



POLYTECH[®]
CLERMONT

GRADUATE SCHOOL OF ENGINEERING |
CLERMONT INSTITUT OF TECHNOLOGY | UNIVERSITÉ CLERMONT AUVERGNE



INTERNATIONAL PROGRAM

MASTER LEVEL
**BIOLOGICAL
ENGINEERING**

AT POLYTECH CLERMONT

DURATION

1 semester
(Fall or Spring)
or 1 year
(September to July)

Total ECTS Credits 60

OBJECTIVES

The aim of the Master program in biological engineering is to bring to international students the theoretical and practical background required to be in adequation with industry leaders in biological engineering.

Different options are offered to international students:

- **one semester (Fall or Spring, 30 ECTS)**
- **or one full year (60 ECTS).**

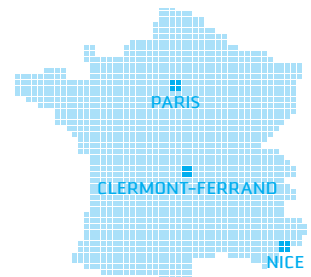
Various topics are covered: from Microbiology to Genetics, skills and knowledge are presented via practical sessions, research projects and an internship...

Courses will be done by highly qualified researchers known for their scientific and pedagogical skills, coming from various French laboratories. The master program is composed of a two-step training program, including projects and internships. The objective of projects is to reinforce the acquisition of theoretical background tackled during the practical sessions.

International students spending one year will attend to a **final internship for research activity at the end of the year** in addition to **research projects**; whereas those spending one semester only.



WHERE?





MASTER LEVEL COURSE CONTENT

FALL SEMESTER (September to December)

GENETIC ENGINEERING BIOINFORMATICS » 3 ECTS

Tools for sequences alignment.

Techniques for cloning DNA fragment in bacterial/yeast systems.

Experimental techniques of genetic engineering and molecular biology (cloning, PCR,...).

Organize and plan an experiment.

1. Construction of DNA probes of a gene of interest
2. Cloning of DNA fragments (probes) in plasmids
3. Genomic DNA Extraction
4. Enzymatic digestion with restriction enzymes
5. Probe and Molecular Hybridization

PLANT BIOTECHNOLOGY » 3 ECTS

Acquisition of notions in botany (major plant kingdoms), physiology of seed and plant development, plant function at the cellular level (plant hormones and cell signaling under normal culture conditions and biotic and abiotic stresses), *in vitro* culture, techniques of genetic transformation of plants and industrial applications.

Use and handling of plants grown *in vitro*, manipulation of unicellular plant organisms in association with microorganisms, concept of industrial uses of plants and properties, genetic transformations of plants.

1. Plant *in vitro* culture
2. Demonstration of the action of gibberelins in barley seeds germination
3. Study of the antibacterial activity of essential oils
4. Analysis of the composition of mint essential oil

15 ECTS

5. Plants-microorganism associations
6. Plant genetic transformation using *Agrobacterium*
7. Carrageenans extraction of a red algae: *Eucheuma Cottonii*

MICROBIOLOGY » 3 ECTS

Standardized methods in microbiology for the detection of bacteria, introduction to the quality insurance (traceability).

Microorganisms at the center of biotechnology - Useful and harmful bacteria.

1. Standards to the application: standardized methods of research and enumeration of major bacteria in food hygiene
2. Use of molecular detection technologies for microorganisms
3. Constraints of work organization in microbiology: holding of a laboratory notebook, traceability

BIOMOLECULE SYNTHESIS » 3 ECTS

Consolidate fundamental principles of chemistry in order to understand molecular biological processes.

Understand the constraints and the methods developed for the synthesis of bioactive molecules.

Amino acid coupling, racemic splitting, Stereospecificity of enzymatic reactions.

FRENCH COURSES » 3 ECTS

French courses are available at Clermont Auvergne INP.

FALL OR SPRING SEMESTER (September to July)

TRAINING COURSES 15 ECTS

MASTER LEVEL COURSE CONTENT



SPRING SEMESTER (January to July)

15 ECTS

INDUSTRIAL TECHNOLOGIES

» 3 ECTS

BIOTECHNOLOGY

Genetic constructions and protoplast production of different plant cells
Developing autonomy in a lab context

Setting up a bioassay to test exogeneous molecules of industrial interests

or

MICROBIOLOGY

Production and use of microorganisms and / or enzymes in the food industry

Separation and purification techniques

Introduction to Experimental Plans

Simulation and Modeling

BIOCHEMICAL METHODS-PROTEIN PURIFICATION » 2 ECTS

Extraction and purification of lactate dehydrogenase (tissue grinding, ammonium sulfate precipitation, ultrafiltration, hydrophobic chromatography, affinity chromatography, native and SDS-page electrophoresis, enzymatic and protein activity assays, purification balance calculations).

Determination of kinetic constants (V_m , K_m , pH effect, etc.) for 2 of the isoenzymes.

INDIVIDUAL RESEARCH PROJECTS

» 15 ECTS – FALL SEMESTER ONLY

In relation with supervisors specialized in bioprocess engineering, genetic engineering, metabolic engineering in different Laboratories on the Cézeaux campus, the objectives of the individual research projects will be to develop innovative techniques or knowledge on a topic given by specialized companies in Food, pharmaceutical, or environmental industry.

IMMUNOLOGY » 2 ECTS

Acquire the basics in immunology and immunological techniques.

Understanding the mechanisms involved in the immune response.

Knowledge of some major known pathologies and different detection methods.

1. Double immuno-diffusion (Ouchterlony)
2. Detection of antigens by the spotting method (Dot blot)
3. Study of the components of a rabbit serum by Western Blot
4. ELISA technique: BSA / anti-BSA system
5. SDS-PAGE Technology

BIOPROCESSES AND BIOCATALYSIS » 4 ECTS

Give an overview of the nature and economic importance of current industrial biological processes.

Development of skills in the field of the application of biocatalysts (microorganisms or isolated enzymes) for the production of molecules of industrial interest.

Analysis of the constraints related to the production of molecules of biological interest. Proposed biotechnological solutions.

FERMENTATION BIOPROCESSES

» 2 ECTS

Conservation laws, Material balances: global and macroscopic, Energy balances: global and macroscopic, Degrees of freedom, Material balances on fermentation processes, Heat balances on an aerobic culture.

FRENCH COURSES » 2 ECTS

French courses are available at Clermont Auvergne INP.

INTERNSHIPS IN RESEARCH LABORATORIES (2 MONTHS)

» 15 ECTS – SPRING SEMESTER ONLY

An internship is encouraged to be a unique international experience for doing research. International students will be host by Academic French Laboratories on the Cézeaux campus for a 2 month internship in the fields of Bioprocess Engineering, Food science or Environment

ADMISSION REQUIREMENTS

Bachelor level - Resume with 240 European credits (ECTS), specialization in Biology Recent transcripts - 2 letters of recommendation

ENGLISH PROFICIENCY

The minimum required is the level B1 of the Common European Framework of Reference for Languages evaluated by English tests as follow: Paper-based TOEFL score = 475, Internet-based TOEFL score = 50, TOEIC score = 550, IELTS = 4.5, Cambridge = FCE, etc.

FRENCH PROFICIENCY

No minimum level of French is expected when entering the program. However, to pass successfully the program, it would be required, at the end of the program, to pass a French test at which a minimum score must be attained. French courses are highly recommended to be taken during the mobility.

APPLICATION PROCESS AND DEADLINES

Applications will be made through the international office of the sending university for nomination. Selection of the candidates will be made by Polytech. The mobility has to be included into an exchange program within an international agreement.

Deadlines to apply Fall semester: 15 June | Spring semester: 15 November

FOCUS ON...

POLYTECH NETWORK

Polytech is a group of 15 public faculties dedicated to higher education, research and innovation in engineering. These institutions, under the authority of the French Ministry of Higher Education and Research, form a network of 15 French universities, sharing a unique model for their 15 faculties of engineering. All 86 different curricula of Polytech correspond to the 86 Masters in engineering degrees (Diplômes d'Ingénieur) that are accredited by CTI (Commission des Titres d'Ingénieur).

All curricula are classified into 12 different scientific fields. Polytech group includes 68 000 alumni and more than 3000 new Masters graduates every year. Geared towards industrialists and economic stakeholders, the graduates are acknowledged for their excellence at national and international level generating numerous job opportunities.

With a staff community of more than 1300 faculty-members, Polytech group supports excellence in 125 research laboratories. More than 1 000 qualified lecturers from companies in all professional sectors also contribute to taking up the challenges in engineering education of the graduate students.

POLYTECH CLERMONT

Founded in 1969, Polytech Clermont-Ferrand is one of the oldest engineering universities in France. Polytech Clermont is a founding member of the Polytech network, and has developed its development in this context, both locally and nationally and internationally.

With six different diplomas through initial and continuing training, Biological Engineering, Civil Engineering, Electrical Engineering, Mathematical Engineering and Modeling, Engineering Physics, Production System Engineering, Polytech Clermont has trained nearly 6000 engineers since its inception.

Key figures

- 1200 student engineers and apprentice engineers
- 8000 graduate engineers
- 6 engineering degrees
- 80 teacher-researchers faculties, 12 associated research laboratories

Polytech Clermont is the Graduate School of Engineering of Clermont Auvergne University.

CLERMONT AUVERGNE INP

- Created as new technology cluster in 2021 regrouping 3 engineering graduate schools
- 19 study programs in Engineering and Science – 1 doctoral school
- Public institution under the authority of the French Ministry of Higher Education, Research and Innovation
- 2100 students registered, 14% International students from over 40 countries

CONTACT DETAILS

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POLYTECH Clermont

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