

# Autumn semester

|  |           |     |
|--|-----------|-----|
| Cellular metabolism and regulation                     | 5 credits | 65h |
| Genetic engineering                                    | 6 credits | 74h |
| Mass transfer  | 6 credits | 51h |
| Biochemical kinetics and bioreactor                    | 6 credits | 69h |
| Improving autonomy and building a professional project | 4 credits | 39h |
| Improve your management abilities                      | 4 credits | 45h |

# Cellular metabolism and regulation

 **ECTS**  
5 credits

 **Component**  
INSTITUT  
NATIONAL  
DES SCIENCES  
APPLIQUEES  
TOULOUSE

 **Number of  
hours**  
65h

## In brief

› **Teaching language(s):** Français, Anglais

## Presentation

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### Objectives

Description of the main metabolic pathways. Thermodynamics and kinetics. Stoichiometric balances. Description of some pathway regulation. Interconnection between the different pathways within the carbon central metabolism.


## Useful info

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### Place

› Toulouse

# Genetic engineering

 **ECTS**  
6 credits **Component**  
INSTITUT  
NATIONAL  
DES SCIENCES  
APPLIQUEES  
TOULOUSE **Number of  
hours**  
74h

## In brief

➤ **Teaching language(s):** Français, Anglais

## Presentation

### Description

- mutations
- transformation
- conjugaison
- transduction
- transposons

Basic tools (enzymes, plasmids, oligonucleotides..)

- Gene cloning
- Expression of recombinant proteins
- Analysis of a gene and its functions (sequencing, gene expression analysis, mutagenesis, protein-protein interactions, ...)

Organisation:

At the beginning of the course, the student will receive a document containing the most important points of the course. Along the course, about two hours will be used to analyse scientific papers in the domain and to solve a general scientific question by proposing adapted molecular biology methods. Simple molecular biology experiments will be performed to allow the student to apply the different concepts seen during the course: microbiology, transduction, genetic engineering tools, use of antibiotics, microscopy, During labwork sessions the student will also manipulate a Molecular biology software. A Group work made on a scientific paper will be presented to the class.

Main difficulties for students:

- \* To integrate different techniques in a general scientific question
- \* To find the methods which will allow to solve a problem

## Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

- Basics of bacterial genetics.
- Basic tools used in genetic engineering (restriction enzymes, plasmids...)
- Basic methods like cloning, PCR, sequencing, direct mutagenesis, microarrays, libraries construction, gene expression analysis...

The student will be able to:

- to describe and summarize basic methods
- to insert these methods in a larger scientific and experimental context
- analyse and criticize a scientific paper in this domain
- perform a simple experiment of molecular biology

use an "in silico cloning" software

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## Pre-requisites

Microbiology / Basic molecular biology

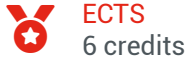
## Useful info

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### Place

➤ Toulouse

# Mass transfer



ECTS  
6 credits



Component  
INSTITUT  
NATIONAL  
DES SCIENCES  
APPLIQUEES  
TOULOUSE



Number of  
hours  
51h

## In brief

› **Teaching language(s):** Français, Anglais

At the end of this module, the student will have understood and be able to explain (main concepts):

To understand mass transfer phenomena (diffusion, convection).

The student will be able to:

- read, interpret, propose an installation flowsheet
- to write global balances on a process in order to calculate matter and energy flows
- identify of information fluxes
- make an critical analysis of a process
- be able to design an optimal set of experiments

## Presentation

### Description

Fundamental laws of mass transfer phenomena : conduction, convection. Steady state and transient state. Mass balance. Transfer in several phases. Reaction and transfer. Application to biotechnologies (oxygen transfer). Heterogeneous catalysis. Optimal design methodology and experimental strategy. Experimental designs. Factorial designs. Response surface. Optimal responses determination. Study of mixtures.

Organisation:

Lectures, tutorials with exercises (application to bioprocess) and lab works

### Objectives

### Pre-requisites


Thermodynamics of solutions / Differential and partial derivative operations

### Useful info

## Place

➤ Toulouse

# Biochemical kinetics and bioreactor

 **ECTS**  
6 credits

 **Component**  
INSTITUT  
NATIONAL  
DES SCIENCES  
APPLIQUEES  
TOULOUSE

 **Number of  
hours**  
69h

## In brief

➤ **Teaching language(s):** Français, Anglais

Organisation:

Lectures, Tutorials.

Practical courses,

- 1) *Saccharomyces cerevisiae* culture. Kinetic and mathematical analysis
- 2) Enzyme reactor design

## Presentation

### Description

Biochemical reactions, reactors and microbial engineering

Reactors instrumentations

Microbial kinetics

Material Balances, stoichiometric and yield relationships

Thermodynamic Balances

Idealized reactors (Batch, Continuous Stirred Tank Reactor, Tubular Reactor), combinations of ideal reactors, recycling reactors and real reactors

Distribution of residence times

Modeling real reactors with combination of ideal reactors

### Objectives

Understanding and implementing the biological reactions

Elements in biochemical engineering. Description of the bioreactor and its instrumentation. Mass, elementary and energetic balances. Application to ethanolic fermentation. Numerical experimental data treatment

### Pre-requisites

Chemical and enzymatic kinetics / Differential and matrix calculations



## Useful info

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### Place

➤ Toulouse

# Improving autonomy and building a professional project

 **ECTS**  
4 credits

 **Component**  
INSTITUT  
NATIONAL  
DES SCIENCES  
APPLIQUEES  
TOULOUSE

 **Number of  
hours**  
39h

## Presentation

## Place

➤ Toulouse

## Objectives

Construire une équipe projet, Approfondir ses connaissances,

Investir le métier, les domaines d'activité, les fonctions.

L'étudiant devra être capable de :

- d'analyser avec les autres un problème posé (Identifier le problème, définir les axes d'approche dans un bilan interactif : organisation, physique, technique, stratégique, motivation, confiance...
- de décider ensemble (permettre à tout le monde d'exprimer son avis, ajuster et réguler sa conduite en fonction de l'analyse collective),
- d'identifier les ressources du groupe (sens critique, repérage des points forts et faibles de chacun).

## Useful info

## Improve your management abilities

 **ECTS**  
4 credits

 **Component**  
INSTITUT  
NATIONAL  
DES SCIENCES  
APPLIQUEES  
TOULOUSE

 **Number of  
hours**  
45h

## Presentation

### Objectives

At the end of this module, the student will have understood and be able to explain :

- \* The basic rules of business law
- \* The objectives, principles and means of marketing
- \* The principles and procedures of financial diagnosis and / or investment

The student will be able to :


Apply principles and rules of management and law in simple situations. Take into account the parameters of the management (customer needs, cost effectiveness and legal compliance).


## Useful info

## Contacts

### Education manager

LUCIE LECLERT

 +33.(0)562266003

 leclert@insa-toulouse.fr

## Place

 Toulouse