UCLouvain

BIRC2M

2023 - 2024

Master [120] in Chemistry and Bioindustries

At Louvain-la-Neuve - 120 credits - 2 years - Day schedule - In French
Dissertation/Graduation Project : **YES** - Internship : **optional**
Activities in English: **YES** - Activities in other languages : **NO**
Activities on other sites : **NO**
Main study domain : **Sciences agronomiques et ingénierie biologique**
Organized by: **Faculty of bioscience engineering (AGRO)**
Programme acronym: **BIRC2M** - Francophone Certification Framework: 7

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Introduction

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Learning outcomes

Master in Chemistry and Bio-industries students must endeavour to diagnose and solve complex and original issues in bioengineering through a multidisciplinary approach in order to develop and implement innovative and sustainable solutions.

This Master's programme aims to train experts in the field of applied chemistry and bio-industries.

The future bioengineers acquire the knowledge and skills required to become:

• professionals able to tackle and diagnose problems in applied chemistry and bio-industries: production and quality, traceability, new processes, bioengineering with a high level of innovation, etc.;

• scientists able to understand complex processes on different scales, used to multidisciplinary approaches (chemistry, physico-chemistry, microbiology, etc.) and consultation with other specialists;

• innovators able to develop new methods in applied chemistry and biology: biotechnologes, nanotechnologies, catalysis, remediation, etc.

Highly versatile and multidisciplinary in character, the course dispensed by the Faculty of Biological, Agricultural and Environmental Engineering focuses on acquiring skills which combine theory and practice to train "bioengineers" mastering a broad base of scientific and technological knowledge and skills, allowing them to adopt an integrated approach to biological, agricultural and environmental systems.

On successful completion of this programme, each student is able to :

1. To explore a body of knowledge (knowledge, methods and techniques, models and processes) in natural and human sciences which serves as the foundation from which to operate with expertise in the fields of applied chemistry and bioindustries.

1.1 To build an advanced knowledge base in the field of applied chemistry and bioindustries and more specifically in the following disciplines [1]:

• Analytical chemistry
• Organic analysis
• Biochemical analysis
• Physical chemistry and physico-chemical calculations
• Chemistry of colloids and surfaces
• Reactor design

1.2 To build highly specialised scientific knowledge in one of the following bioengineering specialisations [2]:

• Science, technology and food quality
• Biomolecular and cell engineering
• Nanobiotechnologies, materials and catalysis
• Environmental technologies: water, soil, air
• Information analysis and management in biological engineering

1.3 To master procedural skills in conducting experiments: analytical chemistry techniques, organic and biochemical analysis techniques, technical analysis of complex matrices, chemometrics or biometrics, as well as specific techniques in relation to their choice of specialisation[3].

1.4 To apply their knowledge critically to tackle a complex problem in the field of applied chemistry or bioindustries by incorporating processes at different scales ranging from the atomic scale to the organism and matter scale, and up to the process scale.

1.5 To apply multiple strands of knowledge to resolve a multidisciplinary problem in the field of applied chemistry or bioindustries in order to develop relevant and innovative solutions.

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[1] Refers to the choice of the Master (core subjects and professional focus). The knowledge of some of these disciplines will have been partially acquired in the Bachelor's degree (in the advanced minor).

[2] Refers to the option / module choice in the Master.

[3] Refers to mastering all the laboratory and field techniques used for the characterisation or monitoring of a system.

2. To explore an integrated body of "engineering and management knowledge" which serves as the foundation from which to operate with expertise in the field of environmental sciences.

2.1 To build an advanced knowledge base (e.g.: concepts, laws, technologies) and tools (e.g. modelling, programming) in engineering sciences:

• Chemometrics and Biometrics
• Biochemical and microbial engineering
• Thermodynamics
• Process engineering: unit operations
• Reactor design

2.2 To build and master highly specialised knowledge and tools in one of the following bioengineering specialisations:

• Science, technology and food quality
• Biomolecular and cell engineering
• Nanobiotechnologies, materials and catalysis
• Environmental technologies: water, soil, air

• Information analysis and management in biological engineering

2.3 To master the operational use of specialised tools in engineering sciences (e.g.: systems analysis, statistical analysis, programming, modelling, etc.)[1]]:

• Chemometrics and biometrics

• Thermodynamics

• Specific tools in relation to the choice of specialisation

2.4 To activate and apply their knowledge of engineering with a critical mind and using a quantitative approach to tackle a complex problem in the field of applied chemistry or bioindustries by incorporating processes at different scales ranging from the atomic scale to the organism and matter scale, and up to the process scale.

2.5 To locate and understand how companies and organisations operate, including the role of the different players, their financial and social realities and responsibilities and the challenges and constraints which characterise their environment.

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[1] The tools are explained on the basis of the radioscopy of the programme and courses.

3. To design and execute a research project, implementing an analytical scientific and, if applicable, systematic approach, to further understanding of an original research problem in their field of specialisation, incorporating several disciplines.

This skill set will develop throughout the 5 years. Amongst others it requires the use of a set of skills as described below. These skills correspond in fact to the different stages of the scientific approach.

The majority of these skills are developed in the Bachelor and Master programmes, with differentiation predominately on 3 levels:

- the level of detail and complexity applied to the scientific problem/research studied;

- the degree of innovation shown by the student;

- the degree of autonomy demonstrated by the student throughout the process.

3.1 To summarise the state of knowledge on a complex research problem which relates to their choice of specialisation: to research information, to select and validate its reliability based on the nature of the source of the information and comparing several sources.

3.2 To specify and define the research question.

3.3 To examine the research question using conceptual abstraction and formulate hypotheses.

3.4 To develop and implement a rigorous methodology to answer the research question.

3.5 To master and apply statistical data analysis tools in the context of a complex scientific issue.

3.6 To analyse and interpret the results to produce a substantiated critique on a complex scientific question.

3.7 To demonstrate an ability to summarise and formulate conclusions on a complex scientific question.

3.8 In each of the skills mentioned above, to demonstrate rigour, precision and the critical thinking essential for any scientific method.

3.9 To demonstrate innovation in at least one of the skills mentioned above.

4. To formulate and resolve a complex environmental engineering problem related to new situations presenting a degree of uncertainty. The student will be able to design appropriate, sustainable and innovative solutions through a systematic approach integrating processes from the nanoscale (atoms, chemical mechanisms,....) to the microscopic and macroscopic scales (organisms, reactor,...). This problem may relate to the management and use of resources (soil, water, plant) and ecosystems, to land management, to the impact of human activities on the capacity of the environment to provide goods and services to humanity.

This skill set will develop throughout the 5 years. Amongst others it requires the use of a set of skills as described below. These skills correspond in fact to the different stages of the engineering approach.

The majority of these skills are developed in the Bachelor and Master programmes, with differentiation predominately on 3 levels:

- the complexity and scope of the problem addressed;

- the degree of autonomy demonstrated by the student throughout the process;

- the degree of depth in each skill.

4.1 To strategically differentiate the key elements from the less critical elements relating to a complex chemical engineering or bioindustries problem, in order to define and determine the field of action for this problem.

4.2 To identify the knowledge acquired and that to be acquired to resolve the complex chemical engineering or bioindustries problem.

4.3 To analyse a complex chemical engineering or bioindustries problem using a systematic and multidisciplinary approach in order to carry out diagnostics and formulate the specifications.

4.4 To demonstrate an ability for conceptual abstraction and formalisation in analysing and resolving the complex chemical engineering or bioindustries problem.

4.5 To develop scientifically and technologically relevant and innovative solutions, through a multidisciplinary (integration and articulation of knowledge) and quantitative approach, making it possible to develop products, systems, processes or services in the field of applied chemistry and bioindustries.

4.6 To test solutions and evaluate their impact in relation to an economic, environmental, social and cultural context.

4.7 To formulate concrete and responsible recommendations to encourage sustainable development in relation to the efficient operational and sustainable implementation of the solutions proposed.

5. To design and implement a multidisciplinary project, alone and in a team, with the stakeholders concerned while taking the objectives into account and incorporating the scientific, technical, environmental, economic and human factors.

The graduate must be able to manage a project alone and in a team, not only the scientific and technological dimensions but also the financial and, if applicable social aspects and with a degree of complexity representative of typical professional scenarios.

5.1 To know and understand the principles and factors of group dynamics (including the constructive role of conflict).

5.2 To know and understand the project management process (project cycles): formulation and definition of the project, project management, monitoring and evaluation of the project.

5.3 To situate a multidisciplinary project within its environment and identify the issues, constraints and stakeholders and to clearly define its objectives.

Year 1 :
core subjects programme :
1. Foundation special subject: 10 credits

CORE COURSES

- Mandatory
- Optional
- Not offered in 2023-2024
- Not offered in 2023-2024 but offered the following year
- Offered in 2023-2024 but not the following year
- Not offered in 2023-2024 or the following year
- Activity with requisites
- Open to incoming exchange students
- Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

Click on the course title to see detailed informations (objectives, methods, evaluation...)

Students taking the option "Information Analysis and Management in Biological Engineering" will enrol at the specific commun courses called "tronc commun" of that option. Students taking the option "Sustainability bioingineering" will enrol at the specific commun courses called "tronc commun" of that option.

Programme for students chosing one of these options 1C, 2C, 3C, 4C, 13C and 18C (66 credits)

				Year 1	Year 2
LBIRC2200	Master thesis		FR [q1+q2] [] [27 Credits]		x
LBIRC2210	Master thesis' accompanying seminar	Sonia Collin Stephan Declerck (coord.) Christine Dupont Eric Gaigneaux Patrick Gerin Michel Ghislain	EN [q1+q2] [30h] [3 Credits] *> French-friendly*		x
LBIRC2101	Biochemical analysis	François Chaumont Pierre Morsomme (coord.)	EN [q1] [22.5h+30h] [4 Credits] *> English-friendly*	x	
LBIRC2108					

				Year 1	Year 2
⊠ LBIR2050	Challenges of sustainable development and transition	Valentin Couvreur Nathalie Delzenne Valérie Swaen (coord.)	FR [q2] [30h] [5 Credits]		x
⊠ LEPL1804	Sustainable development and transition	David Bol Hervé Jeanmart Patricia Luis Alconero Xavier Marichal Jean-Pierre Raskin	FR [q1] [22.5h+15h] [3 Credits]		x
⊠ LEPL2211	Business issues introduction				

					Year 1	2
⊠ LEPL1804	Sustainable development and transition	David Bol Hervé Jeanmart Patricia Luis Alconero Xavier Marichal Jean-Pierre Raskin	FR [q1] [22.5h+15h] [3 Credits]			x
⊠ LEPL2211	Business issues introduction	Benoît Gailly	EN [q2] [30h] [3 Credits] *> French-friendly*			x
⊠ LLSMG2054	Management humain	Laurent Taskin	FR [q1] [30h] [5 Credits] ⊘			x
⊠ LMAPR2001A	Project "chemical & materials engineering for a sustainable future"		EN [q2] [22.5h+30h] [5 Credits] *> French-friendly*			x
⊠ LMECA2711	Quality management and control.	Nicolas Bronchart	EN [q2] [30h+30h] [5 Credits] *> French-friendly*			x

⊠ Programme du Tronc commun pour l'option 12C (67 credits)

O LBIRC2200	Master thesis		FR [q1+q2] [] [27 Credits]			x
O LBIRC2210	Master thesis' accompanying seminar	Sonia Collin Stephan Declerck (coord.) Christine Dupont Eric Gaigneaux Patrick Gerin Michel Ghislain	EN [q1+q2] [30h] [3 Credits] *> French-friendly*			x
O LBIRC2101	Biochemical analysis	François Chaumont Pierre Morsomme (coord.)	FR [q1] [22.5h+30h] [4 Credits] *> English-friendly*		x	
O LBIRC2108	Biochemical and Microbial Engineering	Benoît Stenuit	EN [q2] [30h+22.5h] [5 Credits] *> French-friendly*			

O LBIRC2108

				Year 1	2
⊠ LEPL2211	Business issues introduction	Benoît Gailly	EN [q2] [30h] [3 Credits] > *French-friendly*		x
⊠ LLSMG2054	Management humain	Laurent Taskin	FR [q1] [30h] [5 Credits] ⊘		x
⊠ LMAPR2001A	Project "chemical & materials engineering for a sustainable future"		EN [q2] [22.5h+30h] [5 Credits] > *French-friendly*		x
⊠ LMECA2711	Quality management and control.	Nicolas Bronchart	EN [q2] [30h+30h] [5 Credits] > *French-friendly*		x

PROFESSIONAL FOCUS [30.0]

Year
1 2

Year
1 2

OPTIONS

From 23 to 25credit(s)

> Option 1C - Food & quality *[en-prog-2023-birc2m-lbirc201o]*
> Option 2C - Biomolecules & cells *[en-prog-2023-birc2m-lbirc202o]*
> Option 3C - Nano(bio)materials and catalysis *[en-prog-2023-birc2m-lbirc203o]*
> Option 4C - Environmental Technology *[en-prog-2023-birc2m-lbirc204o]*
> Option 10C - Data Science *[en-prog-2023-birc2m-lbirc210o]*
> Option 12C - Sustainability engineering *[en-prog-2023-birc2m-lbirc206o]*
> Busniess Creation (Option 13C) *[en-prog-2023-birc2m-lbirc213o]*
> Option 18C : Human health *[en-prog-2023-birc2m-lbirc205o]*

OPTION 1C - FOOD & QUALITY [24.0]

- Mandatory
- Optional
- Not offered in 2023-2024
- Not offered in 2023-2024 but offered the following year
- Offered in 2023-2024 but not the following year
- Not offered in 2023-2024 or the following year
- Activity with requisites
- Open to incoming exchange students
- Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

Click on the course title to see detailed informations (objectives, methods, evaluation...)

Content:

				Year 1	Year 2
LBRAL2102	Physiological and nutritional biochemistry	Cathy Debier Emeline Dierge (compensates Yvan Larondelle) Yvan Larondelle (coord.)	EN [q1] [37.5h+0h] [4 Credits] *> French-friendly*		x
LBRAL2103	Food chemistry	Sonia Collin	EN [q1] [30h+30h] [5 Credits]	x	
LBRAL2104	Food microbiology	Annika Gillis	EN [q2] [30h+22.5h] [4 Credits] *> French-friendly*	x	
LBRAL2201	Food technology	Axel Kather Benoît Stenuit (coord.)	EN [q2] [52.5h] [5 Credits] *> French-friendly*		

OPTION 2C - BIOMOLECULES & CELLS [24.0]

- Mandatory
- Optional
- Not offered in 2023-2024
- Not offered in 2023-2024 but offered the following year
- Offered in 2023-2024 but not the following year
- Not offered in 2023-2024 or the following year
- Activity with requisites
- Open to incoming exchange students
- Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

Click on the course title to see detailed informations (objectives, methods, evaluation...)

Content:

				Year 1	Year 2
LBRMC2101	Genetic engineering	François Chaumont (coord.) Charles Hachez	FR [q1] [37.5h+15h] [5 Credits] > English-friendly	x	
LBRMC2201	Bioinformatics : DNA and protein sequence analysis	Michel Ghislain	EN [q1] [30h+15h] [4 Credits] > French-friendly		x
LBRMC2202	Cell culture technology	David Alsteens Charles Hachez (coord.) Pascal Hols	EN [q1] [30h] [3 Credits] > French-friendly		x

Courses to be chosen for 12 credits minimum

LBBMC2101	Structural and functional biochemistry	Pierre Morsomme Patrice Soumillion	EN [q1] [36h+6h] [4 Credits]	x	x
LBBMC2104	Animal physiological biochemistry	Pierre Morsomme Melissa Page	EN [q2] [36h+18h] [5 Credits]	x	x
LBBMC2105	Protein engineering and directed evolution	Pierre Morsomme Patrice Soumillion	EN [q2] [36h+18h] [5 Credits]	x	x

Cell culture technology

Year

OPTION 10C - DATA SCIENCE [25.0]

- O Mandatory
- ⊠ Optional
- △ Not offered in 2023-2024
- ⊘ Not offered in 2023-2024 but offered the following year

OPTION 12C - SUSTAINABILITY ENGINEERING [23.0]

- Mandatory
- Optional
- Not offered in 2023-2024
- Not offered in 2023-2024 but offered the following year
- Offered in 2023-2024 but not the following year
- Not offered in 2023-2024 or the following year
- Activity with requisites
- Open to incoming exchange students
- Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

Click on the course title to see detailed informations (objectives, methods, evaluation...)

Content:

			Year 1	Year 2
LBIR1362	Environmental Economics	Frédéric Gaspart		

BUSNINESS CREATION (OPTION 13C) [24.0]

L'objectif du module INEO est de fournir aux étudiants, créateurs potentiels d'entreprise, les outils d'analyse et de réflexion qui les aideront à comprendre les processus entrepreneuriaux afin de créer ou reprendre une entreprise et de développer des projets de cette nature au sein d'organisations existantes. En outre, cette formation permet aux étudiants de se familiariser avec d'autres disciplines et d'apprendre à travailler en équipes multidisciplinaires. Les étudiants qui souhaitent suivre le module interdisciplinaire en entrepreneuriat (INEO) doivent s'y inscrire en même temps qu'à l'option dès la première année de master. En effet, le programme de ce module devra s'articuler avec celui de l'option sur les deux années de master. Attention: l'inscription à ce module fait l'objet d'une sélection. Ce n'est qu'après avoir reçu l'accord de participation à ce programme que les étudiants pourront prendre contact avec le vice-doyen pour aménager leur programme de cours personnel et répartir les cours INEO et les cours d'option sur les deux années du master.

- Mandatory
- Optional
- Not offered in 2023-2024
- Not offered in 2023-2024 but offered the following year
- Offered in 2023-2024 but not the following year
- Not offered in 2023-2024 or the following year
- Activity with requisites
- Open to incoming exchange students
- Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

Click on the course title to see detailed informations (objectives, methods, evaluation...)

Access to this option is limited via a selection process at the beginning of the master programme (https://uclouvain.be/fr/etudier/ineo). Students enrolled for this option do not take the course LBIRC2210 (master thesis' accompanying seminar) and are required to take another course for 3 credits.

Year
1 2

Content:

OPTION 18C : HUMAN HEALTH [24.0]

- Mandatory
- Optional
- Not offered in 2023-2024
- Not offered in 2023-2024 but offered the following year
- Offered in 2023-2024 but not the following year
- Not offered in 2023-2024 or the following year
- Activity with requisites
- Open to incoming exchange students
- Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

Click on the course title to see detailed informations (objectives, methods, evaluation...)

Content:

				Year 1	Year 2
LBIO1237B	Immunology : basis and applications in biology - Lectures	Jean-Paul Dehoux	FR [q1] [25h] [3 Credits]		x
LBRAL2102	Physiological and nutritional biochemistry				

Course prerequisites

There are no prerequisites between course units (CUs) for this programme, i.e. the programme activity (course unit, CU) whose learning outcomes are to be certified and the corresponding credits awarded by the jury before registration in another CU.

The programme's courses and learning outcomes

For each UCLouvain training programme, a reference framework of learning outcomes specifies the the skills expected of every graduate on completion of the programme. Course unit descriptions specify targeted learning outcomes, as well as the unit's contribution to reference framework of learning outcomes.

BIRC2M - Information

Access Requirements

Master course admission requirements are defined by the French Community of Belgium Decree of 7 November 2013 defining the hiher education landscape and the academic organisation of courses.

General and specific admission requirements for this programme must be satisfied at the time of enrolling at the university.

Unless explicitly mentioned, the bachelor's, master's and licentiate degrees listed in this table or on this page are to be understood as those issued by an institution of the French, Flemish or German-speaking Community, or by the Royal Military Academy.

In the event of the divergence between the different linguistic versions of the present conditions, the French version shall prevail.

SUMMARY

University Bachelors

Diploma

BA en agronomie, orientation environnement - crédits supplémentaires entre 45 et 60

BA en agronomie, orientation forêt et nature - crédits supplémentaires entre 45 et 60

Teaching method

The overall structure of the programmes for the Bachelor of Science in Engineering (Bioengineering) and the Master in Bioengineering clearly reflect the

concepts of specialization, gradual choice and individualization of the courses.

1st cycle (Bachelor) :

- same programme for SC and AGRO in first year (BIR11BA),
- special programme in second year (BIR12BA) for all the BIR students
- distinct programme with 30 credits for option courses in third year (BIR**C**13BA, BIR**A**13BA, BIR**E**13BA) : three advanced subsidiary subjects available : chemistry (BIRC), agronomy (BIRA), environment (BIRE).

2nd cycle (Master) :

There are two kinds of international mobility : students who have already gained their Bachelor degree can move abroad to study for their Master at another institution ; it is also possible to take some course modules in another institution. The mobility rate for AGRO students on exchange schemes such as Erasmus is around 30-40% and the number of our students who go abroad is similar to the number of foreign students who come to study here.

This mobility should increase given the harmonization of education at the European level and the conclusion of new partnership agreements outside ERASMUS as well as membership of thematic networks. The AGRO Faculty is also a member of the ATHENS network.

In particular, the programme of the Master in Chemistry and Bio-industries offers an option course on brewing, organized in cooperation with the University of Lorraine (France). The precise terms for the exchange of course and students between the two institutions are still being negotiated and will be announced as soon as possible.

Possible trainings at the end of the programme