Syllabus & Objectifs
Année académique 2018-2019

BIOTECH 5

TEACHING COMPONENTS

UI5-9-SI-1
Sciences de l'Ingénieur

Volume horaire des enseignements de l'unité d'enseignement :

CM	TD / TE	TP	
27h	89h	15h	
SEMESTRES CONCERNES : 9			
Crédits : 7 ECTS			

Détail des enseignements de l'unité d'enseignement

- Ingénierie des protéines
- Génie de la réaction
- Biostatistiques
- Opération Unitaire – Microfluidique
- Projet innovant (SBIP)

Compétences que l'unité d'enseignement contribue à former

Bloc de compétences 0 : Acquisition d'une culture scientifique

- Acquisition d'un large champ de connaissances scientifiques fondamentales

Bloc de compétences 1 : Analyse d'un système, identification d'un besoin et mise en place d'une démarche de conception d'un produit/procédé en lien avec les biotechnologies

- Appréhender, comprendre et analyser un système complexe

MI5-9-SI01 – Protein Engineering

Professor :

Baldissera GIOVANI

baldisseragiovani@gmail.com

Total number of teaching hours : 21h

CM	TD / TE	TP	Support	Project
6h	10h	5h		Team work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

To develop the students' sensitivity towards the physico-chemical laws and interactions regulating the structure of proteins and peptides. To develop the students' sensitivity to allow them to select the best target for a molecular modification

Specific objectives and acquired competencies

- To select the best cycle of production/purification/analyses/use of the modified molecule
- To understand and be able to analyse critically an article describing the structural and functional modifications of a protein
- To be able to communicate with a specialist
- Analytical and synthesis skills

Detailed course structure

1. **Module « General aspects of protein engineering»**
    - 1.1. Synthesis and modification of a protein
        a. Systematic protein engineering
        b. Combinatorial protein engineering
    - 1.2. Natural protein modifications
        a. The targets
        b. The biological role of post-transnational modifications
        c. Natural vs non-natural protein modifications
    - 1.3. Site directed mutagenesis
        a. Double primer mutagenesis
        b. Cassette mutagenesis

2. **Module « Solid Phase Peptide Synthesis»**
    - 1.4. Fundamental aspects of protein synthesis
    - 1.5. SPPS vs in solution peptide synthesis
    - 1.6. Solid Phase Peptide Synthesis (SPPS)
        a. Foundamental aspects of SPPS
        b. Properties of solid supports, resin features
        c. Functional groups, linkers
        d. Protecting groups tactics
        e. Side chain protecting groups, orthogonal protecting groups

f. Optimised SPPS
g. Checking coupling efficiency with nynhydrin test
h. Peptide cleavage, crude purification and analysis
i. SPPS and combinatorial chemistry

3. Module « Bioconjugation techniques»

1.7. Functional targets for bioconjugation
1.8. Applications of bioconjugating techniques
a. Tags and probes
b. Radio-immuno conjugates
c. Antibodies modification and conjugation
d. Immunotoxins
e. Protein microarray
1.9. Bioconjugation on existing functionalities
1.10. Bioconjugation on added functionalities
1.11. Cross-linkers
a. Zero-lenght cross-linkers
b. Homobifunctional cross-linkers
c. Heterobifunctional cross-linkers

4. Module « Chemical ligation»

1.12. Native Chemical Ligation (NCL)
1.13. Sequential Native Chemical Ligation
1.14. Expressed Protein Ligation (EPL)
a. Uses
b. How to produce a protein with a C-terminal thioester
c. How to produce a protein with a N-terminal cysteine
d. Role of the inteins in EPL
1.15. Sequential Expressed Protein Ligation

Conditions of Exams

Tests during the course : two

Project presentation : one

Written Exam : one

MI4-8-SI02 – Reaction Process Engineering

Professor :

To determine

Total number of teaching hours: 15h

CM	TD / TE	TP	Support	Project
5h	10h			-
CONCERNED SEMESTER : 8				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

- Analyze and design processes of a chemical reaction
- Provide a solid foundation in basic engineering principles
- Be able to apply the basics of (bio)chemical modelling

Specific objectives and acquired competencies

- Be able to understand the different main steps of a reaction
- Be able to determine the operating conditions associated with the main transformation processes encountered in bio-reactors : capacity to use mathematical tools to solve it
- Implement these concepts to solve problems encountered on a (bio)chemical reaction
- Be able to design a chemical modelling on a bioreactor

Detailed course structure

Sessions	**Chapters**	**Teaching Method**[1]
Session 1	Introduction on transformations and dimensions, Physical and thermal properties	Lecture, Problem solving
Session 2	Heat transfer: mathematical approaches and tools on process engineering Heat transfer applications : bioreactor modelling	Lecture, Problem solving
Session 3	Modelling of the (bio)processes : introduction on optimization	Lecture, Problem solving

Conditions of Exams

Quizzes	0%
Project	0%
Final exam	100%
Attendance	0%
Total	100%

Final Exam

The aim of the final exam is to evaluate student comprehension of learnt topics. This exam will cover many of the issues taught in class.

[1] Lecture, handouts, slides, audiovisual, interactive methods, problem solving, projects ...

MI5-9-SI-03 – Biostatistics

Professor :

Pierre-Antoine Gourraud

gourraud@methodomics.com

Total number of teaching hours : 30h

CM	TD / TE	TP	Support	Project
10h	10h	10h		Team Work on R
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 10h				
Credits : 2 ECTS				

General objectives of education

To complete the initiation to Biostatistics using a practical and illustrated approach of typical data analysis problem in Biotechnology

Specific objectives and acquired competencies

To format electronically a dataset
- To formulate the main statistical questions related to a data set
- To understand the concept of statistical estimation of a parameter by population sampling
- To interpret a confidence interval
- To calculate and interpret Odds ratio
- To perform and interpret a Chi2-test from a contingency table
- To build the appropriate statistical hypothesis testing related to a complex question in Biology.
- To compute and interpret the informative values of a diagnosis or screening test

Detailed course structure

1) The data
2) Data description
3) Modelisation and statistical hypothesis testings
4) Epidemiology : Study design and measurement of association between exposure and disease status
5) Analysis of binary trait: Sensibility, Specificity, ROC
6) Non parametric tests
7) Guidelines to build a medical questionnary

Conditions of Exams

MCQ
Project related to a statistical study of a dataset, by group of 5-6 persons

MI5-9-SI04 – Microfluidics

Professor :

Yannick Coffinier

yannick.coffinier@iri.univ-lille1.fr

Total number of teaching hours : 15h

CM	TD / TE	TP	Support	Project
6h	9h			
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

Learning about laws ruling continous and droplet based microfluidics and recent applications to the field of biology/medecine/biotechnology.

Specific objectives and acquired competencies

- Basic notions. What's new at the micro/nanofluidic scale in comparison to macrofluidic scale?
- Some dimensionless number
- Lab on a chip concept

Detailed course structure

I. Introduction to microfluidics (MF)
II. Basics in MF
- Reynolds Number (Re)
- Péclet Number (Pe)
- Laminar Flow
    1) Shear driven flow
    2) Couette flow
    3) PDF flow
    4) Effect in laminar flow
        - a) Taylor dispersion
        - b) Hydrodynamic focusing
    5) Turbulent flow
- Electrokinetics
    1) EOF
    2) Electrophoresis
    3) Dielectrophoresis

III. MF components
I) Mixers
II) Valves
III) Micropumps

IV. Micro-total analysis system concept

V. Digital MF

- Surface Tension, Contact angle, Capillarity force
- Electrowetting (EWOD)
- Superhydrophobic surfaces : application to EWOD
- Surface acoustic wave (SAW)

Conditions of Exams

Written exam *2 : half- period and end-period)to assess what they've learned

Oral presentation (10 min.+3min. for questions). Students have to present scientific project based on the fabrication of a new micro-nanodevice or concept for the field of their choice. They should include marketing and production points of view too and more if possible (toxicology, ethic....).

MI5-9-SI05 – SBIP

Professor :

Pierre Ougen

pierre.ougen@supbiotech.fr

Total number of teaching hours :

CM	TD / TE	TP	Support	Project
	70h			Team Work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 15h				
Credits : 2 ECTS				

General objectives of education

Manage in team an innovative project linked to biotechnological issues.
Be able to bring a proof of concept of the project
Be able to decide on a positioning strategy of the project (Market study, Business model approach, Legislation).

Specific objectives and acquired competencies

1) Be able to finish the validation of a technical solution a proof of concept
2) Be able to provide technology transfer
3) Be able to finish the market study
4) Finalize its project by writing a brief resume of the concept in a book

Conditions of Exams

Final oral examination
Written complete report in a book format

UI5-9-SS-1
Sciences de spécialité

Volume horaire des enseignements de l'unité d'enseignement :

CM	TD / TE	TP	
37h	66h	15h	
SEMESTRES CONCERNES : 9			
Crédits : 7 ECTS			

Détail des enseignements de l'unité d'enseignement

- Datamining / Database design
- Bioraffinerie
- Ecoconception
- Nanobiotechnologies / Miniaturisation
- Chimie Combinatoire

Compétences que l'unité d'enseignement contribue à former

Bloc de compétences 0 : Acquisition d'une culture scientifique

- Acquisition d'un large champ de connaissances scientifiques fondamentales

Bloc de compétences 1 : Analyse d'un système, identification d'un besoin et mise en place d'une démarche de conception d'un produit/procédé en lien avec les biotechnologies

- Appréhender, comprendre et analyser un système complexe

Bloc de compétences 4 : Prise en compte de l'environnement et de la biodiversité au quotidien

- Etre un ingénieur "responsable" (approche de l'éthique comme valeur - respect règles - autrui - nature)

Bloc de compétences 5 : Management d'équipe et connaissance de soi

- Gérer le collectif
- Maitriser son discours
- Se former tout au long de la vie

MI5-9-SS01 – Datamining

Professor :

Maxime Blanc

maxime.blanc@gmail.com

Total number of teaching hours: 25h

CM	TD / TE	TP	Support	Project
10h	5h	5h		Team Work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 10h				
Credits : 1 ECTS				

General objectives of education

In a data driven world, traditional charts and usual means of visualization are now out of fashion. Data is the new soil and the the new oil. Professionals are being required to support their case and make data-driven decisions. Non-IT professionals must now more than ever being able to produce and comprehend clear insights from wide datasets and communicate results effectively.

Specific objectives and acquired competencies

To unleash the true impact of data management and data science, this course aims to provide students the right framework to glean new insights and interact with their data.

1. To understand and experience what is at stake with data visualization
2. To understand and experience how bad visualization can confuse the audience
3. To develop analysis methods and skills on large datasets and various formats
4. To discover and practice new charting and design techniques
5. To discover and practice advanced data analysis and charting tools
6. To develop self teaching skills on data visualization
7. To setup a data visualization technical environment for a project

- Apply this framework during a team project on a dataset of students' choice.

Detailed course structure

1. What is « Data Visualization »?
    a. Definition
    b. Showcase on medical data
    c. Video from David McCandless, Data Journalist @ The Guardian, speaking at TED on how data visualization helps telling the right story behind numbers.
2. Stories behind the numbers
    a. Real life behind numbers
    b. Show case on a NY Times cover story
    c. Data journalism @ New York Times
    d. Data art and emotions
    e. Showcase with The Dumpster, a twitter visualization about breakups tends over a year
    f. Data entertainment
    g. Showcase on OkCupid user trends to create a buzz
    h. Data complexity and in-depth trends analysis for public policies decision making

    i. Showcase with Hans Rosling, on how public health policies around the world are impacting economic development and life expectancy
    j. Workshop to improve chart readability of a given document.
3. Harvest and transform your data
    a. Design rules
    b. Methodology
    c. Technical concepts: non structured, semi-structured, structured data.
    d. State of art on file formats (json, csv, tsv, xml, xls(x), shp, dbf, arff)
    e. Available data sources : where to harvest data
    f. Data scraping
    g. Showcase on live data scraping
4. Tools of the trade
    a. State of art on software tools
    b. Visual.ly
    c. Google Docs
    d. R
    e. D3.js
    f. Adobe Illustrator
    g. Showcase on d3.js on spatial data
5. How to visualize
    a. Patterns over time
    b. Discrete values
    c. Visual cues
6. Practical works
    a. Data scraping on weather data

Data interaction with shared google spreadsheet providing Alumni data through a json endpoint

Conditions of Exams

8. Live MCQ during courses
9. Online MCQ (1 hr)

Group work on data visualization of 4 up to 6 students on a dataset of their choice.

MI5-9-SS02 – Database design

Professor :

Maxime BLANC

maxime.blanc@gmail.com

Total number of teaching hours : 15h

CM	TD / TE	TP	Support	Project
	10h	10h		Team Work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

In a data driven world, non-IT professionals are overwhelmed with data though constantly looking for structured insights and knowledge. They are then asked to contribute to software development project, from inception phase, requirements elicitation up to data model design and even data management process definition. They are challenged beyond Microsoft Excel and simple end-users means of data management. Students must be able to address such data issues.

Specific objectives and acquired competencies

This course aims to provide students general knowledge on data management processes, state of art database technologies and a complete design methodology.

10. To understand and experience what is at stake with data management
11. To understand and experience how bad data model design and data quality quality can lead to bad decisions
12. To know and practice how to elicit and analyse business requirements
13. To know and practice data modelling (conceptual, logical, physical schema)
14. To develop self teaching skills on database design
15. To know SQL programming basics
16. To setup a technical environment for a project (web server, database server)
17. Apply this methodology during a team project with a fully working app (front-end, back-end, database server)

Detailed course structure

1. Data vs information vs knowledge
    a. Definitions
    b. Showcase
2. What is a database
    a. Definition
    b. State of art technologies (relational, object, graph, document)
3. Conceptual modelling
    a. Definition
    b. Tools of the trade
    c. Methodology : requirement elicitation

    d. Workshop
    e. Methodology : functional dependencies
    f. Workshop
    g. Methodology : normal forms
    h. Workshop
    i. Methodology : ER basics, entity, relationship
    j. Workshop
    k. Methodology : attributes, cardinality, degree, primary and foreign key
    l. Workshop
    m. Methodology : design rules and guidelines
    n. Workshop
4. Logical modelling
    a. Definition
    b. Tools of the trade
    c. Methodology : from conceptual to logical model
    d. Workshop
5. Physical modelling
    a. Definition
    b. Tools of the trade
    c. Showcase on database server setup
    d. Workshop
6. SQL
    a. Definition
    b. Showcase on database
7. Practical works
    a. Fully working app and database design, from requirement elicitations to implementation.
    b. SQL queries

Conditions of Exams

18. Online MCQ (1 hr)
19. Group work on database design of 4 up to 6 students.

MI5-9-SS03 – Bioprocesses and applications

Professor :

David Guerrand

david.guerrand@inra.fr

Total number of teaching hours: 15h

CM	TD / TE	TP	Support	Project
5h	10h			Case study
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

Bring a global vision of recent developments in industrial biotechnologies with a focus on energy, chemistry and agroindustries. Highlight recent industrial realizations selected in different regions (Europe, North America, Asia) and from different typologies of industries (startup companies to large multinationals).

Specific objectives and acquired competencies

- Understand the concept of key bioprocesses involved in industrial biotechnologies (fermentation, biocatalysis).
- Know the major industry players in biotechnology in the following domains: energy, chemical compounds, food and cosmetics and their recent realizations.
- Understand the new business models used in the biotechnology sector (alliances, JV, collaborative R&D, technology licensing…).

Detailed course structure

Note: pre-reading assignments will be shared with students prior to the lectures

General introduction to bioprocesses and biotechnologies

a. Definitions and global picture
b. Technologies overview : enzymes, yeast, bacteria, micro-algae

1. Bioprocesses for new sources of energy

1.1 Bioethanol, first and second generation technology, Key industrial players in Europe and North America. Adressing the 2nd generation bioethanol challenges: technology (converting the ligno-cellulosic biomass, enzyme and GMO yeast solutions) and economy (the impact of oil price volatility).
1.2 Bio-based hydrocarbons as alternatives to fossil resources.
Industry example : isobutene derived biofuels
1.3 The potential of micro-algae.

2.Introduction to bio-based chemical compounds

2.1 Converting lipids, carbohydrates and proteins to produce chemical building blocks. Overview of key molecules, comparing leading technologies.
2.2 Industry focus : bio-based succinic acid, using yeast fermentation technology

2.3 New approach in plastic material life cycle (from polymers to monomers for reuse).

3.Biotechnology tools for agro-food industries

3.1 The importance of fermentation in food : from food preservation to generating biotechnology tools
3.2 Enzyme technology for food processing : global overview, key industry players, economical dimension and leading trends
3.3 Modern biotechnology for traditional food : innovation examples in brewing, dairy, winemaking and baking sectors

4. Biotechnology based development and production of food & nutraceutical molecules

4.1 Nature sourced ingredients vs. biotech engineered ingredients ; overview, examples.
4.2 The race for intense sweeteners. How biotechnology can be a solution : the example of fermentation produced steviosides
4.3 Getting nature's benefits in a fermentor : yeast technology to produce resveratrol, a powerful antioxydant

5. New developments in fragrances and ingredients for the cosmetic industry

5.1 Flavour and Fragrance production & bio-processes.
Industry example : vanillin, world's favourite food flavour / limited natural resources. Enzyme technology for bioconversion ; yeast technology
5.2 Biobased surfactants

Conditions of Exams

An evaluation will be done asking the students to write a 1-page document presenting an overview of a bioprocess based technology using a set of articles and documents (provided by the teacher). Work will be qualified on : (i) ability to present the technology in a concise format, (ii) ability to challenge the process on both technical and economical aspects and (iii) ability to bring a personal vision to the subject.

MI5-9-SS04 – Ecoconception

Professor:

Fabien PEZOUS

Total number of teaching hours : 15h

CM	TD / TE	TP	Support	Project
6h	9h			Team work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h (Project)				
Credits : 1 ECTS				

General objectives of education

To dispense to the students the multidisciplinary fundamental scientific teachings but also the necessary scientific methods to assure eventually the direction of a packaging project

Acquire the theoretical and practical control of the management of the processes adapted to the packaging jobs

Specific objectives and acquired competencies

Definition of a packaging consistent with the positioning

Tools of design and conception packaging

Identification of specific solutions in the design of the packaging

Good understanding of the insertion of the packaging in the point of sale

Detailed course structure

Preliminary module: Tools of conception and desgin

1. Packaging history
2. Definition and functions

Module 1: Packaging, graphic development and management

1. The role of the packaging
2. The design of the packaging
    a. How to choose
    b. The elements
        i. Colors
        ii. Materials
3. Market expectations
    a. Pharmaceutical industry
    b. Food industry
    c. Cosmetic industry
    d. Packaging needs

Module 2: Biodegradation creation, interactions and compatibility packaging-contents

1. Ecodesign
2. Life Cycle Assessment
3. Evolutions, regulation
4. Raw material selection

Module 3: Audit of the performances of a packaging – Quality of materials

Conditions of Exams

Team homework and presentation

MI5-9-SS05 – Nanobiotechnologies

Professor :

Yannick Coffinier

yannick.coffinier@iri.univ-lille1.fr

Total number of teaching hours: 15h

CM	TD / TE	TP	Support	Project
10h	20h			Team Work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 10h				
Credits : 2 ECTS				

General objectives of education

Application of micro and nanodevices to the field of biology/medicine/biotechnology.

Specific objectives and acquired competencies

- Biosensors conception
- Nano-objects for therapy, diagnosis, imaging....

Detailed course structure

I. Introduction to nanobiotechnologies

II. Biosensors

II-1) Surface chemistry

- Langmuir-Blodgett film (Physisorption)
- Self-assembly Monolayer (SAM) (Chemisorption)
- Characterization methods (FTIR, XPS, contact angle, Ellipsometry…)
- Probe immobilization strategies

II-2) Transducers

- Optical
  1) Labeled (fluorescence, chemiluminescence…)
  2) Label-free
     a- Surface Plasmon resonance
     b - Interferometry
     c - Waveguide
     d - Photonic crystals
- Mechanical
- Electrical/Electrochemical

III) Nanoparticles (NPs) in biomedical applications

III-1) Vectors

III-2) Magnetic NPs

- MRI contrast enhancement
- Magnetic fluid hyperthermia
- Heat-triggered drug release
- Multifunctional platforms

III-3) Quantum Dots (QDs) or Semiconductor Nanocrystals (NCs)

IV. Nanotechnologies (organization, investment, market…):
- Global world
- In France

V. Micro- Nanofabrication

V-1) Top-down approach
- Photolithography
- Electron Beam lithography (EBL)
- Other photolithographies (X-ray, DUV, EUV)
- Transfer methods (wet etching, dry etching)
- Non-conventional lithographies :
  - Nano-imprint lithography (NIL)
  - Nano-embossing
  - Soft-lithography
  - Nanosphere lithography
  - SPM lithographies

V-2) Bottom-up approach
- Molecular Beam Epitaxy (MBE)
- Atomic layer deposition (ALD)
- Thin film depositions (CVD, PVD)
- Nanoparticles (NPs) synthesis
- Carbon based materials synthesis and properties (Carbon NTs, graphene)

Conditions of Exams

Written exam *2 : half- period and end-period)to assess what they've learned

Oral presentation (10 min.+3min. for questions). Students have to present scientific project based on the fabrication of a new micro-nanodevice or concept for the field of their choice. They should include marketing and production points of view too and more if possible (toxicology, ethic....).

MI5-9-SS06 – Combinatorial Chemistry

Professor :

Roman Lopez

roman.lopez@ymail.com

Total number of teaching hours : 18h

CM	TD / TE	TP	Support	Project
6h	12h			Article study
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

Know the high-speed testing strategies (experimental and virtual) in chemistry and biology, infrastructure, devices and applications in the fields of drug discovery, fine chemicals, and chemical biology.

Specific objectives and acquired competencies

Know the strategy of preparation of molecules and their evaluation via high-speed tests.
Implement the virtual evaluation strategies.
Describe the systems and equipment used

Detailed course structure

1. Biological high throughput screening
2. Miniaturization and automation bioassay: Example of inhibitors of ricin
3. Combinatorial Chemistry: parallel synthesis broadband
4. Synthesis on solid support: resins
5. Parallel Synthesis solution supported reagents and "scavengers"
6. Summary of targeted compound libraries and virtual screening
7. Systems and robotic equipment, the Lims
8. Applications to search for chemical catalysts via immunological systems

Conditions of Exams

Participation in class.
Analysis of a scientific publication

UI5-9-AF-1
Apprentissages fondamentaux, Entreprenariat

Volume horaire des enseignements de l'unité d'enseignement :

CM	TD / TE	TP	
23h	37h		
SEMESTRES CONCERNES : 9			
Crédits : 4 ECTS			

Détail des enseignements de l'unité d'enseignement

- Intelligence économique
- Management international
- Enjeux géopolitiques
- Droit du travail
- Comptabilité/business plan

Compétences que l'unité d'enseignement contribue à former

Bloc de compétences 0 : Acquisition d'une culture scientifique

- Acquisition d'un large champ de connaissances scientifiques fondamentales
- Maîtriser les fondamentaux en vue de la modélisation et la simulation des systèmes
- Former l'élève-ingénieur à la recherche et par la recherche

Bloc de compétences 1 : Analyse d'un système, identification d'un besoin et mise en place d'une démarche de conception d'un produit/procédé en lien avec les biotechnologies

- Capacité à intégrer les données économiques du marché

Bloc de compétences 4 : Prise en compte de l'environnement et de la biodiversité au quotidien

- S'intégrer dans une démarche de développement durable et respecter la biodiversité (aspects social - écologique - économique)
- Maîtriser son environnement de travail (aspects économique - réglementaire - technique - international)

MI5-9-AF01 – Competitive Intelligence

Professor :

Sébastien Montaufier

sebastien.montaufier@gmail.com

Total number of teaching hours : 12h

CM	TD / TE	TP	Support	Project
6h	6h			Team work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h (Project)				
Credits : 1 ECTS				

General objectives of education

Understand the science of manipulation based on the scientific publications. Learn one new tool in competitive intelligence, the strategic chess and two new methods to gather information. The first is applied on trade shows, and the second on online influence operations.

Specific objectives and acquired competencies

- Learn the six basic different leverages to obtain information (Liking, Reciprocity, Social proof, Scarcity, Authority, Consistency)
- View a lot of different examples based on scientific publications.
- Learn their limits and how to combine / improve these methods
- Understand how to structure an operation with manipulation tools
- Understand the difference between a classical tradeshow and an organized tradeshow to collect information with a lot of example on tools/methods.
- Learn how to organize this kind of operation with an example in USA based on 7 teams.
- Understand how some companies can create organized influence online operations with specific tools and methods.

Detailed course structure

1. **Introduction**
    a. Opener: A first example of what is manipulation
    b. First exercise: Explain the method used in the opener
    c. The undergraduate program, remember your past years
    d. What's in it for me?
    e. The different parts of competitive intelligence
    f. What is an expert in human intelligence? Example with slyness, NLP, Psy ops…
    g. The graduate program
        i. Manipulation Tools and structured operations
        ii. Strategic Chess
        iii. Evaluation
2. **The strategic chess: Detection and information risk management**
    1. First example: The Fukushima problem
        1. French in Japan
        2. Reaction of France embassy

3. The price of the aircraft: until 14.361€
4. Crisis management at Airfrance

2. Strategic chess

a. The basis: The socio-dynamic map
b. Structure of a chessboard
c. The three kind of chessboards
d. The global grid

3. Last example

1. The problematic
2. The chessboard
3. One derivative strategy

3. The art and science of influence

3.1. Origine

a. The book
b. Story around the book
c. One derivative strategy

3.2. Introduction

a. What are automatic behaviour patterns?
   The Indian jewellery store
   Animal models
   Human experiment with a library copying machine
   Explanation on the Indian store
   Why automatic behaviour in human action?
b. Why there are profiteers?
   Animal vs Humans
   A short example: The contrast principle
c. Three characteristics on automatic behaviour
d. The six weapons of influence

3.3. Reciprocation

a. Practice case
b. The concept of reciprocity in commercial, political domains
c. The Krishna Group
d. Reciprocity origin
e. Properties of the reciprocity
f. To go further

3.4. Principle of consistency

a. Practice case
b. Introduction with horse racing
c. Highlighting the principle with the beach theft
d. The purpose of society consistency
e. Hijacking the principle of consistency: Christmas gifts
f. How to amplify this principle?
g. To go further

3.5. Social Proof

a. Case study
b. Introduction to the principle of social proof
c. Two particular cases who derived from social proof
d. To go further

3.6. Liking
   a. Practice case
   b. What is liking? (Thermomix example)
   c. Factors who can influence liking (Emotional transfer)
   d. Appearance and liking
   e. Resemblance
   f. Collaboration practice case: The summer camp
   g. What is an emotional transfer?
   h. Ben Franklin and Pavlov

3.7. Authority
   a. The Milgram experiment
   b. The foundation of authority
   c. How to use signs of authority?
   d. To go further

3.8. Scarcity
   a. Shreddies
   b. The new Coca-Cola
   c. Optimal conditions for scarcity
   d. To go further

3.9. Conclusion
   a. Towel and environment
   b. The six weapons of influence
   c. To go further

4. Trade show intelligence

1. Introduction
2. Trade show spying: Two level methods
   1. Technical and technological methods
   2. Low level human methods
3. Two high level methods
   1. The 25C3 trade show
   2. Ciro cattuto tools
   3. How to hack the GSM network?
4. One human methods
5. What is a trade show intelligence operation?
   1. Steps for a trade show intelligence procedure
   2. Seven teams for a typical trade show
   3. The sample timetable
   4. The checklist
   5. The global process
6. The trade show process
   1. Before

      The quarterback

      How to identify needs

      N-1 trade show: learn from the past

      Gephi to map internet

      Fear the Foca: How to study metadata

      How to create a research plan?

      The protection and operational plan

Recruitment and training plan

2. During

   Installation: the seven teams

   Real time management: the war room and the trade show

3. After

   The Retex

5. Influence operation

1. Introduction
2. First steps
   1. The engagement letter
   2. Monitoring tools and team
   3. Analysis tools
3. Security
   1. Why you need security?
   2. Proxy and VPN
   3. Tor
   4. Darknet
   5. Why security is different of anonymity?
   6. One example with a French scientific publication
   7. The best solution: Free Wi-Fi
4. Influence war
   1. The global organization
   2. Communication team
   3. Action team
   4. Security team

Conditions of Exams

These works will be done by group (~3/4 persons by group). Each promotion has a different subject, but the same work based on a PowerPoint presentation with:

- A short introduction
- A strategic chessboard with a short presentation of different actors.
- An interventional strategy based on the manipulation course.

Example of subject:
You will work on the course Sanofi example. In this example, you will present a strategy to fight against counterfeiting drugs. You can work on communication to patient, or on possible lobbying operations. Your objectives are to reduce counterfeiting drugs importations or consumption.

MI5-9-AF02 – International Management

Professor :

Sheldon Austin

Total number of teaching hours : 15h

CM	TD / TE	TP	Support	Project
5h	10h			Case study
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

This course is designed to develop an understanding of the good practices and issues found when working in a group setting in a global environment.

Specific objectives and acquired competencies

Principles of good leadership

-Gain an understanding of leadership and management practices

-Introduce basic concepts of working in a group setting

Organizational structure of team

-Define expectations of participants in a team effort

-Define expectations of participants in a team effort

Cross-cultural communications

-Develop an understanding of cultural differences and the impact they may have in the work place.

Conflict resolution

-Define conflict types

-Define a conflict in a professional environment

-Consider different methods to resolve conflicts in work setting

-Incorporate understanding of other cultural norms when in a group/team setting

Detailed course structure

- *Session 1*
  - Introduction to module
  - Leadership vs management
  - Good leadership practice
  - Leadership styles
  - Management issues
- *Session 2*
  - Management issues
  - Presentations, exercises, role plays, discussion
- *Session 3*
  - Cultural differences
  - Exercises, discussion
- *Session 4*
  - Conflict resolution
  - Group exercise - conflict simulation and role play
- *Session 5*
  - Conflict resolution
  - Exercises, discussion

Conditions of Exams

One written exam

MI5-9-AF03 – Geopolitical Issues

Professor:

To determined

Total number of teaching hours : 9h

CM	TD / TE	TP	Support	Project
3h	6h			
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 3h				
Credits : 0.5 ECTS				

General objectives of education

To focus on some specific knowledge to better understand the big environmental issues, to bring up to date information and data to follow the evolutions, to build a personal and critical opinion

Specific objectives and acquired competencies

Be able to analyze the great complexity of environmental challenges, on a national and international level. To demonstrate the impact of environmental issues on industries, agriculture and business in general. To highlight those intertwined relationships

Detailed course structure

1) A growing population, with a modern way of life, facing the scarcity of natural resources
2) Alarming pollution leading to frightening climate changes, biodiversity loss, deforestation, marine disasters.
3) An international awareness: Achievements and disappointments International conferences (Kyoto, Cancun, Nagoya, Rio…). The national policies led by the big polluters (the historical agreement between China and the USA), the expectancies of developing countries
4) Sustainable development: an undeniable priority for industry and agriculture. The beginning of a new area in business, a new and profitable impulse.

Conditions of Exams

Debates among students about key issues
An oral presentation on an environmental topic, lasting 15 minutes.
Then, answers to questions coming from the teacher or other students (around 10 minutes)
A written test (1H30) on a controversial topic, studied during the classes.

MI5-9-AF04 – Regulation
(Course in French)

Professor :

Marie Moin

Total number of teaching hours : 15h

CM	TD / TE	TP	Support	Project
6h	9h			Team Work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 3h				
Credits : 1 ECTS				

General objectives of education

Connaitre les fondamentaux du droit du travail.
Etre averti lors de son intégration en entreprise mais aussi veiller au respect de la loi lorsqu'il évoluera vers des fonctions d'encadrement.

Specific objectives and acquired competencies

Approfondissement des points dont un cadre doit avoir une connaissance plus approfondie, à savoir :
Le contrat de travail
La représentation des salariés dans l'entreprise : la représentation du personnel, la représentation syndicale, le CHSCT…
Les clauses de confidentialité et de non concurrence
La rupture du contrat de travail : licenciement, démission rupture conventionnelle et prise d'acte de rupture
Les conflits en droit du travail.

Detailed course structure

Cours magistral destiné à transmettre les fondamentaux des matières sus visées.
Exercices pratiques visant à s'assurer de la bonne compréhension.
Visite du Conseil Des Prud'hommes et écoute des affaires inscrites à l'ordre du jour dans ce Conseil.

Conditions of Exams

L'évaluation des compétences est commune au module de droit du travail et de droit d'auteur. Elle intègre également les connaissances acquises au cours de l'année précédente.
Cette réunion des différents modules de droit pour l'évaluation poursuit un objectif pédagogique : démontrer que si l'étude du droit est toujours séquencée pour des raisons pratiques évidentes, le droit forme un tout et qu'un grand nombre de règles sont transversales.

MI5-9-AF05 – Finance / Business Plan

Professor :

Alexandre STERN / Gilles TROLET

Total number of teaching hours : 9h

CM	TD / TE	TP	Support	Project
3h	6h			Home work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 2h				
Credits : 0.5 ECTS				

General objectives of education

Familiarize with a comprehension of the general environment of corporate financing. Focus on private equity as it is one of the main financing sources for (i) unquoted companies, and (ii) the creation and first steps of IT companies.

Detailed course structure

1) PRELIMINARY SECTION: THE CURRENT GLOBAL CONTEXT
    1. Background: the dot-com bubble
    2. The subprime crisis
    3. Impact of financial crisis on real economy
    4. Next step: the credit default swaps (CDS) crisis?
2) INTRODUCTION: OVERVIEW OF CORPORATE FINANCING SOURCES
    1. Subsidies
    2. Debt
    3. Equity (Public/Private)
3) SECTION 1: PRIVATE EQUITY
    A. Description of private equity
        1. Definition / Background
        2. Investment strategies / investment considerations
            (i) Venture capital (seed, early/late stage)
            (ii) Expansion capital
            (iii) Buy-out (management buy-in; management buy-out; leveraged buy-out)
            (iv) Special situations (turnaround; distressed)
            (v) Mezzanine
            (vi) Funds of funds (primary; secondary)
    B. Professional organizations (AFIC, EVCA, BVCA, NVCA, etc.)
        1. Amounts raised in France, in Europe, in the US
        2. Amounts invested in France, in Europe, in the US
    C. Operation of a private equity fund
        1. Private equity funds' structures
            (i) General diagram of a private equity fund
            (ii) Main private equity fund structures in Europe and the US
            (iii) Private equity funds' terms and conditions
        2. Investment teams
        3. Private equity funds' economics/process
            (i) Fund raising
            (ii) Deal flow / deal selection / deal execution
            (iii) Deal monitoring/follow-up

(iv) Disinvestments (calendar, sharing of proceeds, etc.)
(v) Track record (valuations – gross/net IRR)

4) SECTION 2: ENTREPRENEURS AND PRIVATE EQUITY – CASE STUDY
    1. Business plan preparation
    2. Fund selection
    3. Deal execution

Conditions of Exams

MCQ

EI5-9-RD-1
Recherche appliquée et développement

Volume horaire des enseignements de l'unité d'enseignement :

CM	TD / TE	TP	
30h	40h	30h	
SEMESTRES CONCERNES : 9			
Crédits : 8 ECTS			

Détail des enseignements de l'unité d'enseignement

- Projet transversal appliqué (Fils rouges)
- Biologie intégrative
- Génomique avancée et robotique
- Expérimentation animale
- Thérapie cellulaire
- Virologie

Compétences que l'unité d'enseignement contribue à former

Bloc de compétences 0 : Acquisition d'une culture scientifique

- Acquisition d'un large champ de connaissances scientifiques fondamentales
- Maîtriser les fondamentaux en vue de la modélisation et la simulation des systèmes
- Former l'élève-ingénieur à la recherche et par la recherche

Bloc de compétences 1 : Analyse d'un système, identification d'un besoin et mise en place d'une démarche de conception d'un produit/procédé en lien avec les biotechnologies

- Appréhender, comprendre et analyser un système complexe

Bloc de compétences 4 : Prise en compte de l'environnement et de la biodiversité au quotidien

- Etre un ingénieur "responsable" (approche de l'éthique comme valeur - respect règles - autrui - nature)

Bloc de compétences 5 : Management d'équipe et connaissance de soi

- Gérer le collectif
- Maitriser son discours
- Se former tout au long de la vie

MI5-9-RD01 - Applied Transversal Project

Professor:

Research Team: Estelle Mogensen / Frank Yates / Rafika Jarray

estelle.mogensen@supbiotech.fr;frank.yates@supbiotech.fr;jarray.rafika@gmail.com

Total number of teaching hours : 30h

CM	TD / TE	TP	Support	Project
		30h		Team Work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 20h				
Credits : 3 ECTS				

General objectives of education

Be able to reproduce a scientific protocol in our laboratory

Apply what has been learnt in the classroom or practical work of the Bachelor Cycle to real laboratory situations.

Specific objectives and acquired competencies

Adequately ensure that the student achieves the learning objectives of the R&D major

Test the knowledge and skills acquisition of the laboratory processes.

Acquire the skills to communicate and to present ideas clearly and coherently to a specific audience in both the written and oral forms.

Acquire collaborative skills through working in a team to achieve common goals.

Be able to learn by themselves, reflect on their learning and take appropriate action to improve it.

Conditions of Exams

Written Report

At the end of each project step, each group is required to submit a piece of written work based on the task that they have completed. This component assesses students on their performance pertaining to knowledge application and written communication.

Oral Presentation

Each student from the group is given an opportunity to present a part of the project orally to a target audience and answer questions posed to the group. The student will be assessed as individuals and as a group. Emphasis is placed on every student being able to display, individually, his ability to be clear and coherent in presenting his ideas and to address and engage an audience.

MI5-9-RD02 - Synthetic Biology

Professor :

Elise DELAGE

delage.elise@laposte.net

Total number of teaching hours: 15h

CM	TD / TE	TP	Support	Project
5h	10h			Article Study
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 3h				
Credits : 1 ECTS				

General objectives of education

- Propose a precise research project that starts from this article and goes beyond, in any direction the group chooses, from fundamental to applied research.
- Justify the project and demonstrate its feasibility on the basis of the article and possibly related ones.
- Apply it in order to obtain preliminary evidence supporting the project.

Specific objectives and acquired competencies

- To understand the basis of synthetic biology approaches and to get an overview of the applications and current achievements in this field
- To be able to analyze R&D projects in the field of synthetic biology
- To be able to apply the principles of synthetic biology to design new R&D projects
- To learn how to use computational tools for the design and modelling of synthetic parts and devices
- To understand the challenges and the risks associated with synthetic biology and to be able to discuss the related ethical and societal concerns

Detailed course structure

SESSION 1

General introduction of the module

I. Introduction to synthetic biology

II. Engineering approach to biology

SESSION2

III. Current research and achievements in synthetic biology

SESSION 3

IV. Challenges in synthetic biology

SESSION 4

Tutorial: Computational tools for the design and modelling of synthetic parts and devices

SESSION 5

- Oral presentations of the group projects

Conditions of Exams

Intermediate presentation + final presentation (15 min + 5 min questions) + Written summary
Assignments/Classroom participation

MI5-9-RD03 - Advanced Genomic

Professor:

Alain RICO

Total number of teaching hours: 20h

CM	TD / TE	TP	Support	Project
5h	10h			Article study
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

To explore in detail the main techniques, other than sequencing methods, available to analyze the complexity of the genome. Furthermore that course will allow students to set up methods with techniques accurate to evaluate and /or measure genomic expression. Finally, understand how automation will help all fields of health in the management of samples

Specific objectives and acquired competencies

- Know to choose an analytical method over another based on a given issue.
- Describe and compare the techniques of quantitative analysis of the redesign of the genome.
- Evaluate the utility of laboratory automation. Implementing a traceability process.
- Differentiate what is automatable what does not. Design automation process of genetic analysis discussed throughout the course.

Detailed course structure

Genomic

Genome analysis

1) Chromosome structure and applications
2) Cytogenetic analysis
    a) Karyotype
    b) FISH
    c) Spectral karyotyping
3) CGH array
    a) Use of CGH array
    b) Design of CGH array
    c) Interpreting CGH result
4) BAC on Beads technology

Transcriptomic: gene expression

1) characterics of gene expression
2) Regulation of the gene expression
3) Various RNA in the cell
    a) RNA interference
4) Why measuring gene expression
5) Methods to Detect Single Gene Transcriptional Change
    a) northern blot.
    b) Reporter gene fusion

c) Real time PCR
d) qRT-PCR: a Semiquantitative RT-PCR

6) Methods to Detect Multiple Gene Transcriptional Changes
a) Differential display
b) Sequencing based method
i) SAGE
ii) RNA seq
iii) Arrays
c) Substractive hybridization methods
i) RDA
ii) SSH
d) New techniques for quantitative gene expression studies

Robotic

Session 1: introduction to robotic

Session 2: instrumental consideration in the field of research

1) Different field for automation
2) Define automation projects requirement
3) Robotic tools:
a) Pipeting.
b) Liquid level sensing
c) Washing.
d) Moving labware
4) Pipetting technologies
5) Tips and robotic tools
6) Software considerations
7) Applications of automation in molecular biology:
a) Library replication.
b) DNA extraction.
c) PCR.
d) Analysis of PCR products
e) ArrayPlex.

Session 3: options and devices for integrated systems

Conditions of Exams

Design exercises of a genetic analysis test by choosing the best technique among those addressed in progress.

• Control of the end of surgery as a part of two hours late in the year.

Additional note on the participation and presence of the student in the course.

MI5-9-RD04 – Cellular Therapy

Professor :

Xavier NISSAN

Total number of teaching hours : 15h

CM	TD / TE	TP	Support	Project
	10h			Team Work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

This course is designed to equip Sup'Biotech. Students with basic but very important molecular & structural bioinformatics methods, focusing on key technologies to solve various problems they may encounter in their further research and/or industrial practice.
The module material is applicable to macromolecules of special interest in biotechnology & medicine (e.g. fluorescent proteins, therapeutic antibodies…).
A set of exercises has been specifically designed in such a way that the students could directly observe most of the concepts presented in the theoretical sessions.
The aim is for the students to get insight in and use modern structural bioinformatics methods.

Specific objectives and acquired competencies

Students will learn how to find sequences & 3D protein molecular models & structures in public data banks for their research and interests using interactive, user-friendly, open-source & state-of-the-art web based browser applications.

Detailed course structure

Participants will use user-friendly softwares (free & open source) for visual investigation of 3D molecular structures of proteins, nucleic acids, and their interactions with each other and with ligands, substrates, and drugs.
Hands-on experience will be largely with molecules of each participant's choosing. Learning specialized scripting command language, such as needed for RasMol or PyMol, is not necessary. Most of the resources will use public databanks and Internet Browsers+Java.
Participants will gain hands-on experience with:
(I) Visual exploration of the 3D structures of macromolecules, such as proteins bound to ligands or nucleic acids.
(II) Where to find protein structures related to your research, how they are determined, how much of the genome is (and is not) known, & why
(III) Inspection of protein 3D structures, ligand interactions, and structural bioinformatics. Seeing non-covalent bonds between a ligand and protein, and measuring distances. Finding amino acids or sequence numbers of interest. Locating patches conserved in evolution & regions of rapid mutation. Visualizing specific oligomers, and their subunit interactions. Imaging of static molecular views. Introduction to homology (comparative) modeling…

Conditions of Exams

A set of challenges (Protein Folding/3D Design and Docking...) has been designed to make the class more interactive and to evaluate the students.
Grading: Attendance/In Class Participation 20, Homework 20, Exam 60.

MI5-9-RD05 - Virology

Professor :

Raid Kassis

raid.kassis@gmail.com

Total number of teaching hours : 20h

CM	TD / TE	TP	Support	Project
10h	10h			Article Study
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

Have basic knowledge in virology and learn to use the cellular and molecular tools to develop research strategies in viral pathogenesis.

Specific objectives and acquired competencies

1. Know the pathophysiology of virus
2. Know some examples of innovative strategies for antiviral fight (eg. AIDS, HPV, influenza, EBV)
3. Know some mechanisms of induction (or inhibition) of the cell death during a viral infection (rabies, Epstein-Barr virus)
4. Have gene therapy concepts using viruses as vector transfer (retroviral vector)
5. Having viral persistence concepts and its role in the scale of a organization
6. The specific case of prions

Detailed course structure

a) Distribution students to relevant recent publications (EBV, Ebola, lyssavirus, prion, papillomavirus)
b) Overview of the virus: protein structure, organization genomics and cell tropism (courses)
c) Neurotropic viral persistence: the model of lyssavirus (courses) / Role of matrix protein in virus-induced apoptosis
d) Pathophysiology of Epstein-Barr virus (presentation) / MicroRNA produced by EBV and cell survival
e) Pathophysiology of papillomavirus (presentation) / Rôle PV-E6 protein in cell transformation
f) Pathophysiology of Ebola virus (presentation) / PI3kinase signaling and control of viral entry
g) Pathogenesis of prion diseases (presentation) / Anti-prion gene / Therapy: use of dominant-negative vectors

Conditions of Exams

Oral presentation from a recent publication
Written exam

MI5-9-RD06 - Animal Testing – Ethic and regulation

Professor :

Arnaud BEURDELEY

abeurdeley@hotmail.com

Total number of teaching hours : 10 h

CM	TD / TE	TP	Support	Project
10h				-
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 3h				
Credits : 1 ECTS				

General objectives of education

The main objective of this course is to sensitize the auditors to the statutory environment governing use of animal models in scientific projects

Specific objectives and acquired competencies

- Capacity for synthesis and analysis
- Organization and Planning
- Criticism and self-criticism
- Team spirit
- Ability to work in a multidisciplinary team
- Ability to communicate with different fields specialists
- Creativity, adaptability to constraints
- Design and research project management

Detailed course structure

- Introduction to functional exploration
    - Presentation
    - History
- Implementation of the current regulations
    - Rule of the 3R
- Implementation of a protocol according to a defined research program
- Case practises (DAPAFIS)

Conditions of Exams

Group project on the writing of a statutory document necessary to the implementation of a protocol of animal experiment (DAPAFIS)

EI5-9-MT-2
Marketing et Management des Produits

Volume horaire des enseignements de l'unité d'enseignement :

CM	TD / TE	TP	
17h	83h		
SEMESTRES CONCERNES : 9			
Crédits : 8 ECTS			

Détail des enseignements de l'unité d'enseignement

- Projet transversal appliqué (Fils rouges)
- Pricing
- Marketing BtoB (avancé)
- Marketing digital
- Finance/business plan
- Media Training
- Packaging / Force de vente
- Stratégie

Compétences que l'unité d'enseignement contribue à former

Bloc de compétences 0 : Acquisition d'une culture scientifique

- Acquisition d'un large champ de connaissances scientifiques fondamentales
- Maîtriser les fondamentaux en vue de la modélisation et la simulation des systèmes
- Former l'élève-ingénieur à la recherche et par la recherche

Bloc de compétences 1 : Analyse d'un système, identification d'un besoin et mise en place d'une démarche de conception d'un produit/procédé en lien avec les biotechnologies

- Appréhender, comprendre et analyser un système complexe
- Capacité à intégrer les données économiques du marché

Bloc de compétences 4 : Prise en compte de l'environnement et de la biodiversité au quotidien

- S'intégrer dans une démarche de développement durable et respecter la biodiversité (aspects social - écologique - économique)
- Maîtriser son environnement de travail (aspects économique - réglementaire - technique - international)

Bloc de compétences 5 : Management d'équipe et connaissance de soi

- Gérer le collectif
- Maitriser son discours
- Se former tout au long de la vie

MI5-9-MT01 - Applied Transversal Project

Professor :

Market Team: Claire Grassi / Mylène Louicellier

mylene.louicellier@wanadoo.fr

Total number of teaching hours : 30h

CM	TD / TE	TP	Support	Project
	15h			Team Work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 30h				
Credits : 3 ECTS				

General objectives of education

Be able to reproduce a scientific marketing approach on an innovative existing product
Apply what has been learnt in the classroom of the Marketing Major.

Specific objectives and acquired competencies

Adequately ensure that the student achieves the learning objectives of the Marketing major

Test the knowledge and skills acquisition of the marketing processes.

Acquire the skills to communicate and to present ideas clearly and coherently to a specific audience in both the written and oral forms.

Acquire collaborative skills through working in a team to achieve common goals.

Be able to learn by themselves, reflect on their learning and take appropriate action to improve it.

Conditions of Exams

Written Report

At the end of each project step, each group is required to submit a piece of written work based on the task that they have completed. This component assesses students on their performance pertaining to knowledge application and written communication.

Oral Presentation

Each student from the group is given an opportunity to present a part of the project orally to a target audience and answer questions posed to the group. The student will be assessed as individuals and as a group. Emphasis is placed on every student being able to display, individually, his ability to be clear and coherent in presenting his ideas and to address and engage an audience.

MI5-9-MT02 - Pricing

Professor :

Mylène Louicellier

mylene.louicellier@wanadoo.fr

Total number of teaching hours : 12h

CM	TD / TE	TP	Support	Project
3h	9h			Case study
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 3h				
Credits : 1 ECTS				

General objectives of education

Build a price policy that will be accepted from the market and profitable for the company, and make it customer-understandable.

Negotiate that price facing the company environment and competition influence

Master price negotiation techniques.

This course should enable students to know the price components and allow them to determine the desirable price of a product and/or service.

This course will also offer the acquisition and training of trading methods related to price and value creation.

Specific objectives and acquired competencies

This course explains and criticizes:

The importance of price in the marketing mix

The main factors to consider in determining the price

Different methods of pricing

The fundamentals of competitive positioning

The Value creation

The Yield management

The influence of new ways to buy

The supply contract

Detailed course structure

At the end of the course, students must develop an understanding the different tools related to the transactions and are able to:

1 Evaluate customer value and customer lifetime value,

2 know and use the different pricing methods,

3 Integrate pricing in management range,

4 Know and evaluate the visible and hidden components of the price of a product or service

5 Use Porter's value chain to determine the competitive advantage and price positioning

6 Evaluate the different notions of value

7 Determine the client's value chain and measure the created value

8 Methodically prepare the terms of a negotiation

9 Negotiate and defend the price and the value of a service, product or offer in different business situations and master the different stages of a win-win negotiation.

Course methods:

Based on a full day work, it will be cut in two parts:

First, theoretical concepts and tools will be explained.

The second part of every chapter will consist of group workshops reproducing, on actual case basis, the various stages of the negotiation and establishment of financial trading:

For instance:

Building of a price including different margin and costs

Competition survey

Preparation of a negotiation

Risk assessment and issues

Negotiation of a service

Negotiating an investment property

The negotiation of facilities furniture

Win-win negotiation

Conditions of Exams

Several multiple-choice tests will estimate theoretical knowledge and reflexes

Mini case studies and simulation workshops during the course will validate technical skills, methods and concepts for each chapter

A participation grade will be assigned

Finally, the integration of knowledge and skills will be tested in the monitoring and evaluation of “FIL ROUGE” marketing project (Applied Transversal Project).

MI5-9-MT03 - Advanced Marketing BtoB

Professor :

Mylène Louicellier

mylene.louicellier@wanadoo.fr

Total number of teaching hours: 12h

CM	TD / TE	TP	Support	Project
3h	9h			Case study
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 3h				
Credits : 1 ECTS				

General objectives of education

Learn about the specific characteristics of B to B Marketing regarding products and services sales and business between professional organisations;

Manage and master marketing tools, including specific BtoB tools;

Include and master strategic thinking and build an overview about marketing tools in strategic BtoB.

Master a general overview of methods, concept and tools in marketing.

Specific objectives and acquired competencies

Students should be able to:

Master the specific concepts, methods and tools of B to B marketing;

Develop expertise as well as knowledge in B to B and Services;

Feature a market study in a scientific and technological environment;

Understand and manage the decision making and the buying decision processes, innovation and service development contracts;

Know the key points in selection, management and sustainability of a product distribution network with high technological content.

Develop a global vision of marketing and its contribution to the global company management.

At the end of BT5, students will have deepen the temporal, methodological and practical aspects of BtoB marketing, while building a concrete project related to “le Project FIL ROUGE Marketing”.

Building this, every student must be able to use and synthesize different concepts, methods and tools, including international business.

Different examples and marketing applications handled by students require the implementation of tools for research and oral and written presentation.

Students must demonstrate the ability to implement professional behaviour, their oral skills in verbal fluency and control, quality of vocabulary, risk assessment concepts, demonstration and ability to convince.

Detailed course structure

The course presents different marketing tools and concepts, and focuses on practical cases and examples based on real companies. The main fields of study are biotechnology, including chemistry, drug, food, cosmetics environment but also telephony and business services.

Many cases or aspects related to each course are used as a basis for the implementation of concepts and knowledge.

Different courses and workshops:

1. The specifics of B to B marketing: a general overview and first milestones of the discipline

2. Field; Segmentation; Actors: Using different tools, including Porter or BCG models, define a marketing problematic using field and trends studies,

3. Market research in B-to-B: importance of mix elements; technological approach, building an information system; Inventory of the actors and their importance. Major steps of a study. Methodology and tools to set the company in its socio-economical environment.

4. Marketing services: specificities, Supply and "oversupply"; Value creation... Issues Evaluation. Implementation, risks. Services within a field; services associated with products; maintenance; customer formations; quality standards.

5. Loyalty tools: concepts and tools used in building customer loyalty, cost evaluation and comparison.

6. Marketing business creation, comparison of different theories related to the market, explanation and critical approach to various existing methodologies, introduction to "effectuation" approach, information system in the launching phase, economic consequences of a marketing decision.

7. Purchasing processes and decision making in B to B: Actors in purchasing network; call for tenders. Complex decision making, different actors and their current influence.

8. Communication in B to B: trade shows; press relations. Integrated communication and cross-channel B to B communication, distribution channels. Entertainment Choice, loyalty; management methods, quick review of social network audience acquisition and community management

Tutorial classes

- Mini case studies in small groups will validate technical skills and concepts for each chapter

- Detailed and critical study of a marketing tool, choosing and understanding the limits (small groups, random assignment)
- Bibliographic approach of a methodology for marketing and development of a critical assessment.

Conditions of Exams

At least one multiple-choice test a year during BT4 and BT5.
MCQ will estimate theoretical knowledge and reflexes
A participation grade will be assigned
Finally, the integration of knowledge and skills will be tested in the monitoring and evaluation of the "FIL ROUGE" marketing project (Applied Transversal Project).

MI5-9-MT04 - Digital Marketing

Professor

Mylène LOUICELLIER

Total number of teaching hours: 12h

CM	TD / TE	TP	Support	Project
3h	9h			Case study
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 3h				
Credits : 0.5 ECTS				

General objectives of education

1. Practical approach based on general theory of digital tools

Specific objectives and acquired competencies

1. To understand the place of digital tools on the development and jobs of marketing field today.
2. To learn the permanent evolution of the digital marketing and its technics
3. To understand that digital marketing needs a real approach of strategy before its application

Detailed course structure

1. Tools, theory and practices of digital marketing
2. Practical analysis of the results
3. Construction of a strategy
4. Autoanalysis of the results and continuity/modifications of the strategy
5. Practical approach with exercises

Conditions of Exams

Project Presentation

MI5-9-MT05 - INNOVATION FINANCING / INTELLECTUAL PROPERTY

Professor :

Jérémie Waicenberg

Total number of teaching hours: 10h

CM	TD / TE	TP	Support	Project
5h	10h			Team Work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 2h				
Credits : 1 ECTS				

General objectives of education

The course "Innovation Financing" aims to give students an overview of different financial models and their uses and to understand relationship between the main players of the financing industry.
Introduction to a Venture Capital case.
The course "Intellectual Property" aims to give students an overview of the patent system, different valuation models.

Specific objectives and acquired competencies

- Feel comfortable the financing language and ecosystem,
- Understand the difference between different financial models,
- Results-oriented teaching : providing information and tools for future decision-makers,
- Fundamental knowledge of the profession,
- Ability to use information (ability to retrieve and analyze information from different sources)
- How to read a patent,
- Feel comfortable with all the different aspects of the patent industry,
- Understanding financial tools in order to estimate a potential value,
- Results-oriented teaching : providing information and tools for future decision-makers,

Detailed course structure

Concept of Value

- Price ≠ Value,
- Source of Information – Business Plan review,

Financial Models

- Distinctive Pharma/Biotech features,
- Financial Methods : DCF, rNPV, Call Option (Overview), Comparable Listed Companies/Recent Transactions,

Use of Financial Models

- Licensing,
- Fund Raising : Introduction,

Private Equity

- Start-up financing cycle,
- Private Equity ≠ Public Funds : A French characteristic,
- International landscape,

Venture Capital

- Quick overview of the business,
- Technical analysis,
    - Financing decision

General introduction to Patents

- What a Patent looks like,
- How to read a Patent,
- The Patent System,

Key Take Away on Patent

Use of Financial Models

- Licensing,
- Fund Raising : Introduction,

Financial Models

- Historical costs valorisation,
- BP and Goodwill valorisation,
- Licensor's side,
- Licensee's side,
- Litigation,

Conclusion

Conditions of Exams

Case Study

MI5-9-MT06 - Packaging / Sales Force

Professor :

Claire Grassi

claire.grassi@supbiotech.fr

Total number of teaching hours: 10h

CM	TD / TE	TP	Support	Project
5h	10h			Team Work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

To lead students to be autonomous in the evaluation of a situation, to be able to choose, adapt and built tools to make the right decisions regarding salesforces, distribution and packaging.

Specific objectives and acquired competencies

Definition of a packaging consistent with the positioning

Identification of specific solutions in the design of the packaging

Good understanding of the insertion of the packaging in the point of sale

Choice of an adapted distribution network

Choice of and adapted salesforce system

Constitution of the toolbox of the salesforce

Sale of ideas and projects to the salesforce

Good understanding of a marketing strategy and its consequences for the mix

Detailed course structure

Preliminary module: Packaging, needs and functions

1. Packaging history
    a. The story
    b. A part of the mix
2. Definition and functions
    a. Definition
    b. Description
    c. Main functions
        i. Basic functions
        ii. Other functions

Module 1: Packaging, brand and design

1. The role of the packaging
    a. Interest
    b. As the silent salesman
    c. As a part of the mix
2. The design of the packaging
    a. The consumer

b. How to choose
c. The elements
    i. Brand identity
    ii. Shape
    iii. Colors
    iv. Materials

3. Market expectations
    a. Pharmaceutical industry
    b. Food industry
    c. Cosmetic industry
    d. Packaging needs

Module 2: Ecology and packaging

1. Ecodesign
    a. Definition
    b. Indicators
    c. Standards
2. Life Cycle Assessment
    a. Definition
    b. Environmental footprint improvement
3. Evolutions, regulation
4. Raw material selection

Module 3: The distribution channels

20. The role of the distribution
21. The different types of distribution
    a. The length
    b. The geographic coverage
    c. The integration
22. How to choose
    a. Criteria
        i. Internal factors
        ii. External factors
    b. The steps
        i. Clients' needs
        ii. Objectives
        iii. Solutions identification
        iv. Solutions analysis
        v. Control

Module 4: The marketing plan

7. The role of the marketing plan
    a. A shared view
    b. A validation for the strategy
    c. The follow up
8. Characteristics
9. Elements
    a. Summary and table of contents
    b. Analysis

c. Strategy and objectives
d. Resources
e. Action

Module 5: Sell to the salesman

8. The role of a salesman
    a. Expectations
    b. Typology
    c. Relationships with the marketing
9. How to help and convince
    a. Support
    b. Tools
    c. Proofs
    d. Presentation
    e. Book

Module 6: The strategy and the marketing mix

1. What is strategy
2. The role of the marketing
3. Link with the mix
    - The marketer and the strategy

Conditions of Exams

Team homework and presentation.
Evaluation based on the presentation and the medium of presentation.

MI5-9-MT07 - Strategy

Professor:

Sheldon Austin

CM	TD / TE	TP	Support	Project
3h	9h			Case study
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 3h				
Credits : 0.5 ECTS				

General objectives of education

Acquire the basic knowledge to conceive of, develop and present a marketing strategy for a product.

Specific objectives and acquired competencies

By the end of the course, the students should be able to:

- Establish the qualities of a specific product.
- Determine its use, general and/or specific.
- Determine the public to which the product should be targeted.
- Design, create, develop and execute a strategy to introduce a product on the market taking into account the product and its potential users: Develop a marketing strategy using creativity, imagination and the tools available for this purpose.
- Work within the budget guidelines imposed for the development of the marketing strategy.
- Explain and present the overall outline of the strategy to the customers for whom it was elaborated.

Detailed course structure

Using a combination of class presentations, exercises and a marketing plan simulation, the students will:

1. Establish the qualities of a specific product,
2. Determine its use, general and/or specific,
3. Analyze the problems and potential opportunities associated with the sale of the product,
4. Determine the market positioning of the product as compared to similar items produced by competitors.
5. Determine the public to whom the product should be targeted, including detailed analyses of the demographic and social factors necessary to define the group or groups to target in developing the marketing strategy.
6. Create, design, develop and execute a strategy to introduce a specific product on the market taking into account the product and its potential users: Develope an annual business plan (simulation) in which students demonstrate their creativity and imagination using the tools available to create a real and viable marketing plan. Incorporate advertising into the plan, introducing elements from the media, internet, TV, et alia.
7. Examine and use imposed budget limitations in the development of an effective marketing strategy within the means available.
8. Present and explain the strategy developed from the simulation to “the customers” who requested this strategy.

Conditions of Exams

One written exam

Group presentation of an actual marketing strategy (simulation), as created and developed by each group during the course.

EI5-9-PB-3
Bioproduction&qualité

Volume horaire des enseignements de l'unité d'enseignement :

CM	TD / TE	TP	
15h	50h	35h	
SEMESTRES CONCERNES : 9			
Crédits : 8 ECTS			

Détail des enseignements de l'unité d'enseignement

- Projet transversal appliqué (Fils rouges)
- Assurance qualité
- Lean management
- Human management
- Computer system
- 6-Sigma
- TP

Compétences que l'unité d'enseignement contribue à former

Bloc de compétences 2 : Mise en œuvre d'un projet : tester, produire et commercialiser une technologie/ un produit en lien avec les Biotechnologies

- Piloter des projets techniques d'industrialisation
- Organiser une activité de production ou de bioproduction
- Optimiser une activité en termes de coût, qualité, délais

Bloc de compétences 3 : Appliquer une démarche qualité : évaluer, contrôler et garantir la qualité d'un système issu du Vivant

- Etablir une politique qualité
- Mettre en œuvre et animer cette politique qualité

Bloc de compétences 5 : Management d'équipe et connaissance de soi

- Gérer le collectif

MI5-9-PB01 - Applied Transversal Project

Professor :

Production team: Souad Fehaili / Etienne Bouillot

souad.fehaili@supbiotech.fr

Total number of teaching hours : 30h

CM	TD / TE	TP	Support	Project
	10h	20h		Team Work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 20h				
Credits : 3 ECTS				

General objectives of education

To adequately ensure that the student achieves the learning objectives of the production major, it is important to test the knowledge and skills acquisition. Accordingly, the project is based on a deep analysis of an Operation, a Supply Chain or a process in a company setting in order to assess whether students are capable of applying what has been learnt in the classroom to real-world situations. Groups will be 5 to 6 students in size on average. Sup'Biotech seeks also to promote closer working relationship with private companies to high-quality research and outstanding academic programs.

Specific objectives and acquired competencies

Four objectives (learning outcomes) are separately articulated: knowledge application, communication, collaboration and independent learning. While candidates learn to work in groups, they will also learn independently through self-reflection and evaluation of their own work processes. The following are the learning outcomes for the Applied Transversal Project:

1. Students knowledge application will acquire the ability to make links across different areas of knowledge and to generate develop and evaluate ideas and information so as to apply these skills to the project task.

2. Student's communication will acquire the skills to communicate effectively and to present ideas clearly and coherently to a specific audience in both the written and oral forms.

3. Student's collaboration will acquire collaborative skills through working in a team to achieve common goals.

Student's independent learning will be able to learn on their own, reflect on their learning and take appropriate action to improve it.

Detailed course structure

Three different subjects have been proposed to our students this year. The third one is a collaboration with a private company.

Subject 1: CONCEPTUALISATION AND MANAGEMENT OF A PRODUCTION LINE

Everything about the production steps is conceptualized:

1) Design of the unit to implement, production capacity, unit cleaning, staff needs, production schedule, energy and water needs, location, shipping requirements…

2) Consider factors that cause product degradation/contamination. Discuss the various controls to implement before the distribution of the product.

3) Consider the financial aspects, capital costs, operating costs (personnel, electricity, and materials), maintenance costs, revenues…

Subject 2: EXPERIMENTAL KITCHEN RENOVATION
The reactivation of the experimental kitchen will be in several stages. Priority will be given to the security and hygiene:

Step 1: Establishment of a State of the art
Step 2: Proposed amendments in accordance with the budget and the regulations in force in the catering
Step 3: Renovation work achievement

Subject 3: INDUSTIALIZATION OF A WHEAT PEPTONE PROCESS
Project in collaboration with a private company

Conditions of Exams

Written Report
At the end of each project step, each group is required to submit a piece of written work based on the task that they have completed. This component assesses students on their performance pertaining to knowledge application and written communication.

Oral Presentation
Each student from the group is given an opportunity to present a part of the project orally to a target audience and answer questions posed to the group. The student will be assessed as individuals and as a group. Emphasis is placed on every student being able to display, individually, his ability to be clear and coherent in presenting his ideas and to address and engage an audience.

MI5-9-PB02 - Quality

Professor :

Drissa DOUMBIA

Total number of teaching hours : 15h

CM	TD / TE	TP	Support	Project
5h	10h			Case study
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

Get general knowledge baseline in Quality Assurance principles and application in Industrial project environment

Specific objectives and acquired competencies

- Understand the Regulatory behavior of Quality Assurance, Quality Management, and all associated system that ensure the overall quality of a product and its manufacturing process
- Understand responsibilities and roles that Industrial stakeholders have with regard to patient/clients in term of Quality Assurance
- Get knowledge on general principle of Quality Management System and Risk Assessment
- Get knowledge on more specific principles of Process Engineering, Quality Control, Certification/Accreditation
- Be able to apply basic principles of Quality in simple Case Study/Examples with various scenarii

Relate each component of the learning program to actual and future professional activity: be able to realize a job with a “Good Quality behavior”

Detailed course structure

4. Introduction
    a. Presentation of Quality Assurance Module including Agenda and Instructors
    b. Concepts, Expectations & learnings from QA module
5. Regulatory overview
    a. Historical background
        i. Patient safety and increase of injuries/sickness & related medicine treatment
        ii. Safety and Healthcare requirements: Legal aspects
        iii. Contextual story: Why Regulatory bodies have been created? Good Manufacturing Practices at the cornerstone
    b. Bodies and regional representation
        i. International organization (WHO, ICH, ISO, ASTM)
        ii. Regional regulations (FDA, EMA, MHRA, MHLW, ANSM)
        iii. Code of Federal Regulations (US) & Pharmacopoeias (US, Eur, Japan)
        iv. Framework of regulations: Industrial compliance
    c. Guidelines & Guidances
        i. Regulatory pyramid, Documentary System and relationship
        ii. Impact of regulations in operational & industrial activities
    d. Interactive workshop: FDA Guidances for industry – Process Validation
6. Quality Management

a. Terminology, definitions & principles
b. Quality impact within an industrial project:
    i. Multi-disciplinary aspects
    ii. Knowledges & Requirements
    iii. Management
c. Quality Management System
    i. Characteristics, implementation and use
    ii. ASTM E2500
d. QMS application:
    i. GMP
    ii. Process Engineering
    iii. (Bio)Pharmaceutical Product Manufacturing
e. Commissioning, Qualification, Validation, & Verification
f. Interactive Workshop: Spotlight on 5M Method & Ishikawa diagram n

7. Risk Assessment & Management
    a. Terminology, definitions, & principles
    b. ICH Quality Guidelines
        i. Good Manufacturing Practice Guide for Active Pharmaceutical Ingredients (Q7)
        ii. Pharmaceutical Development (Q8)
        iii. Quality Risk Management (Q9)
        iv. Pharmaceutical Quality System (Q10)
    c. Tools and Applications: Methods to tackle and mitigate the risk
        i. Hazard Analysis Critical Control Point (HACCP)
        ii. Failure, Mode, Effect Analysis (FMEA)
        iii. Ishikawa/Fishbone/5M
    d. Notion of Failure, CAPA, Deviations (and many others such as OOS, OOT, OOE)
    e. Interactive workshop: Conducting a Risk Based Approach during product development
8. Quality by Design)
    a. Historical background and applicability
    b. Definition and characteristic
    c. QbD Approach
        i. Regulatory guidelines and recommendations
        ii. Development & Manufacturing
        iii. Product Life Cycle & Supply Chain
    d. QbD Strategy
        i. Quality Target Product Profile
        ii. Critical Quality Attributes
        iii. Critical Process Parameters
        iv. Design and implementation of a Control Strategy
    e. Traditional Development vs. Quality by Design
    f. Case Study: Vaccines manufacturing process

- Certification, Audit, Compliance
    - Terminology, Definitions
    - Principles & Application
    - Certificate of Compliance
        - Standards compliance
        - Testing approach & Quality Agreements
        - ISO 9001 certification
    - Audits
        - External Audits
            - Regulatory/Certification Audits
            - Supplier Audits

- Internal Audits

1. Conclusion & Perspectives

Experience Returns

Conditions of Exams

Knowledge Test: Multiple Choice Questionnaire (20 questions) to be performed in 30 minutes.
Classroom participation: Bonus point for classroom interaction including questions (with regard to pertinence and interest), rationale around a technical questions raised by the teacher/speaker, and participation in debates/thought and Interactive Case Study.

Rating of classroom participation need to be clarifies and set up prior to the Education lecture sessions.

MI5-9-PB03 - Lean Management

Professor :

Etienne Bouillot

Total number of teaching hours : 15h

CM	TD / TE	TP	Support	Project
5h	10h			Team Work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

Lean management as

- A way to see, and work on, operational processes
- An approach to develop the operational performance
- A lean perspective on managing teams and projects

Specific objectives and acquired competencies

- Value stream description and performance improvement
- 7 wastes
- 5 S
- A3s
- Total productive maintenance

Detailed course structure

I. Introduction to lean : origins, process and flow

II. Value stream mapping
- Cycle time
- Value Adding time
- Lead time

III. 7 wastes
- 7 wastes
- Methodologies for improvements (1st part)
- Lean vs 6 sigmas vs Theory of constraints

IV. Project description and management using A3s

V. Methodologies for improvement
- Kaizen
- 5S

VI. Lean management
- Principles of lean management
  - Essence of lean management
  - Purpose, people, process
  - Visual Communication
  - Lean role in continuous improvement
- Toyota kata

VII. Lean product and process development

VIII. Total Productive Maintenance

- Maintenance
- TPM and Lean
- OEE
- Equipments
- Equipment failures
- Types of maintenance
- Process of intervention
- Organization
- TPM
- Getting there : eight steps of maintenance

Conditions of Exams

Based on

- Attendance
- Class participation
- VSM home work and presentation
- A3 utilization and presentation for red thread projects

MI5-9-PB04 – Human Management

Professor :

Fabien PEZOUS

Total number of teaching hours : 15h

CM	TD / TE	TP	Support	Project
5h	10h			Case study
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

One of the complexities and challenges for leadership and management on a production line is human resource management (HRM). While the processes and procedures are well defined in a variety of laws, instructions, and policies, few managers are fully aware of the myriad requirements and responsibilities that apply to leadership.

This course is designed to inform students about HRM as they will experience it in leadership positions. The course will first introduce (or in some cases reintroduce) students to the fundamentals or "basics" of HRM, covering areas such as employee management (recruiting, staffing, performance reviews, etc.), training and development, employee relations, etc. Using this introduction as the foundation, the course will then dig deeper into the more complex and less well defined areas of HRM, to provide students with the opportunity to apply best practices to the challenges they will face in more junior leadership positions.

Specific objectives and acquired competencies

These broad intentions can be defined more precisely through an examination of the course's specific objectives. By the end of the course the student will be able to:

1. Appreciate the importance of human resource management as a field of study and as a central management function
2. Know the elements of the human resource function (e.g. – recruitment, selection, training and development, etc.) and be familiar with each element's key concepts & terminology; and

Apply the principles and techniques of human resource management gained through this course to the discussion of major personnel issues and the solution of typical case problems.

Conditions of Exams

Practical work during sessions: awareness exercises to the problems encountered and their mode of treatment

Degree of participation in the courses: questions, remarks and suggestion with implementation of lessons, during exercises, case studies treated group out of session

MI5-9-PB05 – Computer System in Production

Professor :

Fabien PEZOUS

Total number of teaching hours : 10h

CM	TD / TE	TP	Support	Project
	10h			Case study
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 0.5 ECTS				

General objectives of education

Introduce students to ERP and computerised systems.

Introduce students to the regulatory applied to the computerised systems within pharmaceuticals, medical devices industries.

Introduce students to the computerised system validation executed in Health products industries

Specific objectives and acquired competencies

To understand the logic and interests of validating computerised systems of a health products industry.

Conditions of Exams

Practical work during sessions

MI5-9-PB06 - CGMPs and Six Sigma

Professor:

Brigitte BRUN

Total number of teaching hours : 10h

CM	TD / TE	TP	Support	Project
	10h			Case study
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 0.5 ECTS				

General objectives of education

Application of Six Sigma tools and change methodology for highly regulated environments.

Specific objectives and acquired competencies

- Six Sigma :
  - To discover and understand Six Sigma
  - To understand the cultural aspects that lead companies to implement a "Six Sigma "or" Lean Six Sigma "approach
  - To know the roles involved
  - To allow students to be involved on 6S
  - The final objective: to obtain basics to become a potential candidate for a 6S project.
- cGmp's
  - To discover and understand GMP projects launch
  - To know the roles and actions involved
  - To understand the challenging aspects that lead companies to implement a "ASTM E2500"verification approach
  - To allow you to be involved on GMP new projects or modifications

The final objective: to obtain basics to become a potential candidate for a GMP project

Detailed course structure

1. Chapter 1: Six Sigma
   - Introduction
     - Six Sigma as holistic and flexible method:
   - Part 1: Six Sigma, a tool for performance
     - 1.1 History
     - 1.2 Why 6S?
     - 1.3 The objectives of 6S
     - 1.4 The 6S "must be"
     - 1.5 6S strategy
     - 1.6 Evolution on the quality field
     - 1.7 Strong complementarities
     - 1.8 Six Sigma and variability
     - 1.9 Lean Six Sigma
     - 1.10 Integrating Six Sigma in a process of industrial performance
6. Part 2: The concepts of Six Sigma
   - 2.1 6S Philosophy
   - 2.2 Variability and challenges
   - 2.3 Statical Process Control (Capability and Performance basics)

- 2.4 DMAIC and tools
- 2.5 6S structure of skills
- 2.6 Different roles
- 2.7 6S management by project.

I. Part 3: Six Sigma Management
   - 3.1 Values and management
   - 3.2 The project levels
   - 3.3 6S Stakeholders
   - 3.4 Ingredients for good team work
   - 3.5 6S training
   - 3.6 Six Sigma project management tools
   - 3.7 Six Sigma project Keys of success
   - 3.8 Gemba & Mudas short reminder.

   Sup'Biotech airways role game

2. Chapter 2: cGMP's
7. Part 1 - Commissioning, Qualification & Validation.
   - Engineering
   - Commissioning Verification
   - GEP
   - GDP
   - Scientific tests
   - The 2 systems
   - Change
   - Qualification for Equipments/ Systems
   - ASTM 25 improvement:
   - Validation strategy
   - Regulatory agencies and International standards
8. Part 2 -Validation Processes for GMP Facilities and Systems.
   - User Requirement Brief (URB)
   - Basic Design (BD)
   - User Requirements Specifications (URS)
   - Validation Master Plan (VMP)
   - Detailed Design
   - Design Review
   - Commissioning
   - Installation Qualification
   - Operation Qualification (OQ)
   - Performance Qualification (PQ)
   - Process Validation (PV)
   - Validation Summary Report (VSR)
   - Continuous Validation Plan (CVP)
   - Deviations reporting
   - Change Control
   - Archiving
   - Decommissioning
9. Part3 -The ASTM E2500-7

   The ASTM E2500-7 Methodology

Conditions of Exams

MCQ

MI5-9-PB07 – TP : Formation aux nouvelles techniques de culture cellulaire

Professor :

Marie-Paule LESLY

Total number of teaching hours : 15h

CM	TD / TE	TP	Support	Project
		15h		Case study
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

Présentation des évolutions technologiques en matière de culture cellulaire.

Specific objectives and acquired competencies

UPSTREAM :

- Evolution de la culture cellulaire dans les vaccins
- Optimisation des conditions de culture cellulaire :
- Criblage des conditions possibles via le Micro-réacteur MRT-24
- Suivi de la culture via des technologies label free

DOWSTREAM :

- présentation de l'ensemble des technologies à usage unique
- Automatisation de ces étapes à usage unique
- Stratégies pour répondre aux nouveaux besoins de la production des médicaments issus des biotechnologies.

MATÉRIEL PÉDAGOGIQUE

- Présentation de la formation par logiciel sur PC
- Photos, échantillons, coupes de produits, carters

Conditions of Exams

Jeu de construction de procédé biotech : travail en groupe

UE5-9MS-1 : MINOR

Total number of teaching hours: 55h

CM	TD / TE	TP	Support	Project
15h	30h	10h		
CONCERNED SEMESTER : 9				
Credits : 4 ECTS				

EI5-9-FP-3
Agro-alimentaire

Volume horaire des enseignements de l'unité d'enseignement :

CM	TD / TE	TP	
15h	30h	10h	
SEMESTRES CONCERNES : 9			
Crédits : 4 ECTS			

Détail des enseignements de l'unité d'enseignement

- Conservation des aliments
- Traçabilité et sécurité alimentaire
- Développement de produits
- TP

Compétences que l'unité d'enseignement contribue à former

Bloc de compétences 0 : Acquisition d'une culture scientifique

- Acquisition d'un large champ de connaissances scientifiques fondamentales
- Former l'élève-ingénieur à la recherche et par la recherche

Bloc de compétences 1 : Analyse d'un système, identification d'un besoin et mise en place d'une démarche de conception d'un produit/procédé en lien avec les biotechnologies

- Appréhender, comprendre et analyser un système complexe

MI5-9-FP01-02 : Food Preservation and tracability

Professor :

Souad Fehaili

souad.fehaili@supbiotech.fr

Total number of teaching hours : 30h

CM	TD / TE	TP	Support	Project
10h	20h			Team work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 10h				
Credits : 2 ECTS				

General objectives of education

Students will be introduced to food safety and food preservation science. Students will gain an understanding of the principles and science behind foodborne illnesses and food preservation methods. They will learn how to apply these principles to safely preserve food by traditional and emerging methods.

Specific objectives and acquired competencies

1. To understand the impact, causes and prevention of foodborne illness.
2. To understand the relationship between food spoilage, food safety and food preservation.
3. To examine, learn and understand the basics of food preservation principles and skills necessary to achieve high quality preserved food products.
4. Master the principle techniques of food preservation
5. Know how to compare the efficiency of technological treatments
6. Know how to select the most appropriate preservation method
7. Know how to classify processed food by processing technology
8. Prevent and master nutrients degradation during processing and food storage

Detailed course structure

1. Food risks

1) Food risks from microbial origins
2) Food risks from chemicals

The potential toxic substances in food
The foreign-substances in food
Additives

3) Control of risks

5M method
HACCP

2. Food preservation

1. Traditional Preservation Technologies
    1.1. Using Preservatives
        1.1.1. Antimicrobials
        1.1.2. Antioxidants
    1.2. Removing water
        1.2.1. Evaporation
            Principles
            Equipments
            Effect on foods

1.2.2. Dehydration
Principles
Equipments
Effect on foods
1.2.3. Freez drying
Principles
Comparison with conventional drying
1.3. Lowering temperature
1.3.1. Chilling
Principles
Chilling of Fresh foods
Chilling Processed foods
Effect on foods
1.3.2. Freezing
Principles
Effect on foods
1.4. Increasing temperature
1.4.1. Blanching
Principles
Equipments
Effect on foods
1.4.2. Pasteurisation
Principles
Equipments
Effect on foods
Pasteurisation of unpackaged liquids
Pasteurisation of packaged products
Effect on foods
1.4.3. Sterilisation
Principles
In-container sterilization
Ultra high-temperature (UHT)/aseptic processes
Effect on foods

2. Emerging Preservation Techniques
Irradiation
Processing using electric fields, high hydrostatic pressure, light or ultrasound

4) Packaging
Type of packaging materials
Rigid and semi-Rigid containers
Flexible containers

Conditions of Exams

Project

To adequately ensure that the student achieves the course and learning objectives, it is important to test the knowledge acquisition through a variety of assessment methods. Accordingly, the group project will be based on a deep analysis of a food preservation process in a company to assess whether students are capable of applying what has been learnt in the classroom to real-world situations

MI5-9-FP03 : Quality Control

Professor :

Souad Fehaili

souad.fehaili@supbiotech.fr

Total number of teaching hours : 15h

CM	TD / TE	TP	Support	Project
5h	10h			Team Work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

This course has been designed to help our students understand the process of developing and marketing a new product. There are five phases to developing and marketing a new product. Known as the 5D's, they are Decide, Discover, Define, Develop and Deploy. However, within each phase there are many different steps. Space and class time limitations do not allow us to fully explore all of them.

Specific objectives and acquired competencies

- To identify the process used in the development of new food product
- To realize that food-product development comprises many disciplines
- To develop an idea
- To apply brainstorming skills in the decision-making process
- To apply the information learned in the previous food sciences courses to define, formulate and evaluate a product so it meets consumer needs
- To apply safety regulations and requirements to food packaging and labelling

Detailed course structure

Sessions	**Contents**	**Teaching Method**
Session 1	Introduction to food product development	Lecture (5h)
Session 2	**Decide** : Brainstorming, decision on a new food product to develop **Discover** – Part 1 To conduct a competitive product review - Discover the competition and defines what the consumer wants or needs - Compare qualitative and quantitative research	Teamwork (3h) Discussions
Session 3	**Discover** – Part 2 To apply market research by using screening tools and conducting focus group	Teamwork (2h) Discussions
Session 4	**Define** : Conceptualize the product - Create a formulation sheet - Describe the conditions necessary for optimum shelf life and product safety Plan for sensory evaluation	Teamwork (3h) Discussions
Sessions 5	**Develop** : Formulate the new food product - Prepare samples of the new food product - Conduct a sensory evaluation	Practical work (10h)

	- Shelf life and food spoilage evaluation - Create a reasonable packaging - Develop a nutritional label	
Sessions 6	**Deploy** : Marketing the product - Production schedules - Where/how to test the market - Type of sales (e-tail, food service, retail…) - Retail price - Promotions/advertising	Teamwork (2h) Discussions
Project final presentation	Project presentation : a complete summary of the project	Oral presentation (30 min) Discussion (30 min)

Conditions of Exams

Quizzes	0%
Project presentation	70%
Final exam	0%
Attendance	30%

MI5-9-FP04 : Practical Work : analyse sensorielle (course in French)

Professor:

Romain EL ANDALOUSSI

Total number of teaching hours: 10h

CM	TD / TE	TP	Support	Project
		10h		Team work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 2h				
Credits : 1 ECTS				

General objectives of education

Connaître la théorie et les applications pratiques de l'analyse sensorielle en agroalimentaire

Specific objectives and acquired competencies

- Savoir décrire un produit agro-alimentaire en analyse sensorielle
- Connaitre et Comprendre les Normes AFNOR de l'analyse sensorielle utilisées dans le monde entier
- Savoir comparer deux produits en vue d'une duplication ou d'un changement visible de qualité sensorielle
- Savoir-faire une cartographie entre deux produits
- Connaître les limites de l'analyse sensorielle (plan LEGISLATION)
- Savoir appliquer l'analyse sensorielle en MARKETING et PUBLICITE
- Arôme dans un produit agroalimentaire

Detailed course structure

Cours

1. Utilisation de l'analyse sensorielle
2. Ensemble des Normes Afnor relatives à l'analyse sensorielle
3. Définitions et utilisation (tests) des Normes relatives à l'olfaction et la gustation
4. Arôme (définition des matières premières et de leur difficulté d'utilisation …)
5. Législation et contrôle analytique de la Législation

Travaux pratiques

1. Comparaison sur des produits type gâteaux, chocolats et bonbons (seuls autorisés pour garder Les règles d'hygiène et de sécurité)
2. Cartographie de comparaison

Conditions of Exams

Written report

EI5-9-CO-1
Cosmétique

Volume horaire des enseignements de l'unité d'enseignement :

CM	TD / TE	TP	
15h	30h	10h	
SEMESTRES CONCERNES : 9			
Crédits : 4 ECTS			

Détail des enseignements de l'unité d'enseignement

- Peaux reconstituées
- Contrôle qualité
- Analyses sensorielles
- Développement de produits

Compétences que l'unité d'enseignement contribue à former

Bloc de compétences 0 : Acquisition d'une culture scientifique

- Acquisition d'un large champ de connaissances scientifiques fondamentales
- Former l'élève-ingénieur à la recherche et par la recherche

Bloc de compétences 1 : Analyse d'un système, identification d'un besoin et mise en place d'une démarche de conception d'un produit/procédé en lien avec les biotechnologies

- Appréhender, comprendre et analyser un système complexe
- Aptitude à élaborer des études de conception de procédés

Bloc de compétences 4 : Prise en compte de l'environnement et de la biodiversité au quotidien

- Etre un ingénieur "responsable" (approche de l'éthique comme valeur - respect règles - autrui - nature)

Bloc de compétences 5 : Management d'équipe et connaissance de soi

- Gérer le collectif
- Maitriser son discours
- Se former tout au long de la vie

MI5-9-CO01 : Reconstituted Skin

Professor :

Charlotte Lequeux

c_lequeux@yahoo.fr

Total number of teaching hours : 15h

CM	TD / TE	TP	Support	Project
5h	10h			Team Work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

The principal objective is to improve students' knowledge in skin biology and cosmetic actives for the cosmetic part. For the pharmaceutical purpose the objective is to present the new therapies based on cell therapies.

Specific objectives and acquired competencies

- Ability to work on an English scientific paper
- Analyze and criticize the paper
- Ability to work autonomously
- Definition of cell therapy and Development of a cell therapy process
- Present different laboratory design for GMP production of cell therapies

Detailed course structure

The different presentations consisted in:

- Skin biology
- Biologic tools used in cosmetology
- Skin substitutes
- Cosmetic Actives (anti-ageing, slimming products…)
- Skin ageing
- Sun and skin
- Innovative cell therapies

Conditions of Exams

Every student will have to perform an oral presentation during approximatively 20 min about a scientific paper in skin biology and cosmetics field.

MI5-9-CO02 : Quality Control

Professor:

Laurence Michel-Dansac

micheldansac@club-internet.fr

Total number of teaching hours : 15h

CM	TD / TE	TP	Support	Project
5h	10h			Case study
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

The goal is to know the main requirements for the formulation of a cosmetic product
From design to marketing (with the file on mandatory European Portal since July 2013) according to the country where it is to be marketed

Specific objectives and acquired competencies

The goal is to discover the importance of legislation to formulate cosmetic products (or other)
-Know the main raw materials and their use
-Know the pattern of major types of formulation
-know read and write the "ingredients" on packaging

Detailed course structure

Legislation: Historic until July 2013
Product Dossier (sensory analysis, physico-chemical and microbiological type of raw material or composition ... toxicological testing, patch testing, efficacy testing ....)
Chemical raw -materials family
Finished products by type: creams nail polish, shampoo ++
Scientists -Methods required by European legislation to control products (allergens, limited products +++)
-The skin and hair

Conditions of Exams

A written examination of 2 hours

MI5-9-CO03 : Sensorial Analysis

Professor:

Laurence Michel-Dansac

Total number of teaching hours: 15h

CM	TD / TE	TP	Support	Project
5h	10h			Case study
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 3h				
Credits : 1 ECTS				

General objectives of education

Understand the use of sensory analysis
Internal and test consumer
For advertising, marketing +++

Specific objectives and acquired competencies

How to assess a cosmetic cream or a food product

Perfume-flavours in cosmetic products and food products

Detailed course structure

Our 5 senses
According to the AFNOR Standards
Mandatory vocabulary odour, texture +++
Test types: binary, duo-trio, triangle
Statistical tests
Various experts
Discriminative tests, hedonic ++
Preference Mapping
Establishment of a panel on two cosmetic creams according to the Standard of May 2012

Conditions of Exams

A written examination of 2 hours

MI5-9-CO04 : Practical Work

Professor:

Ranesha GOOROCHURN

Total number of teaching hours : 10h

CM	TD / TE	TP	Support	Project
		10h		Team work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 2h				
Credits : 1 ECTS				

General objectives of education

Based on raw materials, this practical work is oriented to manage formulation of product, and respect quality of the product

Specific objectives and acquired competencies

Protocol is explained to the students. Then, students must be autonomous to show good results

Detailed course structure

Protocol is given to the students to be prepared before the practical work.

Conditions of Exams

Written report

EI5-9-GE-2
Environnement

Volume horaire des enseignements de l'unité d'enseignement :

CM	TD / TE	TP	
15h	30h	10h	
SEMESTRES CONCERNES : 9			
Crédits : 4 ECTS			

Détail des enseignements de l'unité d'enseignement

- Gestion des risques liés aux polluants
- Pollution / Bioremédiation
- Ecologie marine
- TP

Compétences que l'unité d'enseignement contribue à former

Bloc de compétences 0 : Acquisition d'une culture scientifique

- Acquisition d'un large champ de connaissances scientifiques fondamentales
- Former l'élève-ingénieur à la recherche et par la recherche

Bloc de compétences 4 : Prise en compte de l'environnement et de la biodiversité au quotidien

- Etre un ingénieur "responsable" (approche de l'éthique comme valeur - respect règles - autrui - nature)

MI5-9-GE01 : Risk Gestion

Professor:

Anne Straczek

Anne.STRACZEK@anses.fr

Total number of teaching hours : 15h

CM	TD / TE	TP	Support	Project
5h	10h			Case study
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

Gain skills to assess environmental risks induced by chemical pollutants either in the frame of observed pollution or to prevent them, propose method to limit them. Understand interactions between science and environmental regulations

Specific objectives and acquired competencies

- Gain basic knowledge of regulatory ecotoxicology: Definition of NOEC, LOEC EC50, PNEC, PEC, AF, Kow, Koc environmental compartments exposed to pollutants, dissipation process, regulatory thresholds, principle of ecotoxicity tests
- Know how to look for, analyse and summarize informations gained from different sources: scientific papers, not specialized information, regulation and guideline documents
- Learn to work in a cross-disciplinary area with basic and news knowledge in chemistry, biology, geochemistry and regulation
- Manage to present results of a work through oral and written communication, in another language
  Manage to work in a team

Detailed course structure

Study of chemical pollutants in environment through a bibliographical work

a. Elaborate how to assess a pollutant, based on a brain storming to determine which kind on information to look for, different kind on information which are available
b. Analysis and interpretation of the information regarding an environmental issue, which is chosen according to interest or professional objectives of the students
c. Present accurately and briefly the results of bibliographical investigations

Case study based on the assessment of an insecticide dossier submitted in a regulatory framework (BPR, Regulation (EU) 528/2012)

- Find and use information in a regulatory or guidance document
- Determine the predicted no effect concentration based on the relevant endpoint found in a public database and the appropriate assessment factor
- Hand calculation of the predicted environmental concentration of the biocide and use of the software developed for this purpose
- Assess risks and other non acceptable effects (persistency, bioaccumulation…) and the harmonized classification according to the CLP regulation
- Propose mitigation measures when inacceptable risks are predicted
- Present accurately and briefly the risk assessment, the results and the consequences

Practical laboratory case : assessment of the feasibility of an ecotoxicity test dealing with the toxicity of a chemical on micro-organisms from a sewage treatment plant

a) Analyze the guideline for this test
b) Identify the tasks and share them in the frame of a project management
c) Determine the main issues and contact professionals or teachers to solve them
d) Present the results of the investigation

Conditions of Exams

Bibliographical work

- Write a brief report as a scientific paper : the quality of the investigations, the data analysis and the writing will be taken into account
- Oral communication (10 minutes) and questions by both students and teacher

Case study: write a report as a biocidal dossier

Practical laboratory case : oral presentation of analysis of the guideline and investigations to solve main issues

MI5-9-GE02/03 : Pollution - Bioremediation

Professor :

Hugo Cruz Ramos

hugocruzramos@hotmail.com

Total number of teaching hours: 15h

CM	TD / TE	TP	Support	Project
5h	10h			Team Work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 3h				
Credits : 1 ECTS				

General objectives of education

1) Acquire knowledge on different aspects of environmental pollution: pollutants, dynamics, effects, risk and remedies.

2) Understanding of appropriate remediation technologies using organisms (bacteria, fungi and plants) on polluted environments: water, soil and air.

Specific objectives and acquired competencies

- Objectives: Acquire knowledge on soil pollutants, dynamics, effects and risks

  Identify water pollutants; acquire knowledge on their dynamics, effects and risks

  Describe air pollutants; acquire knowledge on their dynamics, effects and risks

  Develop knowledge of the equipment employed in atmospheric sampling and measurements

  Describe some microbial metabolic processes involved in bioremediation

  Understand the active fungal role in the bioremediation of polluted environments

  Discuss about innovative pollution remedies

  Develop a level of comprehension of the use of a plant's ability to contain or remove pollutants from environment

  Acquire knowledge on leading-edge genetic-engineering approaches in bioremediation

Detailed course structure

1. **Soil Pollution**
   1.1. Dynamics, effects and risks of dioxin pollutants
   1.2. Dynamics, effects and risks of lead pollutants

2. **Water Pollution**
   2.1. The concept of the exposome
   2.2. Bisphenol A and chromosome abnormalities

3. **Air pollution**
   3.1. Air pollution and DNA mutations
   3.2. Genetic effects of dioxin.

4. **Atmospheric sampling**
   4.1. Atmospheric CO_2 sampling and modeling
   4.2. Aerosolized virus collected from air

5. **Microbial biodegradation**
   5.1. Biodegradation of mycrocystins
   5.2. Bioremediation in marine ecosystems

6. **Mycoremediation**
   6.1. Mycoremediation of dyes
   6.2. Yeast metal binding protein linked to heavy metal tolerance

7. **Pollution remedies**
   7.1. A car powered by hydrogen a pollution-free vehicle?
   7.2. Plants as fertilization and weed control systems
   7.3. An autonomous house?

8. **Phytoremediation**
   8.1. Phytoremediation assessment.
   8.2. Accumulation of Cs in endophytic fungi-plant associations.

9. **Pollution / Methods applied in bioremediation. Student's lectures**
   Biotechnical approaches for assessment and remediation of polluted environments

Conditions of Exams

Scientific publication analysis
Note on the participation
Written exam on Pollution and Bioremediation
Oral presentation

MI5-9-GE04: Soil science and urban Ecology

Professor:

Céline COLIN-BELLIER

Total number of teaching hours : 10h

CM	TD / TE	TP	Support	Project
		10h		Team Work
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 2h				
Credits : 1 ECTS				

General objectives of education

Based on the knowledge seen during S8, Understanding advanced notions in soil science specifically in urban areas in order to comprehend and be prepared to future issues of ecological engineering which will be essentially urban / peri-urban. Understand the role of the soil in the general overall functioning of terrestrial systems. Integrate both mineral and biological origin of the soil in the learning to be able to be operational on urban soil.

Specific objectives and acquired competencies

- Get knowledge on the composition, function of the soil and the risk
- Acquire knowledge on the different analysis related to the soil quality
- Acquire methodology for soil mapping
- Get knowledge on urban soil and its problematic (pollution /pollution)

Get basics on urban planning

Detailed course structure

I. Basics in urban soil science

   a. Function of the soil
   b. Pedogenesis in urban soil
   c. Definition of the components of the urban soil
   d. Physical characteristics of the urban soil
   e. Biodiversity of the soil
   f. Ecosystemic approach
   g. Overview on basic analysis with applied exercice, natural and urban soil
   h. « Real » exercice : Mapping on site, following

II. Soil in urban areas

   a. Definition of a urban sol
   b. Pollution and depollution
   c. urban planning problematic : how to treat the soil ?

Compost set up

During the first sessions, few observations were done with soil auger. It helped to decided where to open 2 or 3 **digs** (1*1,5 m², 1 to 2 m deep) to observe soils horizons (differents colors, texture touching it, structure, biodviersity) and to sample it, one sampple by horizon, about 3 to 5 horizons by dig. After that, the soil samples are to be analised at lab

Lab analysis : particle size (clay, loam, silt, sand) by sedimentation, pH water (actual pH) and pH Kcl (to forecast futur pH), organic matter, C, N, (organic fertility), cationic exchangeable capacity (mineral fertility), (DNA, when possible)

Interpretation of lab results and management thinking/propositions

Conditions of Exams

Written exam : 15’ exam to see the progression,the understanding, at the beginnig of the day

Oral presentation : Eurosoil works presentation

Practice works : interpretation of lab results

EI5-9-HP-4
Santé

Volume horaire des enseignements de l'unité d'enseignement :

CM	TD / TE	TP	
15h	30h	10h	
SEMESTRES CONCERNES : 9			
Crédits : 4 ECTS			

Détail des enseignements de l'unité d'enseignement

- Chimie médicinale
- Angiogénèse
- Management de la santé
- Neurobiologie

Compétences que l'unité d'enseignement contribue à former

Bloc de compétences 0 : Acquisition d'une culture scientifique

- Acquisition d'un large champ de connaissances scientifiques fondamentales
- Former l'élève-ingénieur à la recherche et par la recherche

Bloc de compétences 1 : Analyse d'un système, identification d'un besoin et mise en place d'une démarche de conception d'un produit/procédé en lien avec les biotechnologies

- Appréhender, comprendre et analyser un système complexe

Bloc de compétences 4 : Prise en compte de l'environnement et de la biodiversité au quotidien

- Maîtriser son environnement de travail (aspects économique - réglementaire - technique - international)

Bloc de compétences 5 : Management d'équipe et connaissance de soi

- Gérer le collectif
- Maitriser son discours
- Se former tout au long de la vie

MI5-9-HP01 : Angiogenesis

Professor:

Bruno Vailhé

bvailhe@gmail.com

Total number of teaching hours : 15h

CM	TD / TE	TP	Support	Project
5h	10h			Article study
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

Understanding the fundamental biological mechanisms of angiogenesis. Knowing the preclinical and clinical fields of application.

Specific objectives and acquired competencies

Knowing and understanding the roles of the:

-cell migration and proliferation

-morphogenesis

-cell adhesion receptors

-pericytes

-cytokines

-extracellular matrix

-endothelial cell progenitors

-proteases

Knowing the in vitro and in vivo models of angiogenesis.

Knowing the fields of application of angiogenesis as a therapeutic target.

Detailed course structure

This course is based on students' oral presentations. Scientific publications are given to the students. Students have to read, understand, analyze and present their publication as if they were given a lecture. Other students are randomly chosen to ask questions during the lecture.

Conditions of Exams

A note is given to the talk, and another note is given according to the quality of the questions.
The competences are evaluated based on this oral examination + MCQ.

MI5-9-HP02: Medicinal Chemistry

Professor :

Roman Lopez

Total number of teaching hours: 10h

CM	TD / TE	TP	Support	Project
	10h			-
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 3h				
Credits : 1 ECTS				

General objectives of education

Master the control optimization strategies of biological and physicochemical properties of bioactive molecules, in the context of drug discovery.

Specific objectives and acquired competencies

Know the parameters affecting the future of a molecule corresponding to the various modes of administration in humans.
Know the rules of Lipinski, ADME, molecular aspects of metabolism.
Synthesize the lessons learned from case studies

Detailed course structure

1. Introduction : structure activity relation SAR
2. Design and optimization of biological molecules : hit to lead
3. Lead optimisation :*in vitro* to *in vivo*
4. Metabolization
5. Lipinski rules
6. Strategy of drug repositioning
7. Examples of biological optimization

Conditions of Exams

Participation
Case study by scientific article analysis

MI5-9-HP03 : Neurobiology

Professor :

Yorick Gitton

Total number of teaching hours : 15h

CM	TD / TE	TP	Support	Project
5h	10h			Article Study
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

Acquisition of the basic information needed to work in a field related directly or indirectly to neurology: neuron concepts, nervous system, neural information, major neural pathologies.
Analyze the status of a scientific question in neurobiology and its challenges by providing a collaborative work from the literature

Specific objectives and acquired competencies

• Know the territorial organization of the nervous system and cellular.
• Know the genetic, molecular and cellular to the establishment of the nervous system (neurogenesis, differentiation, proliferation, migration, axon guidance ...).
• Know the major regulatory cascades involved in fundamental processes of neurobiology such as proliferation, differentiation, migration, cell survival,
• Know the cellular mechanisms and / or molecular involved in some major diseases (in societal issue) nervous system.
• Understand the importance of research in neurobiology for the elucidation of the mechanisms of many diseases and the identification of new therapeutic targets.
• Know how to analyze the literature and use its transversal knowledge to develop a comprehensive synthesis on a defined topic and assess the challenges in the field of R & D.

Detailed course structure

The neuron. He has special? How is he talking about?
Where are and where will the neurons?
How are tasks distributed in the nervous system?
Which centers organize neural functions above?

Conditions of Exams

MCQ 10mn (7 questions) at the beginning of each course.
The first, to assess initial knowledge.
The following, to measure the acquisition of basic course before. (1/3)
Oral participation on going interaction to prepare the project.
Oral presentation at end of cycle to present a collaborative project (maximum 3 students) on a bibliographic Neurology subject (2/3).

MI5-9-HP04 : Molecular Innovation

Professor :

Charlotte LEQUEUX

c_lequeux@yahoo.fr

Total number of teaching hours: 10h

CM	TD / TE	TP	Support	Project
	10h			Case study
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 3h				
Credits : 1 ECTS				

General objectives of education

Apprehend the different steps of the molecular innovation
Understand the key factors in the conception of an innovative product
Understand the role and sometimes the risk for the patient of the innovation

Detailed course structure

Based on sequential conferences by different actors of the health sector

Conditions of Exams

Presence / Participation
Serious game based on a innovative health product

EI5-9-EN-5
Entreprenariat

Volume horaire des enseignements de l'unité d'enseignement :

CM	TD / TE	TP	Projectl
60h	80h		120h
SEMESTRES CONCERNES : 9			
Crédits : 12 ECTS			

Détail des enseignements de l'unité d'enseignement

- Plan marketing (avancé)
- Modèles économiques de l'innovation
- Financer l'innovation, se faire accompagner
- Plan de développement commercial : levée de fonds
- Communication vers sa cible et Elevator Pitch
- Preuve de concept et modélisation de l'industrialisation

Compétences que l'unité d'enseignement contribue à former

Bloc de compétences 0 : Acquisition d'une culture scientifique

- Acquisition d'un large champ de connaissances scientifiques fondamentales
- Former l'élève-ingénieur à la recherche et par la recherche

Bloc de compétences 1 : Analyse d'un système, identification d'un besoin et mise en place d'une démarche de conception d'un produit/procédé en lien avec les biotechnologies

- Appréhender, comprendre et analyser un système complexe
- Capacité à intégrer les données économiques du marché

Bloc de compétences 2 : Mise en œuvre d'un projet : tester, produire et commercialiser une technologie/ un produit en lien avec les Biotechnologies

- Piloter des projets techniques d'industrialisation
- Maîtriser les conditions de succès de la commercialisation

Bloc de compétences 4 : Prise en compte de l'environnement et de la biodiversité au quotidien

- Maîtriser son environnement de travail (aspects économique - réglementaire - technique - international)

Bloc de compétences 5 : Management d'équipe et connaissance de soi

- Maitriser son discours
- Se former tout au long de la vie

MI5-9-EN01 : Market Study (advanced)

Professor :

Mylène LOUICELLIER

Total number of teaching hours :

CM	TD / TE	TP	Support	Project
5h	15h			20h
CONCERNED SEMESTER : 9				
Credits : 2				

General objectives of education

- Apply the general approaches of the market survey seen in Biotech4
- Be able to explain the different choices of its own market

Specific objectives and acquired competencies

- Be able to describe a real market for its project and the way to win on it
- Growth perspectives and potential business to do
- Be able to choose the good partnership for the POC

Detailed course structure

- Applications of the tools to realize a market survey
- Building an adapted marketing “MIX” and its offer
- Definition of the added value for its entrepreneurship project
- Develop an advanced knowledge of the competition and the way to increment a differentiation
- Write a business plan, including each competitor

Conditions of Exams

Participation, in class

Pitch on business plan including market survey

MI5-9-EN02 : Business Model of the innovation

Professor :

Mylène LOUICELLIER

Total number of teaching hours :

CM	TD / TE	TP	Support	Project
5h	15h			20h
CONCERNED SEMESTER : 9				
Credits : 2				

General objectives of education

- Be able to finalize the business model of its innovation

Specific objectives and acquired competencies

- Be able to define the way to generate revenue for a company
- Be able to define its own business model and its acceptance from the target

Detailed course structure

- Critical and comparative explanation of the economic models of innovation
- Choice of its own business model
- Validation of its relevance in the field of innovation

Conditions of Exams

Participation

Pitch on economic model

MI5-9-EN03 : Finance and innovation

Professor :

A. BOUSQUET

Total number of teaching hours :

CM	TD / TE	TP	Support	Project
10h	10h			20h
CONCERNED SEMESTER : 9				
Credits : 2				

General objectives of education

- Be able to prepare a real application for an incubator
- Know the fundamentals of fundraising

Specific objectives and acquired competencies

- Prepare a complete file to obtain finance during the emergence phase
- Prepare a survey
- Be able to understand the different ways of finance for a company
- Be able to "pitch" and convince an incubator

Detailed course structure

- Principles of fundraising
- Simulation of its own fundraising and its implications
- Preparation of a "BPI" or "BA" file
- Preparation of an application for an incubator

Conditions of Exams

Participation

Pitch to convince incubator

MI5-9-EN04 : Commercial development plan : fundraising

Professor :

M. LOUICELLIER

Total number of teaching hours :

CM	TD / TE	TP	Support	Project
10h	20h			20h
CONCERNED SEMESTER : 9				
Credits : 2				

General objectives of education

- Be able to define the complete strategy of its own company
- Be able to show the complete economic approaches for the project leader

Specific objectives and acquired competencies

- Be able to define all the parameters of the strategy for the company
- Be able to explain the choices for this strategy
- Be able to assume its choices and assure a growth of the sales figures

Detailed course structure

1. Business forecasts, their foundations

2. Workshop, making an appointment, conducting a commercial visit

3. How to manage your customers

Conditions of Exams

Participation
Pitch on strategy

MI5-9-EN05 : Communication and elevator pitch

Professor :

Julien SEBRIER

Total number of teaching hours :

CM	TD / TE	TP	Support	Project
15h	15h			20h
CONCERNED SEMESTER : 9				
Credits : 2				

General objectives of education

- Be able to create a dialogue with its ecosystem
- Be able to convince the ecosystem

Specific objectives and acquired competencies

- Be able to define the good type of communication
- Be able to choose the good tools to communicate: website, plate…
- Be present on social networks

Detailed course structure

- Build an integrated communication plan
- Compare the different communication tools
- Choose the right combination according to its needs and its budget
- Prepare a professional pitch for the corresponding ecosystem

Conditions of Exams

Participation
Pitch on ecosystem

MI5-9-EN06 : PoC and industrialization

Professor :

Pascal QUETIN

Total number of teaching hours :

CM	TD / TE	TP	Support	Project
15h	15h			20h
CONCERNED SEMESTER : 9				
Credits : 2				

General objectives of education

- Be able to create a Proof of Concept (PoC)
- Be able to modelize all the phases of industrialization

Specific objectives and acquired competencies

- Construct all steps of the conception
- Be able to have the good coworkers to obtain the PoC
- Imagine all the phases of the transfer in industry for the project
- Validate the business model, the finance and viability of the project

Detailed course structure

- Finalize a structured analysis of the PoC
- Compare the different approaches of construction to gain time and money
- Choose the right combination according to its needs and its budget
- Prepare a model of the phases of industrialization : viability of the concept

Conditions of Exams

Participation

Validation of the PoC : positive or not; if not, why

EI5-9-BI-4
Bioinformatique

Volume horaire des enseignements de l'unité d'enseignement :

CM	TD / TE	TP	Project
24h	20h	56h	50h
SEMESTRES CONCERNES : 9			
Crédits : 12 ECTS			

Détail des enseignements de l'unité d'enseignement

- Projet transversal appliqué
- Réseau Métabolique / Avancé
- Génomique / Transcriptomique / Avancé
- Dynamiques des systèmes / Avancée
- Chimie-informatique
- Modélisation moléculaire
- L'analyse des « Big data »

Compétences que l'unité d'enseignement contribue à former

Bloc de compétences 0 : Acquisition d'une culture scientifique

- Acquisition d'un large champ de connaissances scientifiques fondamentales
- Maîtriser les fondamentaux en vue de la modélisation et la simulation des systèmes
- Former l'élève-ingénieur à la recherche et par la recherche

Bloc de compétences 1 : Analyse d'un système, identification d'un besoin et mise en place d'une démarche de conception d'un produit/procédé en lien avec les biotechnologies

- Appréhender, comprendre et analyser un système complexe
- Capacité à simuler et valider des solutions

Bloc de compétences 5 : Management d'équipe et connaissance de soi

- Gérer le collectif
- Maitriser son discours
- Se former tout au long de la vie

MI5-9-BI01: Metabolic Network / Advanced

Professor:

Dr. Jean-Yves Trosset

Total number of teaching hours: 16h

CM	TD / TE		TP	Support	Project
	8h		8h		-
CONCERNED SEMESTER : 9					
Estimated personal work to the year : 10h					
Credits : 1 ECTS					

General objectives of education

Acquire the basic techniques to simulate and study metabolic networks with the global objective to optimize cell growth, biomass and metabolites production.

Specific objectives and acquired competencies

Mathematical techniques to identify stationary state(s) of a dynamical system to calculate stationary flux using linear algebra.

Detailed course structure

1. **Theory**

a. SVD on stoichiometry Matrix
b. Determination of Stationary Flux
c. Linear Programming
d. Biomass optimization

2. Practice:

a. Flux Balance Analysis with R or Python

Conditions of Exams

Participation to the course (one half), Mini-project (one half).

MI5-9-BI02 : Genomics – Transcriptomics / Advanced

Professor:

Dr. Mathilde Daures

Total number of teaching hours: 16h

CM	TD / TE	TP	Support	Project
8h		8h		-
CONCERNED SEMESTER : 9				
Estimated personal work to the year: 2h				
Credits : 1 ECTS				

General objectives of education

Acquire practical knowledge for gene expression data analysis.

Specific objectives and acquired competencies

Ability to conduct gene expression data analysis with a Bioinformatics platform (BioConductor with R). Advanced tools for statistical analysis of gene expression data (clustering, heat map, gene network reconstruction).

Detailed course structure

1. **Theory**
    a. Structure of RNAseq
    b. Raw data
    c. quality check
    d. RNAseq reads alignment
    e. Gene Expression level
    f. Gene network reconstruction

2. **Practice**
    a. Differential Expression analysis with R/Bioconductor packages
    b. Class discovery: Principal Component Analysis, Clustering, Heatmaps

Conditions of Exams

Participation to the course and practice sessions in class

MI5-9-BI03: System Dynamics / Advanced

Professor:

Bertrand Miannay

Total number of teaching hours: 16h

CM	TD / TE	TP	Support	Project
8h		8h		-
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 3h				
Credits : 1 ECTS				

General objectives of education

Acquire basic knowledge of the different modelling approaches in systemic biology.

Specific objectives and acquired competencies

The objective of the course is to introduce Boolean and R. Thomas approaches of genetic network.

Detailed course structure

1. **Theory**
    a. Boolean algebra
    b. Boolean automata and Network
    c. The R. Thomas approach for genetic Network analysis
    d. Graph transition diagram
    e. Dynamic transition and stability conditions
2. **Practice**
    a. Example of R. Thomas network modelling on ecological interactive systems.

Conditions of Exams

Participation to the course and practice sessions in class

MI5-9-BI04 : Cheminformatics

Professor :

Jean-Yves Trosset

Total number of teaching hours: 16h

CM	TD / TE	TP	Support	Project
4h		12h		-
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 5h				
Credits: 1 ECTS				

General objectives of education

Acquire basic modeling in QSAR modelling of pharmacological properties of chemical compound collections.

Specific objectives and acquired competencies

Software and tools to analyse chemical and their activity in living system at a ligand-based level (physical properties of chemical), at the chemical-proteomics level (interaction ligand -receptor) and at a cellular level (phenotypic screening)

Detailed course structure

3. **Theory**
    a. Molecular Descriptors
    b. Interaction ligand receptors
    c. Pharmacophore model
    d. Pseudo Receptor Model
    e. The QSAR approach
    f. Fragment-based approaches
4. **Practice**
    b. Exercises using webservers (Platform from University Diderot Paris Descartes)

Conditions of Exams

Participation to the course and practice sessions in class

MI5-9-BI05: Molecular Modelling

Professor:

Alexandre Ismail

Total number of teaching hours: 15h

CM	TD / TE	TP	Support	Project
5h	5h	10h		-
CONCERNED SEMESTER : 8				
Estimated personal work to the year : 5h				
Credits : 1 ECTS				

General objectives of education

Acquire basic knowledge in the protein engineering and in silico protein design for enzyme activity optimization, increase thermal and catalytic activity.

Specific objectives and acquired competencies

Modelling tools for 3D protein, Predict affinity or stability of mutant enzymes

Detailed course structure

3. **Protein Modelling**

a. Energy Landscape
b. Conformational Sampling
c. Stability of Proteins
d. Protein Dynamics
e. Protein folding.
f. Homology Modelling
g. Threading
h. Mini-proteins design

4. Mutagenesis and Protein Engineering:

a. Directed Evolution
b. In *silico* Alanine Scanning
c. Engineering of catalytic mechanisms
d. Rational screening of residue side chains

Conditions of Exams

Participation to the course and exercise practice with free modelling software (VMD, Chimera).

MI5-9-BI06: Big Data Analysis

Professor:

Jean-Philippe Meyniel

Total number of teaching hours: 16h

CM	TD / TE	TP	Support	Project
4h	4h	8h		-
CONCERNED SEMESTER : 9				
Estimated personal work to the year : 2h				
Credits : 1 ECTS				

General objectives of education

Acquire basic concepts and practice of Data Mining and how to treat large volumes of data. Get familiar with Data Driven approach: synergies between statistical techniques and graphical tools.

Specific objectives and acquired competencies

On practical experience on large scale genome data analysis.

Detailed course structure

1. **Theory**
    a. The data Driven approach
    b. Pipeline protocols
    c. Unstructured versus structured data
    d. Application to large scale genomic data analysis
    e. Deconvolution of data matrices
2. **Practice**
    a. Exercises of data example using the iSoft package installed on distant machines.

Conditions of Exams

Participation to the course and practice sessions in class