



# Master in Bio-informatics and Modelling

The 2024-2025 programme is subject to change. It is provided for information purposes only.

## Programme mnemonic

MA-BINF

> Focus *Research* : M-BINFA

## Studies level

Master 120 credits

## Learning language

english and french

## Schedule

office hours

## Studies category / subcategory

Sciences and technics / Sciences

## Campus

Plaine and Solbosch

## Programme objectives

Addressing current biological problems—from genome sequencing to the study of biomolecular structures and the analysis of dynamical cellular processes—increasingly relies on the complementarity between experimental and theoretical approaches. These approaches allow biological systems to be analysed, modelled, and simulated on computers from the molecular and cellular scales up to entire organisms and populations. To meet this trend, this master programme trains students from various academic backgrounds into computational genomics and proteomics, structural bioinformatic, and modelling of dynamical processes. Graduates of this Master are able to use and design bioinformatics and modelling tools to address all aspects of a biological question, in close collaboration with experimental researchers.

## Programme's added value

ULB has played a pioneering role in developing the new disciplines covered in this Master, and has now reached a critical number of research groups and teachers with expertise in these areas. An increasing number of research laboratories in various faculties (Sciences, Applied Sciences, Medicine, and Bioengineering) have an interest in bioinformatics and modelling. The master in bioinformatics and modelling also benefits from the existence of interfaculty and interuniversity structures such as the Brussels Interuniversity Institute of Bioinformatics - (IB)<sup>2</sup> (<https://ibsquare.be/>), which gathers bioinformaticians both from VUB and ULB.

The curriculum offered by the ULB for this Master covers all areas of modern bioinformatics and modelling. Areas of applications include genome analysis, epigenetics, rational drug design, modelling of genetic and metabolic networks, synthetic biology, as well as the treatment of large data sets ("big data").

The sector of academic research as well as innovative pharmaceutical and biotechnology companies are seeking to recruit young scientists with benefit from this type of training. This tendency, started several years ago, has been continuously gaining in importance.

## Teaching methods

The Master programme consists of:

- > Lecture courses
- > Practical work on computers
- > Exercise sessions
- > Personal assignments and projects

The curriculum includes:

- > An internship (in an academic or professional environment) (10 credits)
- > A Master's thesis (25 credits)

## Succeed in your studies

Choose





The information and guidance counsellors at the InfOR-études [<https://www.ulb.be/en/studies-info-desk-1>] service will help you choose your studies throughout the year.

#### Succeed

Take part in preparatory courses [<https://www.ulb.be/en/studies-info-desk-1>] or get help to succeed [<https://www.ulb.be/en/studies-info-desk-1>], before or during your studies.

#### Get help

Apply for financial aid, look for accommodation or a student job, get support [<https://www.ulb.be/fr/aides-services-et-accompagnement/aid-services-and-support-1>] for your specific needs.

## International/Openness

The Master in Bioinformatics and Modelling has academic and industrial partnerships at the national and international levels that enable student exchanges (e.g. as part of the Erasmus programme) and internships. Students have the opportunity to spend one or two semesters in a foreign university.

## Job opportunities

The Master in Bioinformatics and Modelling enables graduates to adapt to a variety of jobs in many fields of activity. Upon

completing the programme, they can pursue careers in the industrial sector (pharmaceuticals, biotechnologies, food, etc.) or in the public sector (environment and sustainable development, quality control, biosecurity, scientific outreach), or remain in the academic sector (teaching and research in secondary or post-secondary schools).

Whatever direction the graduates decide on, their interdisciplinary training will be a major asset.

### Contacts

 [ma-binf@ulb.be](mailto:ma-binf@ulb.be)

 +32 2 650 40 14

 <http://www.bioinfomaster.ulb.be>

### Jury President

Jean-François FLOT

### Jury Secretary

Matthieu DEFRANCE



# Master in Bio-informatics and Modelling

## Focus Research

The Master in Bioinformatics and Modelling is an interdisciplinary programme that enables students to master and develop bioinformatic tools and modelling approaches to address biological questions. The curriculum is organised around 3 main topics: (1) genomics, proteomics, and evolution, (2) biophysics and structural bioinformatics, and (3) modelling dynamical systems in biology.

### Bloc 1 | M-BINFA | MA-BINF

## Cours de mise à niveau

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*A total of ten credits chosen from the following*

#### Module 1

BIOL-F4003 (optional) **Biologie générale et mécanismes de l'évolution** | Patrick MARDULYN (Coordinator) and Martine VERCAUTEREN  
⌚ 5 credits [lecture: 60h] 📅 first term 🗨️ French

CHIM-F208 (optional) **Biochimie 1** | Cyril GUEYDAN (Coordinator) and Véronique KRUYSS  
⌚ 5 credits [lecture: 60h] 📅 academic year 🗨️ French

#### Module 2

INFO-F101 (optional) **Programmation** | Thierry MASSART (Coordinator)  
⌚ 10 credits [lecture: 36h, tutorial classes: 36h, practical work: 24h, project: 60h] 📅 first term 🗨️ French

## Cours obligatoires

BINF-F401 **Computational Methods for Functional Genomics** | Vincent DETOURS (Coordinator)  
⌚ 5 credits [lecture: 36h, practical work: 24h] 📅 second term

BINF-F402 **Genomics, Transcriptomics and Epigenomics** | Jean-François FLOT (Coordinator) and Matthieu DEFANCE  
⌚ 5 credits [lecture: 48h, project: 30h] 📅 first term 🗨️ English

BINF-F403 **Biophysics and structural bioinformatics I** | Dimitri GILIS (Coordinator) and Fabrizio PUCCI  
⌚ 5 credits [lecture: 36h, practical work: 24h] 📅 first term 🗨️ English

BINF-F404 **Modeling dynamical systems in biology** | Didier GONZE (Coordinator)  
⌚ 5 credits [lecture: 36h, practical work: 24h] 📅 first term

BINF-F405 **Biophysics and structural bioinformatics II** | Dimitri GILIS (Coordinator), Fabrizio PUCCI and Wim VRANKEN  
⌚ 5 credits [lecture: 36h, practical work: 24h] 📅 second term

BING-F4002 **Acquisition et analyse de données** | Marius GILBERT (Coordinator) and Marc DUFRENE  
⌚ 5 credits [lecture: 24h, tutorial classes: 36h] 📅 first term 🗨️ French

CHIM-F422 **Modélisation des rythmes du vivant** | Didier GONZE (Coordinator), Geneviève DUPONT and Jean-Christophe LELOUP  
⌚ 5 credits [lecture: 24h, tutorial classes: 24h, project: 30h] 📅 second term 🗨️ French

INFO-F422 **Statistical foundations of machine learning** | Gianluca BONTEMPI (Coordinator)  
⌚ 5 credits [lecture: 24h, tutorial classes: 12h, project: 60h] 📅 second term 🗨️ English

INFO-F434 **Biological databases and analysis of macromolecular sequences** | Didier GONZE (Coordinator)  
⌚ 5 credits [lecture: 36h, practical work: 24h] 📅 first term 🗨️ English

INFO-F438

[Algorithms in computational biology](#) | John IACONO (Coordinator)

🕒 5 credits [lecture: 24h, tutorial classes: 12h, project: 60h] 📅 second term 🗣️ English



# Master in Bio-informatics and Modelling

## Focus Research

### Bloc 2 | M-BINFA | MA-BINF

## Poursuite du cursus

### Cours obligatoires

- MEMO-F518** [Mémoire](#) | Jean-François FLOT (Coordinator)  
 ⌚ 25 credits [mfe/tfe: 300h] 📅 first and second terms
- STAG-F036** [Stage \(en milieu académique ou industriel\)](#) | Gianluca BONTEMPI (Coordinator)  
 ⌚ 10 credits [work placement: 120h] 📅 first and second terms 🗨️ French

### Cours spécifiques

Sur demande motivée de l'étudiant-e et moyennant accord du Jury, un maximum de 10 crédits de cours à options peuvent être choisis parmi les cours d'un autre Master de l'ULB (ou, de manière exceptionnelle et à titre de dérogation pour un maximum de 5 crédits, parmi les cours d'un Bachelier de l'ULB).

*A total of 25 credits chosen from the following*

- BINF-F501** (optional) [Determination of biomolecular structures and structural data analysis](#) | René WINTJENS (Coordinator)  
 ⌚ 5 credits [lecture: 18h, tutorial classes: 10h, project: 32h] 📅 first term
- BING-F525** (optional) [Modélisation des écosystèmes aquatiques](#) | Nathalie GYPENS (Coordinator)  
 ⌚ 5 credits [lecture: 24h, tutorial classes: 36h] 📅 first term 🗨️ French
- BING-H4000** (optional) [Modeling and control of dynamical systems in bioengineering](#) | Philippe BOGAERTS (Coordinator) and Didier GONZE  
 ⌚ 5 credits [lecture: 48h, tutorial classes: 12h] 📅 second term 🗨️ English
- BIOL-F208** (optional) [Biochimie et physiologie de la cellule](#) | Vincent RAUSSENS (Coordinator), Véronique KRUYIS and Maud MARTIN  
 ⌚ 5 credits [lecture: 60h] 📅 first term 🗨️ French
- CHIM-F4001** (optional) [Rational drug design and PKPD modeling](#) | Jean-Christophe LELOUP (Coordinator) and Martine PREVOST  
 ⌚ 5 credits [lecture: 36h, tutorial classes: 12h, project: 24h] 📅 second term 🗨️ English
- CHIM-F443** (optional) [Approches computationnelles des états de la matière](#) | Nathalie VAECK (Coordinator), Antoine Aerts, Emilie CAUET and Martine PREVOST  
 ⌚ 5 credits [practical work: 36h, project: 24h] 📅 first term 🗨️ French
- INFO-F409** (optional) [Learning dynamics](#) | Tom LENAERTS (Coordinator)  
 ⌚ 5 credits [lecture: 24h, project: 60h] 📅 first term 🗨️ English
- INFO-F413** (optional) [Randomized algorithms](#) | Jean CARDINAL (Coordinator)  
 ⌚ 5 credits [lecture: 24h, tutorial classes: 12h, project: 60h] 📅 first term 🗨️ English
- INFO-F439** (optional) [Methods in Bioinformatics](#) | Matthieu DEFRANCE (Coordinator) and Wim VRANKEN  
 ⌚ 5 credits [lecture: 24h, project: 90h] 📅 second term 🗨️ English
- INFO-H400** (optional) [Medical Information Systems](#) | DAVID WIKLER (Coordinator)  
 ⌚ 5 credits [lecture: 24h, tutorial classes: 24h, practical work: 12h] 📅 second term 🗨️ English
- INFO-H410** (optional) [Techniques of artificial intelligence](#) | Hugues BERSINI (Coordinator)  
 ⌚ 5 credits [lecture: 24h, tutorial classes: 12h] 📅 second term 🗨️ English

- INFO-H413  
(optional) **Heuristic optimisation** | Thomas,T STUTZLE (Coordinator)  
⌚ 5 credits [lecture: 24h, tutorial classes: 12h, practical work: 24h] 📅 second term 🗨 English
- INFO-H414  
(optional) **Swarm Intelligence** | Marco DORIGO (Coordinator) and Mauro BIRATTARI  
⌚ 5 credits [lecture: 12h, practical work: 48h] 📅 second term 🗨 English
- INFO-H415  
(optional) **Advanced databases** | Esteban ZIMANYI (Coordinator)  
⌚ 5 credits [lecture: 24h, tutorial classes: 24h, practical work: 12h] 📅 first term 🗨 English
- INFO-H500  
(optional) **Image acquisition and processing** | Olivier DEBEIR (Coordinator)  
⌚ 5 credits [lecture: 24h, practical work: 24h] 📅 first term 🗨 English
- INFO-H501  
(optional) **Pattern recognition and image analysis** | Olivier DEBEIR (Coordinator) and Christine DECAESTECKER  
⌚ 5 credits [lecture: 36h, practical work: 24h] 📅 second term 🗨 English
- INFO-H515  
(optional) **Big Data: Distributed Data Management and Scalable Analytics** | Dimitrios SACHARIDIS (Coordinator) and Gianluca BONTEMPI  
⌚ 5 credits [lecture: 24h, tutorial classes: 12h, project: 24h] 📅 second term 🗨 English
- PHYS-F512  
(optional) **Molecular motors and stochastic processes** | Pierre GASPARD (Coordinator)  
⌚ 5 credits [lecture: 36h, tutorial classes: 24h] 📅 first term 🗨 English
- STAT-F408  
(optional) **Computational statistics** | Maarten JANSEN (Coordinator)  
⌚ 5 credits [lecture: 24h, tutorial classes: 12h, project: 100h] 📅 second term 🗨 English

