



Master of Science in Biomolecular Sciences

The two year master emphasizes on 4 particular domains of Biomolecular Sciences:

- Protein Structure and Function
- Applied Immunology
- Advanced Molecular Biology
- Bioinformatics



Vrije
Universiteit
Brussel

FACULTY OF SCIENCE AND
BIOENGINEERING SCIENCES

Two years, 120 ECTS

Campus: Etterbeek, Brussels, Belgium

Realize your Master plan in Brussels

Biomolecular Sciences is a two-year scientific program that focuses on the biochemical unity that underlies the biological diversity. Biomolecular Science is a rapidly developing discipline in modern life science. It stands at the crossroads of chemical, biological, physical and computational sciences and focuses on the molecular understanding of cellular function. Anticipating this evolution, this Master program will focus on the understanding of cellular processes, biological molecules and their interactions.

Developing a state of mind

The Master is conceived as a multidisciplinary and research-oriented program. The program also aims to develop the state of mind to perform and manage research in a multidisciplinary and international context. Therefore, our students are also trained in different aspects of research communication and research management.

Discovery-based laboratory

The two-year program has a strong emphasis on performing research. Its concept will require full-time attendance and will involve active participation in lectures and discovery-based laboratory work to develop the state of mind that drives the progress of science.

Admission requirements

For admission in the Master of Science in Biomolecular Sciences, students need a Bachelor degree in the area of biology, chemistry, or biomedical science or equivalent. Equivalency will be evaluated case by case by the examination board. To be admitted to the program, the students need to be proficient in English. (www.vub.ac.be/en/admission)

Application

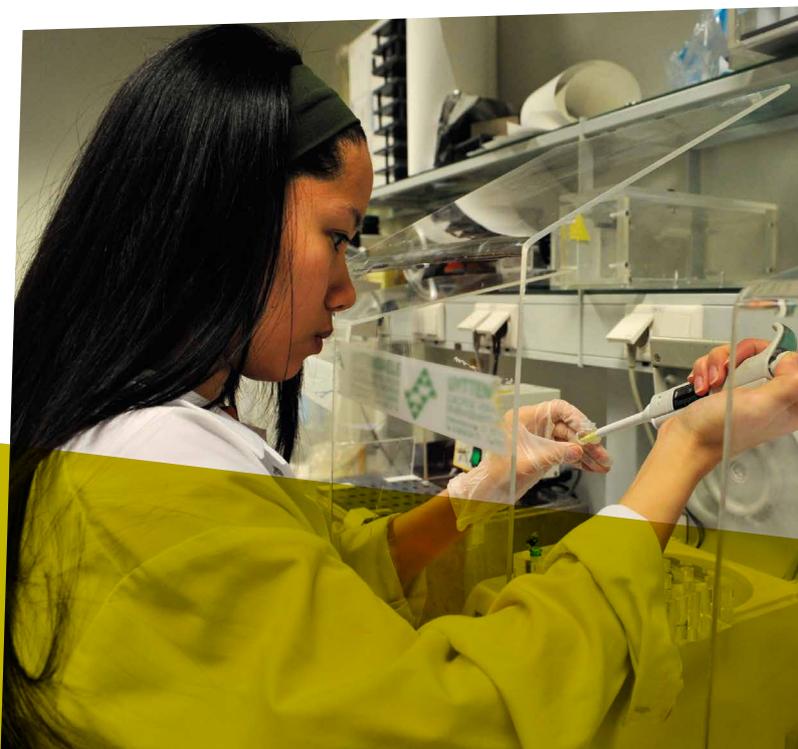
Prospective students have to pre-apply by filling out the pre-application form that can be downloaded from the website of the Vrije Universiteit Brussel at www.vub.ac.be/biomolecular-sciences/master.

We only accept pre-application through this form. All correspondence will proceed via electronic mail. No reply will be sent to applicants who fail to enclose all required information. The filled out form has to be sent to Ms. Greta Devuyst at gjdevuys@vub.ac.be. Based on this information, the program director and his staff will evaluate whether or not the basic requirements for admission have been fulfilled.

Once you have received a positive answer to your pre-application, you have to proceed to the final application.

To do so, go to www.vub.ac.be/en/admission

Please read the information very carefully and follow the instructions strictly. In case you have any questions or problems when filling out the online application, please mail to admissions@vub.ac.be



Outline of the program

The content of the program was outlined by a number of outstanding and multidisciplinary scientific teams. The embedding of the program in this high level scientific environment is our guarantee for a strong multidisciplinary program that interlaces theoretical formation with research-oriented skills.

To endorse the research-oriented nature of the Master, the advanced courses and the electives are taught by leading researchers with a proven scientific track record (see 'Research Areas').

The program of the first year is composed of **4 modules**, all of which have to be followed. The courses within each module are at advanced level and consist of 26 class hours and 6 days of practical training.

The practical trainings link up with the advanced courses and will take place in the research labs under the guidance of experienced postdocs.

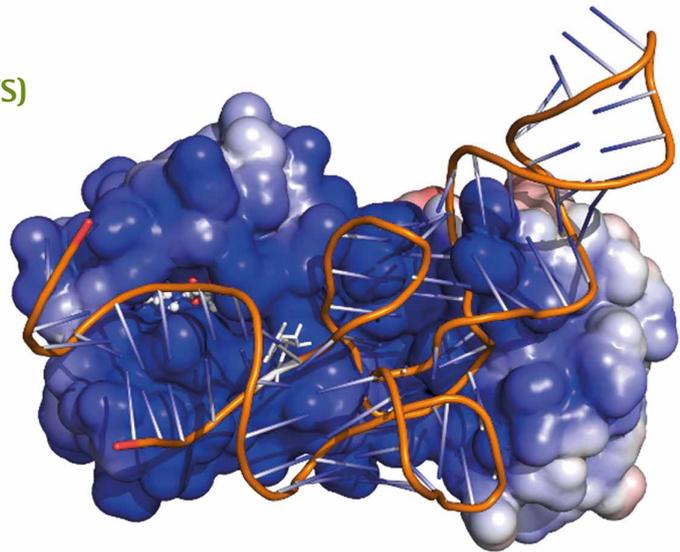
Protein Structure and Function (15 ECTS)

Molecular Biophysics (Prof. Remy Loris)

Protein Structure and Function (Prof. Han Remaut)

Mechanisms, Kinetics and Applications of Enzyme

Catalysis (Prof. Wim Versées)



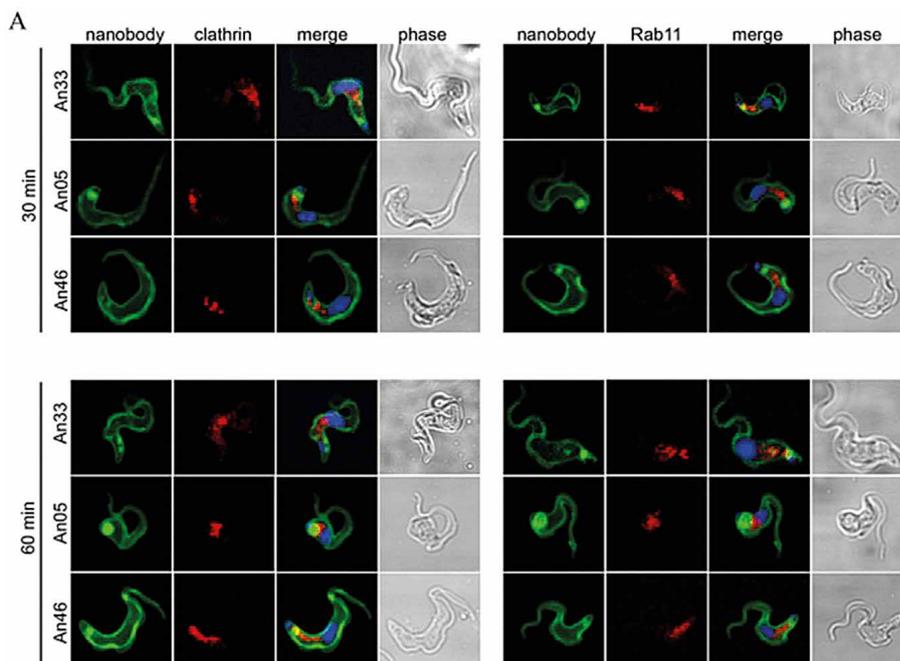
Three dimensional structure, determined via X-ray crystallography, of an enzyme acting upon an RNA molecule, in complex with its tRNA substrate, *Nucleic Acids Research* 40, 5149-5161 (2012)

Applied Immunology (15 ECTS)

Cellular Biology and Immunology (Prof. Patrick De Baetselier)

Recombinant Antibody Engineering (Prof. Serge Muyldermans)

Parasitology and Immunodiagnosics (Prof. Stefan Magez)



High affinity nanobodies against the Trypanosome brucei VSG are potent trypanolytic agent that block endocytosis, *PLoS Pathog.* 2011 Jun; 7(6)

Advanced Molecular Biology (20 ECTS)

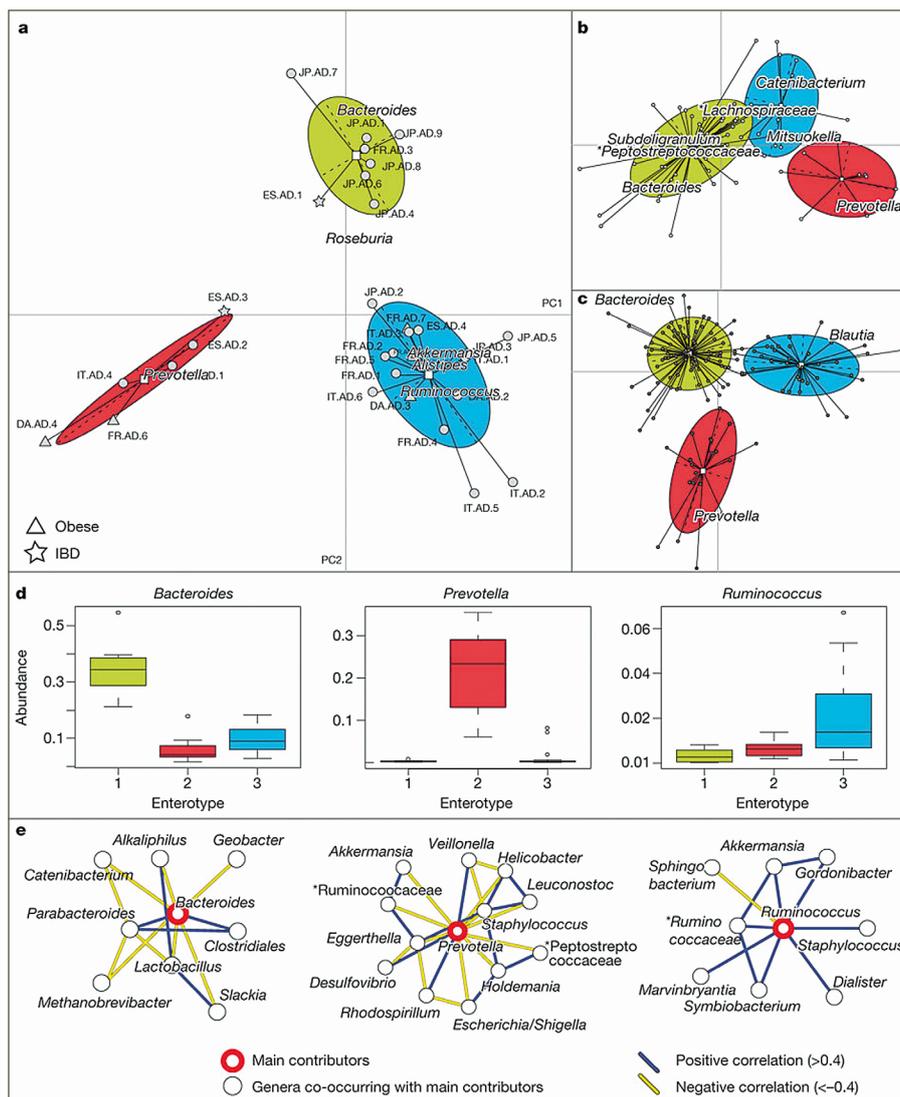
Advanced Molecular Biology (Prof. Daniel Charlier)
 Molecular Microbiology (Prof. Pierre Cornelis)
 Plant Molecular Biology (Prof. Geert Angenon)
 Developmental Biology (Prof. Luc Ieyns)



Expression of the Wnt receptor, frizzled 5, in the specific region of the future brain of a mouse embryo. Dev Dyn. 2007 Jul;236(7):2011-9.

Bioinformatics (10 ECTS)

Bioinformatics and Omics (Prof. Jeroen Raes)
 Biostatistics (Prof. Dominique Maes)



Enterotypes of the human intestinal flora, *Nature* 473, 174–180 (12 May 2011)



The program of the **second year** pays much attention to the acquisition of research competences.

The programme consists of **three modules**: Elective courses, Master Proof and Research Communication and Management.

Master Proof (30 ECTS)

To obtain a Master degree, a student must carry out, under the direction and supervision of a promoter, an independent research project and prepare a dissertation, that is, a written account of the research and its results.

Elective courses (20 ECTS)

Four elective courses have to be selected from the following list (4x5 ECTS):

- High Throughput Techniques
- Structural Biology Methods
- Molecular Phylogenetics and Evolution
- Microbial Life in Extreme Conditions
- Stem Cell Biology
- Bacterial Genetics and Genomics
- Micro- and Nanobiotechnology
- Protein Maturation and Trafficking
- Advanced Aspects of Molecular Pharmacology
- Vaccine Technology

Research Communication and Management (10 ECTS)

This part of the program includes the writing of the results of the dissertation in a publication format, seminars on intellectual property rights, scientific writing, project development and the writing of a research proposal.

The latter can be a proposal for a continuation of the topic of the Master Proof, a proposal for a PhD project, or a proposal for another research project in Biomolecular Sciences, and is intended to help the students to continue their career in biomolecular research.

Detailed descriptions of the course contents, expected knowledge at the start of the course and examinations formats can be consulted on the website at www.vub.ac.be/biomolecular-sciences/master



Ongoing research

Since its establishment in 1969, the Bio-Engineering department of the Vrije Universiteit Brussel acquired a sound reputation in training and in basic and applied research in molecular biology and biotechnology. Following the biotech revolution in the seventies, the interest in applied biotechnology has grown steadily. A few of the major discoveries at the Vrije Universiteit Brussel include:

- the first development of a genetically modified plant
- identification of a unique class of camel antibodies with far reaching implications in biotechnology and medicine
- development of pioneering technology for the analysis of protein structure
- breakthroughs in the knowledge of the role of macrophages in cancer and malaria
- elucidation of the action mechanism of antihypertensive drugs
- innovative techniques in the culture of micro-organisms involved in fermented food products



Laboratories & Research Areas

Pierre Cornelis

Pseudomonas - siderophores - iron metabolism - quorum sensing - efflux pumps

Remy Loris

protein structure and conformation - bacterial TA modules - intrinsic disorder - protein dynamics

Stefan Magez

(immuno)parasitology - TNF - vaccination - trypanosomes - diagnostic development

Serge Muyldermans

camel heavy-chain antibodies and single-domain antibodies - antibody engineering - phage display - high throughput screening - protein structure and conformation

Jeroen Raes

bioinformatics - next-generation sequencing - metagenomics - human microbiome - ecosystems biology

Han Remaut

host-pathogen interaction - protein secretion - bacterial cell surfaces - anti-virulence therapeutics

Patrick De Baetselier

myeloid cell heterogeneity and functions - functional genomics - invasion and metastasis - trypanosomes

Dominique Maes

phase transitions in protein solutions - crystallisation - nucleation - growth kinetics - microgravity - mass transport

Wim Versées

structural enzymology - enzyme complexes - tRNA modification - (bacterial) GTPases

Daniel Charlier

transcriptional regulation - regulatory networks - protein-DNA interactions - extremophiles - Archaea

Geert Angenon

plant amino acid metabolism - stress metabolism - plant transformation technology - DNA repair and recombination

Luc Leyns

signaling pathways - gene expression - embryonic development - growth and differentiation of stem cells

Students as scientists

During the practical trainings problem-solving based formats are used in which students work collaboratively to make observations and analyze experimental results. Students who learned via problem-solving formats demonstrate better problem-solving ability, conceptual understanding, and success in subsequent courses compared with students who learn in traditional, passive formats.

All Master students will individually conduct original research in a professor's research lab. This opportunity is challenging for the instructors but teaches students the essence of investigation.

Studying and living in Brussels

Brussels is the heart of Europe with cities such as Antwerp, Bruges, Amsterdam, Paris and London very close by. As the decision-making city of Europe, Brussels has become an international capital, where opinion leaders from all over the world meet to use their influence in policy making decisions as well as to do business. Nevertheless, it remains intimate enough to allow its inhabitants to enjoy all the advantages of a vibrant city. Language is not a barrier in the capital of Europe.

The cosmopolitan city has something to offer for every taste and interest. Visit a museum, enjoy the many events and festivals, get to know the Belgian cuisine with, its famous chocolate and world renowned beers, relax in one of the many parks (e.g. Zoniën forest) that make Brussels one of the greenest capitals.

The Brussels-Capital Region is one of the European hubs of scientific research and advanced technologies. It has adopted a proactive policy based on its natural assets: the presence of university centres of excellence, including the Vrije Universiteit Brussel, and four industrial higher education institutes, three faculties of medicine and university hospitals, as well as several public and private research centres. Against this lively intellectual background, university research centres are closely linked with Brussels-based companies involved

in the high-tech sector. Scientific research in the Brussels-Capital Region is mainly geared towards highly specialised sectors and advanced technologies such as information technology, using state-of-the-art equipment and procedures; electromechanical engineering; biotechnology; life science; medical research and environmental protection.

The Vrije Universiteit Brussel (VUB) is a dynamic and modern university. The university and the university hospital are spread over two green campuses in the Brussels-Capital Region. It counts over 11,000 students, of which 2,500 are international. The campus offers everything a student needs: an extensive library, modern computer labs, sport facilities, a restaurant, a job service, cultural activities and language courses. There are also rooms on the campus. For more information: www.vub.ac.be/housing.





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Biomolecular Sciences

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