Aims of the programme

The main objective of this two-year full-time graduate Master’s programme is to prepare students for the challenges in Biosciences of the 21st century. The complete sequence of the human and other genomes, which are available since a few years, resulted in a drastic change in the way of thinking in Biosciences. Investigations on the molecular basis of major human diseases, such as cancer, atherosclerosis, type 2 diabetes and Parkinson's, are not performed anymore on a single gene, mRNA, protein or metabolite level, but are addressed on whole genome, transcriptome, proteome and metabolome level. Therefore, students have to be able to think on “omics” levels (genomics, transcriptomics, proteomics, metabolomics and physiomics) and have to be able to understand and apply the respective new technologies. This involves the handling of large amounts of data and thus Bioinformatics is an essential element in the modern education in Biosciences.

The programme offers an interdisciplinary learning environment gathering the most modern technologies in Biosciences. It, thus, provides the students with deep insights into relevant wet lab technologies. Moreover, the Master’s programme will prepare the students in Systems Biology approaches.

Systems Biology is the extension of Biochemistry and Physiology with the goal to understand and model whole systems, such as individual cells, organs and finally whole organisms on the basis of their constituting molecules. In this way, Systems Biology integrates established disciplines in Biosciences and renovates them for the challenges of the future.

Participants of the programme will be offered a challenging combined theoretical and practical knowledge of integrated biology with a close insertion of the students into research projects within the Life Sciences Research Unit of the University of Luxembourg. The studies are capped in the 4th semester by a Master thesis that demonstrates the ability of the student to conduct independent research under guidance of a faculty member.

Studying in Luxembourg

The University of Luxembourg, founded in 2003, offers an inspiring international learning environment with innovative course formats and a high degree of interaction due to small student numbers. The design of the curriculum is unique in the details of its organization and cannot be found at other universities in the vicinity of Luxembourg. The course programme has a strong focus on practical education and provides "hands on" experience in different technologies of modern Biosciences. For specialized technologies, which are not yet established at the University of Luxembourg, partner institutions such as the CRP-Santé and the CRP-Gabriel Lippmann for the microarray and the proteomics platforms and the IGBMC in Strasbourg for the Mouse Clinic, will be involved.

Employability and career opportunities

The graduate programme prepares the students primarily for further specialization in PhD programmes (at the University of Luxembourg and abroad). The broad education in modern biosciences will provide the students with an ideal background for the requirements of Biosciences in the 21st century. Including their Master thesis, the students will perform at least 1,450 hours of practical work in computer labs and wet labs. This ensures that at the moment of receiving their Master's degree, the students have learned their "handicraft" and are well prepared for positions in biotech and pharma industry even without a PhD.

Partnership with Seattle, Buffalo and within the University of the Greater Region (UGR)

Since November 2008 the Institute for Systems Biology (ISB) in Seattle (www.systemsbio.org) is a strategic partner of the University of Luxembourg in a 5-years project of the Luxembourgish government (The Luxembourg Health Sciences and Technologies Plan). The government aims to develop a centre of expertise in the area of systems biology and molecular medicine—the “Luxembourg Centre for Systems Biomedicine” (LCSB). The LCSB will provide excellent practical and theoretical training options for the master students who will have the possibility to perform high quality MSc thesis projects and continue then world-class research projects as PhD students also in collaboration with the ISB. Student exchange is possible to Buffalo, USA (Cancer Systems Biology) and within the University of the Greater Region (UGR) to Nancy or Liege (focus on Systems Engineering) and to Saarbrücken (Bioinformatics, Biotechnology).

Application requirements

A Bachelor’s degree or equivalent (at least 180 ECTS) in Biosciences (Biology, Biochemistry etc.) or Bioinformatics is required. Students from related disciplines, such as Computer Sciences, Chemistry, Physics and Mathematics are encouraged to apply and may be accepted, if sufficient knowledge in the relevant fields can be documented. For all students, good knowledge of English is essential.

Master in Integrated Systems Biology

Aims of the programme

The main objective of this two-year full-time graduate Master’s programme is to prepare students for the challenges in Biosciences of the 21st century. The complete sequence of the human and other genomes, which are available since a few years, resulted in a drastic change in the way of thinking in Biosciences. Investigations on the molecular basis of major human diseases, such as cancer, atherosclerosis, type 2 diabetes and Parkinson’s, are not performed anymore on a single gene, mRNA, protein or metabolite level, but are addressed on whole genome, transcriptome, proteome and metabolome level. Therefore, students have to be able to think on “omics” levels (genomics, transcriptomics, proteomics, metabolomics and physiomics) and have to be able to understand and apply the respective new technologies. This involves the handling of large amounts of data and thus Bioinformatics is an essential element in the modern education in Biosciences.

The programme offers an interdisciplinary learning environment gathering the most modern technologies in Biosciences. It, thus, provides the students with deep insights into relevant wet lab technologies. Moreover, the Master’s programme will prepare the students in Systems Biology approaches.

Systems Biology is the extension of Biochemistry and Physiology with the goal to understand and model whole systems, such as individual cells, organs and finally whole organisms on the basis of their constituting molecules. In this way, Systems Biology integrates established disciplines in Biosciences and renovates them for the challenges of the future.

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The University of Luxembourg, founded in 2003, offers an inspiring international learning environment with innovative course formats and a high degree of interaction due to small student numbers. The design of the curriculum is unique in the details of its organization and cannot be found at other universities in the vicinity of Luxembourg. The course programme has a strong focus on practical education and provides “hands on” experience in different technologies of modern Biosciences. For specialized technologies, which are not yet established at the University of Luxembourg, partner institutions such as the CRP-Santé and the CRP-Gabriel Lippmann for the microarray and the proteomics platforms and the IGBMC in Strasbourg for the Mouse Clinic, will be involved.

Employability and career opportunities

The graduate programme prepares the students primarily for further specialization in PhD programmes (at the University of Luxembourg and abroad). The broad education in modern biosciences will provide the students with an ideal background for the requirements of Biosciences in the 21st century. Including their Master thesis, the students will perform at least 1,450 hours of practical work in computer labs and wet labs. This ensures that at the moment of receiving their Master’s degree, the students have learned their “handicraft” and are well prepared for positions in biotech and pharma industry even without a PhD.

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Application requirements

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The Master programme is organised in four semesters (two years) of full time studies and has a total volume of 120 ECTS. The programme starts annually in September (winter term) and is designed for a maximum of 18 students per year. All courses will be instructed in English.

The curriculum offers 450 lecture hours distributed over 20 individual courses. The courses are organised as non-overlapping blocks of 2 to 4 weeks allowing the students to concentrate on one topic at a time. Most lecture courses are followed by practical courses of the same topic. The order of courses follows the central dogma of molecular biology: going from DNA (genomics), via mRNA (transcriptomics), protein (proteomics), metabolites (metabolomics) to physiological effects (physiomics). Teaching will be performed in form of lectures, practicals, seminars and practical instructions for a Master thesis. Throughout the whole programme key attention is focused on practical education (45% of time). During the first semester, particular attention will be paid to leveling up the students coming from different disciplines. The following courses will be taught:

Modern biotechnologies
- Introduction to Bioinformatics
- Gene Regulation/Practicals in Gene Regulation
- Protein Structure and Function/Practicals in Proteomics
- Endocrine Regulation of Biochemical Pathways/Practicals in Metabolomics
- Advanced Cell Biology/Practicals in Cell Biology
- Molecular basis of diseases I
- Molecular basis of diseases II

Systems biology
- Introduction to Systems biology/Practicals in Systems Biology
- Modeling of Intracellular Molecular Networks
- Advanced Systems Biology

General courses
- Bioscience Seminar Series
- Journal Club
- Safety in the Laboratory
- Writing Publications and Grants
- Patenting and Biotech Companies

Master thesis
The master thesis will be performed during the 4th semester, but can already be started earlier. Since the Master’s programme is closely related with the research priorities of the Life Science Research Unit and the Luxembourg Centre for Systems Biomedicine, each team of the department will offer Master thesis projects. In this way the students have multiple possibilities for specialization. In addition, there will also be the choice to perform the practical part of the Master thesis in research groups located outside of the University of Luxembourg.

Programme outline
Duration
Two years (120 ECTS), divided into 4 semesters.

Costs
No tuition fees are charged, but students need to pay a registration fee of 200 € per semester.

Number of seats
The programme is presently designed for 18 students per year.

Eligibility
Bachelor’s degree in Biosciences (e.g. Biology or Biochemistry) or Bioinformatics or equivalent, good knowledge of English.

Further information
The programme is organised by the Life Sciences Research Unit.

Life Sciences Research Unit
University of Luxembourg/Campus Limpertsberg
162a, avenue de la Faëncine
L-1511 Luxembourg

http://misb.uni.lu (Website of the Master in Integrated Systems Biology)
misb@uni.lu

Course director
Prof. Dr. Thomas Sauter
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Online registration is possible on www.uni.lu in the students’ section.

The “Service des Etudes et de la Vie Etudiante” (SEVE) provides enrolment and individual support to students: seve.infos@uni.lu
T +352 / 46 66 44-6060

http://misb.uni.lu