, Catherine Ghezzi, Florence Courtois, Olivier Lerouxel, Gabrielle Tichtinsky, Sandrine Fraboulet, Fabien Lanté.

Course content: 27h lectures (18 sessions) ; 12h tutorials (8 sessions) ; 18h practical work (6 sessions).

Language of instruction: English

Entry requirement: Basics of cell biology (see BIO231 and BIO331)

Core or optional course: Core

Objectives:

- To know the experimental approach in biology including its ethical dimension.
- To know a function integrating the electrical activity of a nerve and the voluntary contraction of a muscle.
- To know two different contraction mechanisms: the voluntary contraction of skeletal muscle and the spontaneous contraction of cardiac muscle.
- To know the mineral nutrition and the management of water stress by plants.
- To know the photosynthetic function and the plant metabolism
- To know plant evolution: growth and differentiation in plants

Course description:

This course covers both animal and plant physiology, integrating in both disciplines an experimental approach directly linked to the theoretical teaching. In animal physiology, it concerns the study of human physiological functions such as homeostasis, rest and action potential and muscular contraction.) The plant physiology part concerns the mineral and carbon nutrition of plants, as well as the development of Angiosperms and its regulation. The TD sessions consist of application exercises, analysis of experimental results and preparation of the TP sessions.

Description of BIO432

Back

Lectures:

Plant physiology:

I. Mineral nutrition and solute transport (3 lectures - 4.5h):

A. Ultrastructure of the plant cell
B. Water potential and solute transport
C. Mineral nutrition and the nitrogen cycle

II. Autotrophy and metabolism (3 lectures - 4.5h):

A. Photosynthesis: C3/C4/CAM metabolism
B. Distribution and use of photo-assimilates

III. Growth and Development (3 lectures – 4.5h):

A. Phytochrome and germination control
B. Cell elongation and differentiation
C. Flowering control
D. Fruit ripening and seed dormancy

Animal physiology:

I. Concept of homeostasis

A. The cell membrane: from reminders to the notion of an excitable cell
B. The functioning of the neuron

II. Membrane resting potential

A. Selective membrane permeability
B. Equilibrium potential of ions

III. Action potential

A. Generation
B. Conduction

IV. Skeletal muscle contraction

A. Synapses
B. The neuromuscular junction: an example of a chemical synapse
C. The skeletal muscle
D. Muscle contraction
E. Pathophysiology of the neuromuscular junction: myasthenias

V. Myocardial contraction

Tutorials:

Plant Physiology:

TD1: Water potential and water movement by osmosis (application exercises/ personal work)

TD2: Root uptake and mineral nutrition (Analysis of results from selected scientific publications, personal work on hypothesis building and data interpretation)

TD3: The functioning of photosynthesis, from the cellular to the molecular scale (application exercises/personal work).

TD4: Hormonal control of cell differentiation and fruit development. (Analysis of results from selected scientific publications, personal work on hypothesis building and data interpretation)

Animal Physiology:

TD1: Preparation for the experimental approach of the electrical activity of the nerve (preparatory work)

TD2: Preparation for the experimental approach to skeletal muscle contraction (preparatory work)

TD3: Electrophysiology exercises 1 (application exercises)

TD4: Electrophysiology exercises 2 (application exercises)

Practical work:

Plant physiology:
Lab 1: Demonstrating the photochemical aspects of photosynthesis (Hill reaction)
Lab 2: Plant growth and development: hormonal control and exogenous factors

Modality: preparatory work evaluated in sessions (Knowledge of the principles of the methods and the experimental conditions, Preparation of an operational flow chart for the practical sessions)

Techniques studied: Spectrophotometry, enzymatic reaction assays, extraction and assay of molecules, biometric analysis and research of quantitative markers

Animal physiology:
Lab 1: Study of the electrical properties of the nerve on a frog sciatic nerve model
Lab 2: Study of voluntary contraction of skeletal muscle on a frog sciatic nerve-gastrocnemius muscle preparation: recording of variations in muscle tension in response to nerve stimulation.
Lab 3: Histology, microscopic observation, spinal cord, nerve, striated skeletal muscle.

BIO403 – Écologie

Back

Parcours, Semestre : L2-Biologie, L2-Biologie International, L2-SVT, S4

Nombre d'ECTS : 6

Responsable(s) pédagogique(s) de l'UE :

- Stéphane Bec, stephane.bec@univ-grenoble-alpes.fr

Équipe pédagogique : Stéphane Bec, Rolland Douzet, Arnaud Foulquier, Stéphane Reynaud, Sophie Sroda, François Pompanon, Florian Boucher, Mathieu Loubiat

Volume Horaire : 19.5h CM (13 séances) ; 20.5h TD (13 séances) ; 8h TP (2 séances, dont 1 séance TP terrain).

Langue d'enseignement : Français

Pré-requis de cette UE : Biologie des organismes animaux et végétaux (voir BIO202) Introduction à la biologie mathématique et à la dynamique des populations (voir MAT206)

UE obligatoire ou à choix : Obligatoire.

Objectifs pédagogiques de cette UE :

- Connaître les différents niveaux d'intégration de l'étude des diversités biologiques (organisme, population, communauté, écosystème)
- Être capable de caractériser ces niveaux d'organisation à un instant t (variables d'états) et d'appréhender leur dynamique dans le temps et dans l'espace.
- Comprendre un état de biodiversité comme résultant d'un ensemble d'interactions entre organismes et facteurs biotiques et abiotiques de leur environnement.
- Être capable d'analyser des graphiques de résultats expérimentaux et de les interpréter en relation avec les concepts généraux de la discipline.
- Appréhender les méthodes d'études utilisées en Écologie : techniques d'inventaire, de dénombrement, protocoles expérimentaux.
- Être capable d'appliquer les concepts de l'Écologie à des cas d'études concrets (TP terrain), notamment à la compréhension des écosystèmes de montagne.

Présentation de cette UE :

Il s'agit d'une UE visant à la compréhension des concepts généraux et fondamentaux de l'écologie. Elle concerne en particulier les différents niveaux d'intégration en écologie (population, communauté, écosystème, biosphère), l'écologie des populations (dynamique des populations), des communautés (filtres historiques, biotiques et abiotiques et composition des communautés) et des écosystèmes (grands cycles biogéochimiques, écotoxicologie).
Les notions abordées sont approfondies en TD par des exercices d'applications et des analyses de résultats expérimentaux et en séance de TP dont une consiste en une sortie terrain.

Descriptif de BIO403

Back

Cours Magistraux :

I. Introduction : (1CM = 1,5h)

A. Définition de l'Écologie.
B. Différents niveaux d'intégration en Écologie

II. Écologie des populations : (3CM = 4,5h)

A. Le système population / environnement
B. Répartitions des populations : typologie et déterminismes.
C. Structure des populations : Densité, dénombrements – Distribution des individus – Structure d'âge – Structure de sexe.
D. Interactions population / environnement : Stratégies d'acquisition des ressources.
E. Écologie du comportement : La vie en groupe, du grégarisme à la socialité.
F. La population dans le temps : Dynamique des populations (modèles de croissance exponentielle et logistique. Modèles de dynamiques de systèmes proie/prédateurs).
G. Stratégies biodémographiques (1) : modèles r et K.

III. Écologie des communautés : (5CM = 7.5h)

A. La communauté : définition – Variables d'état : Richesse et Diversité spécifique.
B. Structuration des communautés : Déterminismes des répartitions des organismes.
C. Facteurs abiotiques : gradients directs – gradients complexes.
D. Facteurs historiques : Éléments de biogéographie : cas d'études chez des communautés alpines.
E. Facteurs biotiques : relations interspécifiques, typologie et exemples en milieu alpin, balance des interactions biotiques avec l'altitude (compétition vs facilitation).
F. Stratégies biodémographiques (2) : modèles CSR
G. Dynamiques des peuplements : les successions écologiques (typologie et déterminismes)
H. Contraintes et adaptations à la vie en milieu alpin.

IV. Grands cycles biogéochimiques : (2CM = 3h)

A. Cycle de l'eau.
B. Cycle du carbone.
C. Cycle de l'azote.

V. Écotoxicologie : (2CM = 3h)

A. Les différents types de polluants et leur transfert
B. Etudes de cas
C. Ecotoxicologie et biomarqueurs

Travaux Dirigés :

- Méthodes de dénombrement et d'estimation de densités de populations.
- Dynamique des populations.
- Successions écologiques.
- Balance des interactions biotiques avec l'altitude.
- Espèces invasives.
- Stratégies biodémographiques en milieu alpin.
- Le concept de niche écologique.
- Le cycle du carbone.
- Écotoxicologie : le cas de PCB.
- La biodiversité face au changement climatique.

Nature : Exercice d'application, analyse de résultats expérimentaux
Modalité : Travail préparatoire en amont de la séance, travail en ilot lors des séances.

Travaux Pratiques :

TP Caractérisation de communautés de faune du sol :

- Observation sous loupe binoculaire et microscope du résultat de techniques d'extraction de la faune du sol (extraction de Berlèse-Tullgren).
- Identification des organismes présents (utilisation de clés de détermination). Acquisition d'images et traitement de celles-ci (logiciel d'acquisition et de traitement d'images. Travail sur indications de taille, étalonnage d'échelles, légendes.)
- Technique de dénombrement total et/ou par sous-échantillonnage.
- Compte-rendu numérique : caractérisation des organismes (images), résultats d'inventaires (table, graphique), comparaison de différentes communautés.

TP terrain : Etude d'une zone humide : le marais de Montfort :

1- Présentation concrète d'un écosystème de type zone humide :

Les caractéristiques physico-chimiques (contraintes abiotiques) – diversité des milieux dans cet écosystème et caractérisation des communautés animales et végétales. Interactions organismes/facteurs abiotiques et organismes/organismes (=relations interspécifiques).

2-Biologie de la conservation :

Statuts réglementaires de conservation et cas concrets d'action de gestion appliqués à la conservation d'espèces patrimoniales (exemple de lépidoptères myrmécophiles à statut de protection élevé.)

Compte rendu numérique : test interactif sous forme d'analyse d'images (interprétation de photos de paysages, de formations végétales, de relations interspécifiques…)

CHI430 – Aqueous solutions in Biology

Back

Course, Semester : L2-international biology, Semester 4

Number of credits: 3

Course director:

- Yohann Moreau, yohann.moreau@univ-grenoble-alpes.fr

Teaching staff: Yohann Moreau.

Teaching content: 7.5h lectures (5 sessions) ; 15h tutorial (10 sessions) ; 6h practical work (2 sessions).

Language of instruction: English

Entry requirement: Definition of a chemical reaction, the equilibrium constant, calculation of pH, predominance diagram and oxidation reduction (see CHI131, CHI233, CHI335)

Core or optional course: Core

Objectives:

- Predict the composition (species concentration) of an aqueous solution as a function of its pH, solubility and potential.
- Calculate the concentration of species as a function of the solubility of the components
- Calculate the pH of a solution composed of a mixture of acid and base
- Know Nernst's law
- Know how to calculate the potential of a battery

Course description:

This course deals with the properties of water as a solvent in relation to biology. It deals in particular with the notion of pH and associated calculations, solubility and redox reactions. The notions seen in the course are deepened in TD by application exercises and in TP by potentiometric titration experiments.

Description of CHI430

Back

Lectures:

5 lectures :

1. pH calculations (mixtures, polyprotic acids/bases, amino-acids)

2-3. solubility (in pure water, solubility and pH, common-ion effect)

4-5. redox systems (redox reactions, Nernst equations, galvanic cells, potential in function of pH)

Tutorials:

Nature : applied exercises

Modality : Preparatory work, and in group

Practical work:

Modality : preparatory work+ lab report/ short test

Technics : potentiometric titrations (pH, solubility)

BIO434 – Experimental project in biology

Back

Course, semester: L2-international biology, Semester 4

Number of credits: 6

Course director: Gabrielle Tichtinsky

- Gabrielle Tichtinsky, gabrielle.tichtinsky@univ-grenoble-alpes.fr

Teaching staff: Virgile Adam, Guillaume Allorent, Davide Cobessi, Florence Courtois, Eve De Rosny, Hans Geiselmann, Cécile Lelong, Olivier Lerouxel, Virginie Stoppin-Mellet, Gabrielle Tichtinsky

Teaching content: 1h lecture (1 session) ; 7.5 h tutorial (4 self-training sessions and 1 face-to-face session) ; 1.5h tutoring (4 sessions) ; 32-40 h Practical work (4-5 sessions of 8h).

Language of instruction: English

Entry requirement: theoretical and experimental knowledge in spectrophotometry, light microscopy, enzymology, protein purification, bacterial culture and genetics, mechanisms of photosynthesis, developmental responses to light in angiosperms (see BIO331, BIO332, BIO334, BIO431, BIO432)

Core or optional course: optional

Objectives:

- Analyze a scientific question, conceive an experimental approach, carry out various experiments semi-autonomously, adapt a protocol to a given project, present and analyze experimental results;
- Organize one's work time, prioritize one's objectives, adapt a work plan in real time according to various constraints, work independently and/or in pairs (discuss choices and make decisions in pairs)
- Search for relevant information via various sources, report in writing and orally on the progress of a project.

Course description:

The objective of this course is to introduce students to the conduct of an experimental project in biology on one of the three themes proposed, namely "Plants and light", "Control of diauxia by the lactose operon in Escherichia coli" or "Biochemical and functional characterization of a protein of interest". The students work in pairs with the help of two teachers during personalized tutorials allowing the construction of the project (framing of the problem, choice of experiments, selection of protocols, interpretation of results). They also benefit from self-training materials that introduce the methods of constructing an experimental plan and analyzing scientific data. The experimental projects are carried out in semi-autonomous conditions during a 5-day mini-internship in a laboratory. This is a professionalizing UE insofar as the skills developed and evaluated correspond in part to those expected for a project manager.

Description of BIO434

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Lectures:

A single introductory slot introduces the notion of scientific approach and presents the organization of the course.

Tutorials:

4 self-taught tutorials on Moodle are to be done at the rate of one tutorial per week for 4 successive weeks, followed by a final tutorial with a teacher.

The topics covered are: (1) The notion of hypothesis in the experimental approach, (2) Controls in experimental biology, (3) Making figures to communicate results. These TDs are based on experimental data largely taken from previous sessions of the UE. They aim at giving expertise that can be directly used for the project, such as the realization of a functional organization chart of the project, the planning of control experiments, the design and realization of figures.

Tutoring:

The design of the project by the pairs is done over a period of 10 weeks, according to a pre-established progression, with 3 planned meetings with the tutor teachers. Specific preparatory work is required before each of these meetings. A 4th tutorial takes place after the practical course in order to finalize the presentation and the analysis of the results.

Practical work:

A 3 to 5 day practical training course takes place at the end of the semester in order to carry out the planned project. This internship takes place on the biology practical work platform (CUBE), allowing the implementation of a diversity of techniques adapted to the project (bacteria and plant culture, numerous biochemical analysis techniques, cytology, etc.).

BIO407 – Questions d'actualités en biologie

Back

Parcours, Semestre : L2-Biologie, L2-Biologie International ; S4

Nombre d'ECTS : 6

Responsable(s) pédagogique(s) de l'UE :

Isabelle Le Brun, isabelle.le-brun@univ-grenoble-alpes.fr

Équipe pédagogique : Christel Carles, Kateryna Fal, Bertrand Favier, Muriel Raveton, Françoise Blanquet, Bertrand Favier, Anthony Lucas, Chantal Thibert, Clément Acquitter, Marc Billaud, Clément Brossard, Eric Fourneret, Benjamin Lemasson, Olivier Epaulard, Cyril Labbé, Jean-Marc Vincent, Lucas Benoit, Isabelle Le Brun

Volume Horaire : 30 h CM (20 séances) ; 30 h TD (20 séances)

Langue d'enseignement : Français

Pré-requis de cette UE : Connaissances en biologie de niveau L1

UE obligatoire ou à choix : A choix

Objectifs pédagogiques de cette UE :

- Savoir actualiser ses connaissances
- Connaître et être capable de réaliser les étapes nécessaires à la réalisation d'un travail de veille scientifique.
- Comprendre comment on fabrique l'information ET proposer un regard critique sur les sources = savoir CROIRE…ou SE MEFIER !!!
- Être capable d'évaluer la fiabilité d'une source.
- Être capable de travailler en groupe (répartition des tâches, échanges des informations, confrontation des idées).
- Être capable d'organiser des idées et de les présenter par écrit.
- Savoir défendre une idée en donnant des arguments scientifiques validés et en faisant preuve d'esprit critique.

Présentation de cette UE :

Dans cette UE, les étudiants travaillent en équipe de 5 à 7 sur 4 problématiques suivant un cycle méthodologique pour acquérir les outils de veille scientifique = « Challenge Méthodo » et trois cycles thematiques pour les utiliser = « Apprentissage Par Problème ». Chaque cycle comprend des conférences (4 à 6 « cours magistraux » selon les thèmes) et 5 séances de TD-tutorat dont les résultats sont présentés à l'écrit et à l'oral. Les 3 thèmes abordés constituant des ouvertures pouvant intéresser au-delà de l'UE, les cours-conférences ont été placés sur un créneau de milieu de journée afin de les rendre accessibles au personnel, enseignants et étudiants de la Licence Science et Technologie. Il s'agit d'une UE professionnalisante dans la mesure où les compétences développées et évaluées correspondent pour partie à celles attendues pour un responsable de veille scientifique et dans les métiers de la communication scientifique.

Descriptif de l'UE BIO 407

Back

Cours Magistraux :

I. Méthodologie : 6 séances de 1h30

Extraire des infos : savoir LIRE & RESUMER | Avoir conscience des limites des moteurs de recherche sur internet| Outiller son esprit critique | Extraire (et synthétiser) des infos : Savoir ÉCOUTER & RÉSUMER | De la recherche scientifique à la vulgarisation scientifique | Modes de publications scientifiques et fraudes associées.

Les thématiques abordées sont susceptibles de changer en fonction de l'actualité scientifique. A titre d'exemple, le programme de l'année 2019-20.

Thématique 1 : 4 amphis de 1h30 « Les plantes » - Évolution, plantes et environnement.

De la domestication à l'amélioration biotechnologique des plantes | Les pratiques culturales : méthodes, impacts et défis actuels | Évolution : d'Aristote à la classification phylogénique | Dépollution des sols

Thématique 2 : 4 amphis de 1h30 « Les animaux » - Les animaux et la recherche.

Réglementation et éthique en expérimentation animale | Transgénèse | CRISPR : Principes, Applications, Législation | Modèles animaux et cancer, points limites

Thématique 3 : 5 amphis de 1h30 « L'Homme » - Technologies médicales et société.

Où en est-on avec la médecine personnalisée ? | Vaccin anti-grippal : une cible mouvante ? | Imagerie médicale, cancer et médecine personnalisée | L'augmentation technologique face à la vulnérabilité | Les révolutions techno-scientifiques sources d'enjeux éthiques et sociaux

Travaux Dirigés :

- METHODOLOGIE : exercices individuels et en équipe, production d'une synthèse par équipe, présentation orale courte

Travailler en équipe efficacement et durablement | Cerner la problématique, sélectionner et référencer ses sources | Hiérarchiser et catégoriser les informations | Résumer et rédiger les messages clés | Présenter et communiquer ses résultats

- THEMATIQUES : production d'une synthèse par équipe, présentation orale et écrite

Accompagnement guidé (tutorat), chaque équipe devra répondre à une problématique par thème d'APP : une fois par écrit et deux fois à l'oral.