GBIO2M - Introduction

Introduction

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This Master's degree programme educates engineers capable of using a large set of skills (analytical, modelling, design and inventiveness) in order to face future technological challenges in the scientific and technical fields linked to biomedical engineering and this in ever evolving European and global contexts.

Upon completion of this Master's degree programme, you will have fundamental knowledge in all areas of biomedical engineering (bioinstrumentation, biomaterials, imaging and medical physics, mathematical modelling, artificial organs and rehabilitation, bioinformatics and biomechanics) as well as cutting edge knowledge of one or more major fields of study.

A series of video portraits of young engineers in biomedical engineering wants to be discovered on the "job description" page of the faculty.

Your profile

You:

- Have developed a marked interest in the biomedical field and its technological outputs (as a result of your undergraduate studies);
- Seek targeted information about current scientific or technological issues as well as the national and international job market;
- Want to play a role in development, production or management in the healthcare field.

Your programme

This Master's degree offers:

- Knowledge of the main scientific and industrial issues in the fields of applied biomedical engineering;
- Classes that emphasize theories and practice to develop advanced professional knowledge;
- The choice of one of more major fields of study in biomedical engineering;
- The chance to complete an internship in a hospital, in industry or in a research centre;
- The possibility of completing part of your master's degree abroad (in Europe or elsewhere) and in certain cases the granting of a dual master's degree (diploma granted jointly by UCLouvain and the institution where you studied abroad).

GBIO2M - Teaching profile

Learning outcomes

Nowadays, more and more engineers are bringing their ingenuity and analytical skills to the healthcare field. The objective of the Master's degree programme in biomedical engineering is to graduate engineers being capable of meeting the scientific and technological challenges of biomedical engineering in an ever-changing global and European context. Inherently multidisciplinary, this programme builds upon a strong collaboration between the sector of Sciences and Technologies, and the sector of Health Sciences.

Building up on students' existing knowledge in basic sciences (physics, chemistry, mathematics) and life science (biology, anatomy, biochemistry and physiology), this Master's degree programme offers the opportunity to develop multidisciplinary skills in a wide range of topics. Graduated students will be able to understand and model living systems and ultimately be able to design analytical or therapeutic tools (for example, developing new biomedical technologies).

Graduated students will have fundamental knowledge of the main fields of biomedical engineering: bioinstrumentation, biomaterials, imaging and medical physics, mathematical modelling, artificial organs and rehabilitation, bioinformatics and biomechanics. They will further acquire advanced training in one or more of these fields of expertise.

By choosing among several elective courses, students can opt either for polyvalent profile or one being more specialised. Fields of particular interest include (1) software development and algorithms for biomedical data; (2) biomaterials (implants, etc.); (3) biomechanics and medical robotics; (4) medical imaging and medical physics; (5) clinical engineering (i.e. engineering jobs in the hospital).

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

1. Demonstrate mastery of a solid body of knowledge and skills in basic science and engineering science allowing them to understand and solve biomedical engineering problems (Axis 1).

1.1 Identify and use biomedical engineering concepts, laws and reasoning to solve problems in a variety of areas:

-Develop algorithms and software particularly for dealing with biomedical data; analyse biological data and medical images

- Biomaterials (interfaces, biocompatibility, etc.)

-Biomechanics, motor control and medical robotics (for surgery and rehabilitation)

-Clinical engineering

1.2 Identify and use the modelling and calculation tools necessary to solve problems raised by the fields mentioned above

1.3 Validate problem solving results, notably those expressed in orders of magnitude:

-in particular validate models by comparing them to theoretical or experimental results

2.Organise and carry out a procedure in applied engineering related to the development of a product and/or a service that meets a need or solves a particular problem in the field of biomedical engineering (Axis 2).

2.1 Analyse a problem, take stock of its functionalities and constraints; create a specifications note that takes into account technical and economic limits.

2.2 Model a problem and design one or more technical solutions using mechanical, electric, electronic and computerised approaches with the specifications note in mind.

2.3 Evaluate and classify solutions with regard to all the criteria in the specifications note: efficiency, feasibility, quality, ergonomics, security, biocompatibility, etc.

2.4 Test a solution though a mock up, a prototype and/or a numerical model.

2.5 Formulate recommendations to improve a technical solution either to reject it or to explain necessary improvements to make the product operational.

3.Organise and carry out a research project to understand a physical phenomenon or new problem related to biomedical engineering (Axis 3).

3.1 Document and summarize the existing body of knowledge.

3.2 Suggest a model and/or an experimental device allowing for the simulation and testing of hypotheses related to the phenomenon being studied.

3.3. Write a summary report explaining the potentialities of the theoretical and/or technical innovation resulting from the research project.

5.5 Draft documents that take into account contextual requirements and social conventions as well as the vocabulary specific to biomedical disciplines.
5.6 Make a convincing oral presentation (in French or English) using modern communication techniques.

6.Demonstrate rigor, openness and critical and ethical awareness in your work: using the technological and scientific innovations at your disposal validate the socio-technical relevance of a hypothesis or a solution (Axis 6).

6.1 Rigorously apply the standards of biomedical engineering (terms, units of measure, quality standards and security).
6.2 Find solutions that go beyond strictly technical issues by considering sustainable development and the socio-economic ethics of a project, particularly concerning the consequences of a medical or therapeutic practice;

				Year 1	2
LGBIO2990	Master Thesis *The graduation project can be written and presented in French or English, in consultation with the supervisor. It may be accessible to exchange students by prior agreement between the supervisors and/or the two universities.*		EN [q1+q2] [] [25 Credits]		x
LGBIO2220	Industrial project in biomedical engineering	Sophie Demoustier Sophie Demoustier (compensates Philippe Lefèvre) Renaud Ronsse Renaud Ronsse (compensates Philippe Lefèvre)	EN [q1+q2] [30h+30h] [5 Credits] *> French-friendly*	x	x
LEPL2020	Professional integration work *The modules of LEPL2020 course are organized over the two annual blocks of the master's degree. It is strongly recommended that students take them from year 1, but they will only be able to register for the course at the earliest the year in which they present their final graduation project.* *Students who have other professional integration activities in their personal programme, or who can demonstrate an equivalent activity could be exempted from this course. This equivalence is at the discretion of the examination board. Another activity should then be chosen to reach the number of ECTS required for their graduation.*		EN [q1+q2] [30h+15h] [2 Credits] Δ *> French-friendly*	x	x

PROFESSIONAL FOCUS [30.0]

- Mandatory
- Optional
- Not offered in 2024-2025
- Not offered in 2024-2025 but offered the following year
- Offered in 2024-2025 but not the following year
- Not offered in 2024-2025 or the following year
- Activity with requisites
- Open to incoming exchange students
- Not open to incoming exchange students

[FR]

> Cours au choix en connaissances socio-économiques *[en-prog-2024-gbio2m-lgbio200o]*

Other elective courses

> Other elective courses *[en-prog-2024-gbio2m-lgbio952o]*

MAJORS IN BIOMEDICAL ENGINEERING

MAJOR IN CLINICAL ENGINEERING

The objective of this major is to provide students with the necessary body of knowledge to work as an engineer in a hospital or in a biomedical products company. It covers areas related to the management of medical technologies, quality control, etc

- O Mandatory
- Optional
- △ Not offered in 2024-2025
- ⊘ Not offered in 2024-2025 but offered the following year
- ⊕ Offered in 2024-2025 but not the following year
- △ ⊕ Not offered in 2024-2025 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...)

From 20 to 30credit(s)

Year

MAJOR IN ACQUISITION AND PROCESSING OF BIOMEDICAL DATA

The objective of this major is to provide students with the necessary body of knowledge to acquire and analyze biomedical data, i.e. either raw signal data or large bases of pre-processed data. This major is especially well-suited for students holding a bachelor in computer science, electricity or applied mathematic

- Mandatory
- Optional
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- Offered in 2024-2025 but not the following year
- Not offered in 2024-2025 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...)

From 20 to 30credit(s)

Year
1 2

Content:

Year
1 2

⊠ LGBIO2020	

MAJOR IN BIOMECHANICS AND MEDICAL ROBOTICS

The goal of this major is to provide students with the necessary body of knowledge to understand and develop technologies related to biomechanics (fluids and solids) and medical robotics (surgical assistance and rehabilitation). This major is particularly well-suited for students holding a bachelor in mechanics.

- Mandatory
- Optional
- Not offered in 2024-2025
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- 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...)

From 20 to 30credit(s)

Content:

Required courses (10 credits)

				Year 1	Year 2
LMECA2170	Numerical Geometry	Vincent Legat Jean-François Remacle	EN [q1] [30h+30h] [5 Credits] > *French-friendly*	x	x
LMECA2355	Mechanical design in biomedical engineering	Greet Kerckhofs Ann Vankrunkelsven (compensates Benoît Raucent)	EN [q1] [30h+30h] [5 Credits] > *French-friendly*	x	x

Elective courses

From 10 to 20credit(s)

LINMA2671	Advanced control and applications	Julien Hendrickx	EN [q1] [30h+30h] [5 Credits] > *French-friendly*	x	x
LINMA2875	System Identification	Gianluca Bianchin	EN [q2] [30h+30h] [5 Credits] > *French-friendly*	x	x
LMECA2300	Advanced Numerical Methods	Philippe Chatelain Christophe Craeye (coord.) Vincent Legat Jean-François Remacle	EN [q2] [30h+30h] [5 Credits] > *French-friendly*	x	x
LMECA2660	Numerical methods in fluid mechanics	Grégoire Winckelmans	EN [q2] [30h+30h] [5 Credits] > *French-friendly*	x	x
LELME2732	Robot modelling and control	Nicolas Docquier (compensates Renaud Ronsse)	EN [q2] [30h+30h] [5 Credits] > *French-friendly*	x	x
LMECA2755	Industrial automation	Bruno Dehez Paul Fisette Renaud Ronsse	EN [q1] [30h+30h] [5 Credits] > *French-friendly*	x	x

MAJOR IN MEDICAL PHYSICS AND MEDICAL IMAGING

The goal of this major is to provide students with the necessary body of knowledge to understand and develop technologies related to medical physics and medical imaging. This major is particularly well-suited for students holding a bachelor in electricity or applied chemistry and physics.

- Mandatory
- Optional
- Not offered in 2024-2025
- Not offered in 2024-2025 but offered the following year
- Offered in 2024-2025 but not the following year
- Not offered in 2024-2025 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...)

From 20 to 30credit(s)

Year
1 2

				Year 1	2
⊠ LSTAT2210	Mixed linear models	Catherine Legrand	FR [q1] [15h+7.5h] [4 Credits]	x	x
⊠ LSTAT2220	Analysis of survival and duration data	Ingrid Van Keilegom	FR [q1] [15h+5h] [4 Credits] > *English-friendly*		

MAJOR IN INTERDISCIPLINARY PROGRAM IN ENTREPRENEURSHIP - INEO

COURS AU CHOIX EN CONNAISSANCES SOCIO-ÉCONOMIQUES

- Mandatory
- Optional
- Not offered in 2024-2025
- Not offered in 2024-2025 but offered the following year
- Offered in 2024-2025 but not the following year
- Not offered in 2024-2025 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
Optional LFSA2995	Company Internship	Dimitri Lederer Jean-Pierre Raskin	[FR] [q1+q2] [30h] [10 Credits]	x	x
Optional LEPL2021	Innovation classes for transition and sustainable development	Benoît Macq Xavier Marichal (compensates Benoît Raucent)	[EN] [q1] [30h+15h] [5 Credits]	x	x

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.

GBIO2M - Information

Access Requirements

Master course admission requirements are defined by the French Community of Belgium Decree of 7 November 2013 defining the higher 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

Specific access requirements

This programme is taught in English with no prerequisite in French. A certificate is required for the holders of a non-Belgian degree, see selection criteria of the Acces on the file.

University Bachelors

Diploma	Special Requirements	Access	Remarks
UCLouvain Bachelors			
Bachelor in Engineering		Direct access	Students who have neither major nor minor in the field of their civil engineering Master's degree may have an adapted master programme.
Others Bachelors of the French speaking Community of Belgium			
Bachelier en sciences de l'ingénieur - orientation ingénieur civil		Direct access	L'étudiant n'ayant suivi au préalable ni la majeure, ni la mineure dans la discipline de son master ingénieur civil peut se voir proposer par le jury un adaptation de son programme de master.
Bachelors of the Dutch speaking Community of Belgium			
Bachelor in engineering		Access with additional training	Students who have no specialisation in the field of their civil enginering master degree may have an adapted master programme with up to 60 additional credits.
Foreign Bachelors			
Bachelor in engineering	Bachelors degree of Cluster Institution	Direct access	Students with a Bachelor’s degree in engineering sciences who have not taken the equivalent of a minor in the field of their civil enginering master

			degree may have an adapted master programme.
Bachelor in Engineering	For others institutions	Access based on application	See personalized access

Non university Bachelors

> Find out more about links to the university

Holders of a 2nd cycle University degree

Diploma	Special Requirements	Access	Remarks
"Licenciés"			

Masters	
Master in Engineering	Direct access

Holders of a non-University 2nd cycle degree

> Find out more about links to the university

Access based on validation of professional experience

> It is possible, under certain conditions, to use one's personal and professional experience to enter a university course without having the required qualifications. However, validation of prior experience does not automatically apply to all courses. Find out more about Validation of priori experience.

Access based on application

Access based on application : access may be granted either directly or on the condition of completing additional courses of a maximum of 60 ECTS credits, or refused.

The first step of the admission procedure requires to submit an application online:https://uclouvain.be/en/study/inscriptions/futurs-etudiants.html

Selection criteria are summarized here (epl-admission@uclouvain.be).

Admission and Enrolment Procedures for general registration

Teaching method

Methods that promote multidisciplinarity

The Master's degree programme in biomedical engineering is by nature interdisciplinary since it lies at the interface between engineering and biomedical sciences. It is grounded on a solid course programme that provides students with knowledge of the main areas in biomedical engineering as well as various majors in related disciplines.

Various teaching strategies

The teaching methods used in the Master's degree programme in biomedical engineering are consistent with that of the Bachelor's degree programme in engineering sciences: active learning, an equal mix of group work and individual work, and emphasis on the development of non-technical skills.

Contacts

Curriculum Management

Entity

Structure entity	SST/EPL/GBIO
Denomination	(GBIO)
Faculty	Louvain School of Engineering (EPL)
Sector	Sciences and Technology (SST)
Acronym	GBIO
Postal address	Place du Levant 3 - bte L5.03.02 1348 Louvain-la-Neuve Tel: +32 (0) 10 47 25 86 - Fax: +32 (0) 10 47 25 98

Academic supervisor: Sophie Demoustier

Jury

- Président du Jury: Claude Oestges
- Secrétaire du Jury: Sophie Demoustier

Useful Contact(s)

- Isabelle Dargent