



## SYSTEMS BIOLOGY

Programme type	Master's studies
Field of study	Medicine Technologies
Study area	Health Sciences
Degree	Master in Health Sciences
Duration	2 years (4 semesters)
Workload	120 ECTS
Language of instruction	English
Location	Vilnius, Lithuania
Starting date	September, 2020

### PROGRAMME DESCRIPTION

- *The objective*

The interdisciplinary Systems Biology Master's program prepares students to do real world work in rapidly developing fields including, but not limited to, biological systems modeling, bioengineering, synthetic biology, bioinformatics, neurobiology, and data analysis. It is ideal for current and future biologists who wish to take advantage of the most powerful statistical models and programming tools in order to produce quantifiable results in their field of choice.

As per its interdisciplinary nature, our program is specifically designed to help students from a life sciences background overcome any apprehensions they may have about working with statistical models and scientific programming tools. Upon completion of the program students will have gained a robust understanding of mathematics and computer science, as well as their varied applications to life sciences.

Similarly, students with computational and bioinformatics backgrounds will have a possibility to gain and deepen their knowledge in molecular and cellular biology and master wetlab skills.

Emerging trends in synthetic biology point us to new fields that focus towards quantitative investigation, experimentation and design at the molecular level. As a result, fields in neurobiology, cell programming, and "-omic"

sciences create a vast demand for professionals equipped with both a high-level understanding of biological principles and the ability to take advantage of advanced mathematical and statistical models. The Systems Biology Masters program seeks to meet this demand.

- *Career opportunities*

The Systems Biology program prepares scientists for lucrative and rewarding professional careers in public and private sectors, as well as for further academic pursuit at the PhD level. Upon completing the program, students can go on to work in roles such as:

- Bioinformatician
- Biological and biomedical information database's curator
- Scientist
- Systems analyst, biomedical data modeller
- High throughput -omics Data analyst
- Cell programmer
- Cell scientist
- Biological technician
- Laboratory manager
- Biomedical engineer
- Biomedical data scientist
- Statistical genomics and genetics specialist
- Medical and health services manager
- Bioprosthetic and rehab equipment engineer

- *Access to further studies*

Graduates can continue their career in PhD studies (physical, life or biomedicine sciences).

## **KEY LEARNING OUTCOMES**

- Know cell structure and behavioural patterns at the molecular level and the functions of human organs and systems and the mechanisms of physiological regulation
- Be able to analyse, manage and model data from the field of system biology with the aim to develop new technologies
- Be able select an appropriate modelling strategy for a given biological domain or problem, and be able to set-up as well as lead projects for fundamental or applied research with the aim to develop new technologies in order to solve arising issues
- Be able to gather and analyse information on research related to system biology with a critical approach, and to carry out a technological watch
- Know and apply modern research methods in genetics, epigenetics, transcriptomics, proteomics and neurobiology
- Be able to interpret mathematical models describing evolutionary processes of biological systems
- Comprehend advanced data processing and programming techniques
- Be able perform practical calculations using modern high-performance open computing platforms
- Be able to describe evolutionary processes of biological systems in mathematical language
- Be able to perform practical and theoretical work in system biology within the deadlines and in accordance with the bioethics requirements
- Have summarising skills enabling them to communicate in a clear manner with specialists from other fields or the public about professional project, on work results, or about the results of tasks
- Be able to work autonomously and as a part of a multidisciplinary team; act honestly and according to ethical obligations
- Be able to critically analyse their own professional practices with a view to improving them.

## PROGRAMME STRUCTURE

The study programme has the following structure:

Course Type	1 <sup>st</sup> Semester	2 <sup>nd</sup> Semester	3 <sup>rd</sup> Semester	4 <sup>th</sup> Semester
<b>Compulsory Courses</b>	Genomics (10 ECTS)	Mathematical Modelling (10 ECTS)	Proteomics (10 ECTS)	Preparation and defence of a master thesis (30 ECTS)
	Data mining (5 ECTS)	Epigenomics (5 ECTS)	Neurobiology (10 ECTS)	
		Transcriptomics (10 ECTS)	Mathematical physiology (5 ECTS)	
		Science forum (5 ECTS)**	Science forum (5 ECTS)**	
<b>Elective Courses (Life and Health sciences bachelor)*</b>	GNU / Linux type operating systems (5 ECTS)			
	Programming for biological data analysis (5 ECTS)			
	Multivariate statistics with R (5 ECTS)			
<b>Elective Courses (Informatics and Physical bachelor)*</b>	Human physiology (5 ECTS)			
	Genome structure (5 ECTS)			
	Cell biology (5 ECTS)			

\* If a student has excellent knowledge from offered elective courses, in line with the Study program committee, the student can choose other course from MSc programs listed below:

"Biochemistry" (621C73001), "Genetics" (621C40001), "Computer modelling" (621I10002), "Software Engineering" (621I30001).  
Restrictions for the selection: a course should have 5 ECTS; a course should not be taught later in the program.

\*\* Seminars with a critical assessment of the latest and most advanced research articles in certain areas. Recent science news, issues, approaches are addressed. The seminars will be given by invited lecturers, potential employers

Short course descriptions can be found [here](#).

## GRADUATION REQUIREMENTS

Public defence of the Master's Thesis.

## ADMISSION REQUIREMENTS AND SELECTION CRITERIA

### Requirements

- Bachelor's degree or its equivalent in study areas such as Informatics, Physical, Life or Health sciences;
- English language proficiency – the level not lower than B2 (following the Common European Framework of Reference for Languages (CEFR), or TOEFL score 75/IELTS score 6.

### *Selection Criteria*

- CV, prepared according to [Europass](#)
- Scientific essay or interview (skype call)

Candidate should prepare scientific essay in one of the announced topics. [Topics and instructions for the essay are here.](#)

### **EXAMINATION AND ASSESSMENT REGULATION**

The form of evaluation is an examination. Every course is concluded with a written evaluation. Student's knowledge and general performance during the exam are evaluated using grading scale from 1 (very poor) to 10 (excellent). The programme ends with Master Thesis.

#### **Academic contact**

[systems.biology@mf.vu.lt](mailto:systems.biology@mf.vu.lt)

#### **Admission contact**

[admissions@cr.vu.lt](mailto:admissions@cr.vu.lt)