UNIVERSITÉ DE RENNES 1

Faculty of Life Sciences and Environmental Studies

↳ *Undergraduate Exchange Programme in Biology*



The *Undergraduate Exchange Programme in Biology* is targeting foreign students willing to study in Rennes but without necessarily having the language skills to attend French speaking courses.
The lectures cover a broad range of topics and reflect the research activities of the teaching staff. Each course includes from 20 to 90% of practical work which are organized in teaching labs organized over 1 to 5 days.
At the end of the programme, the students may apply to an internship in a research laboratory (8 weeks – the placement is not guaranteed).

Admission

The *Undergraduate Exchange Programme in Biology* is open to international students from our partner universities. Students have to be selected by their home university.
Two years of undergraduate studies are required for admission.

Courses

5 teaching units, 6 ECTS (European Transfer Credit System) each:

UE1bis - Molecular Interactions and enzymology
UE2bis - Immunology, virology and application
UE3bis - Cell cycle, apoptosis and aging
UE4bis - Eukaryotic Genetics
UE7bis - Biology and physiology of reproduction

An optional free-of-charge **French language course** can also be taken on a volunteer basis (4 hours per week, 5 ECTS credits) during the semester.

Planning

- starts September 3rd , ends mid-December ;
- 1 week holiday break between the very end of October and the beginning of November;
- Christmas vacation and revision from December 21st to 7th January
- First exams session from January 7-8th to 11th

Contact

Dari-beaulieu@univ-rennes1.fr

UE1bis - Molecular Interactions and enzymology
Lectures: 24 hours
Tutorials: 14 hours
Practical work: 15 hours
ECTS: 6

Objectives: Understand protein/protein and protein/ligand interactions through the kinetics point of view and at the molecular level; Assimilate how different types of enzyme work (michaeliennes, two substrates and allosteric); Know how to use and master the bases of mathematical treatment of the molecular interaction allowing to the determination of affinity constants and kinetic parameters.
Lectures: Background, history and classification. The different models for molecular interaction. Study of molecular interactions protein/ligand and protein/protein at the methodological, structural and kinetic levels, (measurement methods, assays and analysis of equations corresponding to the modes of linear and nonlinear representations for the determination of binding constants and kinetic parameters. Application to the interaction enzyme / substrate and Quantification and purification tracking. In-depth analysis of the Michaelis-Menten equation under the assumption of equilibrium and steady state. Kinetic parameters determination in the presence of inhibitors. Kinetics study of enzymes with two substrates, molecular interactions in binary or ternary complexes. Catalytic site-directed mutagenesis. Molecular Interactions: working and regulation of allosteric enzymes.
Tutorial: many exercises will be offered on topic discussed in conference. The objective is to develop the student ability to reason about problems of enzymology and learn to apply the concepts covered during lectures from experimental data interpretation.
Practicals: Experimental works taking place over two days. The first day will be devoted to the purification of a two substrates enzyme and the second day, to the study of its mechanism. Assessments: Continuous assessment includes a mid-term written test of 1 hour in the middle of the semester, and a notation of the experimental work in the second practice sessions, a report and a test on the practical session.
Prerequisites: knowledge of the biomolecules (structure) and basis of enzymology

UE2bis - Immunology, virology and application
Lectures: 27 hours
Tutorials: 8 hours
Practical work: 17 hours
ECTS: 6

Objectives: Give students solid bases in immunology and virology. Tackle the diversity of technologic applications developed from this knowledge. At the end of this course the student must be able to master antibodies use in biology (production, concepts and experimental implementation). They must know how to use their knowledge in immunology and virology to understand and participate to an experimental strategy using immunology and virology tools.
Lecture: Bases of Immunology: major principles of immune defence system in mammals, distinction of "self and non self", innate and acquired immunity functions.
Bases of Virology: properties, characteristics and classification of virus, transmission mode, viral multiplication cycles of principal viral groups, cellular response.
Knowledge of principal applications: polyclonal and monoclonal antibody, vaccination, techniques of research of an infectious agent, virus vector of genetic information
Tutorial work: Many exercises will be proposed to students on application of learned concepts and there will be a deepening of study techniques of immune system and virus. The objective is to develop the aptitude to reason on immune and virology problems and to master fundamentals principles of an organism's immune defence system.
Practical work: During 2 days of practical work, students will practice a few basic methods in haematology and immunochemistry: blood group test, blood smear analysis for leucocytes morphology. Mononuclear cells purification from blood. Rosette-forming T cells counting. Virtual flow cytometry analysis. Ouchterlony analysis of Ig constitution and isotype. Cytopathogenic effects and viral titre determination. Investigate the scientific literature to answer topical question in immunology or virology (oral and written team work).
Assessment: Graded pratical work. Graded oral presentation. End of Semester written final exam.
Prerequisites: Knowledge in cellular biology, molecular biology, biochemistry and enzymology

UE3bis - Cell cycle, apoptosis and aging
Lectures: 24 hours
Tutorials: 8 hours
Practical work: 21 hours
ECTS: 6

Objectives: The aim of this course is to:

- Describe the molecular mechanisms involved in apoptosis
- Provide complete overview of regulatory mechanisms controlling cell cycle.
- Describe the why and how cellular aging occurs in animals.
- Describe changes in chromatin associated with apoptosis, cell cycle and aging.

At the end of this course the student should:

- Master the concepts underlying the cell choice between cell cycle arrest and apoptosis.
- Have a clear understanding of the rationale behind the use of different animal models to study these phenomena.
- Be able to interpret experimental data covering this topic.

Lecture: Mechanisms regulating cell cycle; Apoptosis and other cell death processes; Cellular aging: replicative versus chronological senescence; Adaptation of chromatin to cell state decisions.
Tutorial work: During tutorials, the students will analyze experimental data illustrating the concepts that had been taught during lectures and they will become familiar with the methods used to generate such data.
Acquired skills:
Teaching programme:
Practical work: During two labwork sessions students will learn:

- How to analyze the apoptotic phenotype of mouse thymocytes.
- How to analyze the effects of a drug affecting cell cycle.

Assessment: Continuous assessment consists of two labwork reports and an oral exam. The terminal exam is a two-hour writing session.
Prerequisites: Have a good knowledge of the basics of cell biology.

UE4bis - Eukaryotic Genetics
Lectures: 22 hours
Tutorials: 18 hours
Practical work: 13 hours

Objectives: The aim of this course is to provide a strong basic knowledge in reverse and forward genetic strategies and about key models that are used in eukaryotic genetic analysis (drosophila, *Caenorhabditis elegans*, mouse, yeast, *Arabidopsis thaliana*…), and to address the principles of genetic cartography and the specific features of the genetic analysis in human.

Learning outcomes: At the end of this course the student must:

- be able to use an advanced genetic vocabulary,
- understand and formulate forward and reverse genetic analysis strategies,
- have some knowledge of the genetic resources available through the internet.

Lecture: Principles of Genetic analysis,
Principles of Genetic cartography,
Forward genetic in yeast and drosophila,
Reverse genetics in yeast and mouse,
Introduction to human genetics.

Tutorial work: Numerous genetic problems will be proposed to the students to apply and test their understanding of the different concepts seen during the lectures. The main goal is to develop the capacity to think and solve genetic problems and to learn how to apply the principles of genetic analysis to experimental data.

Practicals: Students will learn in 4 practical sessions to perform and to interpret genetic experiments in *C. elegans.* They will also learn to use the online resources available for this model.

Assessments: Continuous assessment undertakes a mid-term oral examination and three 15 min written tests during the 2nd, 3rd and 4th practical sessions. Final term examination is a 2 hours written exam.

Prerequisites: The "Bases of Genetics" unit taught during the 2nd year.

UE7bis - Biology and physiology of reproduction

Lectures: 26 hours

Tutorials: 10 hours

Practical work: 2 hours

Objectives: To understand the reproductive function at systemic, organ, cell and molecular levels. The emphasis is on the gametes and hormones production including sex steroids, as well as on their role in the preparation of the female after fertilization, to carry the embryo, during pregnancy (Viviparous) and feed it after birth for a period of lactation.

To understand sexuality processes: (sexual orientation, becoming man/woman, sexualisation of the brain...)

Lecture: Differentiation and sexual determinism; Hypothalamo pituitary axe (Structure and function); Male and female reproductive system (Structure and function (gametogenesis and steroidogenesis); Fertilization, Placenta Physiology and endocrinology; Lactation: mammary gland, mammogenesis, lactogenesis; Brain sexualisation: sexual orientation, becoming man/woman, etc.

Tutorials: Data analysis of publications related to the course content. The objective is to learn how to make a link between the concepts treated in courses and the experimental results.

Practicals: Lab work sessions allow students to understand the experimental approaches and techniques used in reproductive function experimental studies.

Study the effects of steroid hormones on genital tract (model of rats ovariectomy and castration treated or not by steroid hormones).

Study of gonadal feedback on the pituitary: ovariectomy or castration and measurement of gonadotropins by ELISA assay. Studies of the control of uterine muscle contraction.

Female and male gametogenesis (histology), Observation of sperm mobility acquisition in rat epididymis.

Assessments A One-hour Continuous written assessment will take place in the middle of the semester. Terminal assessment is a two-hour writing.