Bachelor's degree in Life Sciences
Course information for incoming undergraduate students

General Information

Spectacular progress has been made in cell and molecular biology in recent decades. This progress has already had a huge impact in sectors as diverse as Health, Biotechnology, Plant Sciences, Nutrition and Agriculture.

At the end of your Bachelor's degree in Life Sciences, you will have acquired the scientific training that will allow you to orient yourself towards the following fields of activity:

Human health: development of innovative pharmacological, cellular or molecular therapies to treat severe pathologies (allergies, kidney failure, heart attack, hypertension, cancers, etc.),
Modern biotechnologies: development of diagnostic or research tools, miniaturization, robotization applied to biology.
Crop production: improvement of production systems in terms of reasoned crop protection and sustainability, optimization of industrial and food products from plants.
Human nutrition: understanding the management of cellular energy resources, providing therapeutic solutions to disease (obesity, anorexia, diabetes, etc.).

Studying Life Sciences is training to participate in future discoveries and their exploitation in everyday life!

Teaching

Some modules in the first semester of the L3 year are taught in English to a small (18 students) group of selected students. These modules may be associated with the second year module in General Microbiology, which is also taught in English in the first semester.

In general, teaching is organized as a mix of lectures, problem-based learning (PBL) in classes of up to 36 students (TD), and lab classes. Some courses have integrated lectures and PBL. In addition, all modules have at least 10% distance learning.

For further information contact the course co-ordinators

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Course website (in French);
http://www.sciences-techniques.univ-nantes.fr/licence-sciences-de-la-vie-2020762.kjsp?RH=1183051082942

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Course summary

First semester (Sept - December, exams - first week in January)

Module Title	Place in Nantes degree schedule		Teaching language	ECTS
	Year	Semester		
Methods in Cell and Molecular Biology	3	1	English	5
Biomolecules and their functions	3	1	English	5
General Microbiology	2	1	English	5
Cell Biology 3/Immunology 2	3	1	Currently taught in French. Project to teach TD classes in English. Lectures will remain in French	5
Molecular Biology 2	3	1		5
Scientific English and TOIEC prep.	3	1		3
Professional/career project	3	1	Currently taught in French. Instructors are willing to integrate English into teaching on student request	2

Second semester (January-April, exams mid-May)

Courses are taught in French, and there are no plans to introduce teaching in English at this level. Second semester courses are specialized in one of three areas;
Cell and molecular biology; Cell biology and animal physiology; Plant and Food Sciences

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Module contents

Methods in Cell and Molecular Biology (42h lab classes - 5ECTS)

This course provides students with the technical analysis skills necessary for the molecular study of the processes of life. It links the fundamental disciplines of Biochemistry, Molecular and Cellular Biology and Immunology, with one goal: exploration of molecules important in the biological and medical fields.

- two half-days of Molecular Biology: Extraction of bacterial plasmids by the plasmid mini-preparation technique (alkaline lysis); restriction map of the purified plasmid by double digestion; transformation of the BL21 strain of E. coli using a recombinant plasmid with metalloproteinase 2 cDNA.
- three half-days of Cell Biology and Immunology: highlighting the detection and quantification of proteins ELISA test; transient transfection in COS cells of six plasmids coding for proteins coupled to fluorescent proteins (plasma membrane localization, cytoplasm or mitochondria) or either secreted enzymes (gelatinase activity).
- five half-days dedicated to extraction, purification and molecular characterization of soluble proteins: precipitation by ammonium sulphate, desalting, exclusion-diffusion chromatography, ionic and pseudo-affinity chromatography, SDS-PAGE, enzyme kinetics. To illustrate these applications, students will be able to work on proteins such as gelatinase and DHA. In addition, the use of fluorescence and absorbance will allow the study and characterization of the binding of ligands to proteins by the Scatchard method.

Biomolecules and their functions (42h integrated lectures and PBL - 5 ECTS)

This U.E. aims to provide accurate knowledge of the importance of interactions involving proteins, through examples of complex protein structures adapted to a specialized biological function.
At several points an experimental bioinformatic approach will make it possible to characterize protein-protein, protein-DNA, or protein-ligand interactions. We will study:
1) How to determine that the protein belongs to a complex
2) How to isolate this complex
3) How to identify the proteins of this complex
4) How to validate the interactions in vitro and in vivo
5) How to characterize this interaction.
In addition, in will be emphasized that since the genomes of many species have been sequenced, it is now the time to analyze the gene product - proteins and their multiple post translational modifications, by proteomics.

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General Microbiology (20h lectures, 12h lab classes, 8h TD - 5ECTS)

The module provides an overview of the organisation of prokaryotic cells, and the diversity, nutrition, growth and physiological tolerance of microorganisms. It covers five of the six domains cited in the American Society for Microbiology recommendations for an introductory course in microbiology ("Cell Structure and Function", "Metabolic Pathways", "Information Flow and Genetics", "Microbial Systems", "Impact of Microorganisms".) the sixth domain, "Evolution" is presented in the first year of the Life Sciences degree programme.

Specific topics are:
- Structure and function of the components of Gram(+) and Gram(-) cells
- Techniques for the identification and phylogenetic classification of bacteria
- Bacterial genetics and gene exchange
- Generation of metabolic energy in different trophic types
- Mechanisms of action of physical and chemical agents for the control of microbial growth, including antibiotics
- Lytic and lysogenic cycles of bacteriophage, and an introduction to virology

The importance of microbes to human activity and the environment are illustrated by presenting the normal human microbiome; examples of bacterial infections; the major industrial applications of bacteria; and the contribution of bacteria to nitrogen and carbon cycles.

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Cell Biology 3/Immunology 2 (27h lectures, 15h TD - 5 ECTS)

In cell biology, the module will address the main mechanisms concerning cell cycle regulation and apoptosis. In particular, it will aim to begin to understand how a malfunction of these processes can lead to the development of pathology (cancer, neurogenerative disease ...).
In Immunology, the module will complete the notions of general immunology acquired in L2 by developing the fundamental mechanistic bases of immune system operation.

Cell Biology Lectures (12,67h)
1. The cell cycle
General strategy of the cycle
Mitotic entry control
Study of genes involved in cycle control in yeast
Cell cycle in mammals
Role of proteolysis in cycle regulation
Role of control points in cycle regulation
2. Apoptosis
Cell functions of apoptosis
Molecular basis of apoptosis
Intrinsic and extrinsic paths
3. Cell cycle and apoptosis in pathology

Immunology Lectures (14,66h)
1. Structure of Ig and BCR
2. Function of the different Ig classes
3. Complement system
4. MHC and antigen presentation
5. Mechanisms generating repertoire diversity
6. Development of B-cells and T-cells
7. Activation and differentiation of B-cells
8. Activation and function of T-cells
9. Heterogeneity and plasticity of CD4 T-cell subpopulations
10. Cytokines and applications
11. Allergy

Problem-based learning (14,67)
The student will deepen the knowledge provided during the course on: Ig and BCR structure, different Ig classes, the different immune functions of MHC, rearrangements of Ig and TCR, development of LB and LT, a clinical case on allergy, activation of LT, complement, cytokines, cell cycle (in unicellular and multicellular eukaryotes) and apoptosis.

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Molecular Biology 2 (24h lectures, 18h TD - 5 ECTS)

Lectures:
Prokaryotes.
-Regulation of the initiation and termination of transcription and translation.
-Importance of post-transcriptional regulation based on RNA structure: attenuation, riboswitch, sRNA.
Eukaryotes.
-Regulation of transcription (action on PIC, epigenetic modifications), splicing, polyadenylation and translation.
Transcription / splicing / polyadenylation coupling.
-Importance of post-transcriptional regulation: export of mRNA to the cytoplasm, first translation and NMD, miRNA and siRNA, mRNA stability control, mRNA localization (mechanisms and utility), editing of mRNA (C to U, A to I).

Problem-based learning:
Exercises based on scientific publications on regulatory mechanisms taking an experimental approach: formulation of hypotheses according to the observed phenomenon and preliminary results, carrying out experiments to test them, analyzing the results obtained and conclusion. The techniques of detection, quantification, determination of the structure of RNA, DNA / Protein , RNA / Protein, and protein / protein interactions, are seen in the course of these exercises.

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Scientific English and TOIEC prep (24h TD - 3 ECTS)

The main objective of this module is to obtain a score of 785 (minimum) in the TOEIC®.
In order to achieve this, specific test preparation will be carried out partly in the multimedia room.
In addition, project work will give students the opportunity to mobilize linguistic skills and scientific knowledge acquired in their area of specialty (study of scientific articles in English, poster writing).

Professional/career project (16h integrated lectures and PBL - 2 ECTS)

The teaching of this UE is organized as follows:
1.Sessions to work in project mode on looking for an internship and oral communication: methodology, CV, cover letter, use of the professional network LinkedIn, the CareerCenter tool and some networks for scientists such as Researchgate.
2. Sessions to live and understand how a professional structure works. These sessions will also allow the student to reflect on their position as a trainee in a professional environment.

2h40: TD 1:Internship Research Methodology
reflection on the objectives for this internship, construction of the various stages of research, decoding of an offer, updating of skills, CV and personalization of the cover letter.
1h20: TD 2:Internship Research Tools
CareerCenter, LinkedIn: presentation and time for students to fill their profile.
2h40: TD 3: Oral communication
The fundamentals of communication, nonverbal communication, how to build a professional presentation to introduce yourself to a recruiter (pitch), adopt a professional posture.
4h00: TD 4: Simulations of interviews in autonomous subgroups and pitch presentation (Evaluation).
4h00: TD 5: The different structures and organizations possible in the world of work Rights and duties of the trainee.
1h20: TD 6:After the bachelor's degree
Work in subgroups, each student presents and discusses their perspectives after graduation.