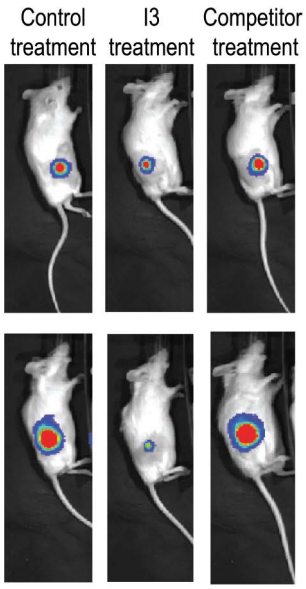
MASTER

LIFE SCIENCES AND TECHNOLOGY

ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

The Master's program in Life Sciences and Technology focuses on key aspects of current biomedical research and applied engineering technologies for fields such as Molecular Medicine, Neuroscience and Biocomputational sciences.
Students have a unique opportunity to interact with a cutting-edge group of scientists whose research is focused on the development of novel therapeutic strategies and associated technological tools.



Xenograft model of human breast cancer HCC1187

Optimization and preclinical validation of Notch signaling inhibitors for cancer therapy

The Notch pathway is a cascade required for stem cell maintenance and development of different organs. Over activation of this pathway due to mutations in the Notch receptor has been shown to cause 50% of human T-cell leukemia and promote tumor progression of various organs. Thus, the importance of Notch signaling in human cancers and the lack of effective therapeutic intervention justify the development of novel inhibitors of this pathway. In order to identify such inhibitors, Prof. Freddy Radtke's lab established a coculture-based drug-screening platform. This permitted to identify a novel small molecule inhibitor referred to as I3. The goal of my project was to further validate Notch inhibitory activity of I3. Using reporter gene assays, we demonstrated that I3 blocks both Notch signaling via Notch1 and Notch2 receptors and active forms of Notch1, Notch2 and Notch3.

To further extend our findings, we have shown that I3 down regulates the active form of Notch1 and its target genes in human T-ALL leukemia and human breast cancer cell lines. Moreover, the block of Notch signaling induces cell proliferation arrest of some human leukemic and breast cancer cell lines. This lab immersion was really interesting because it allowed me to confirm my carrier plan to do a PhD in this field after my master.

Watch the video:

Niels Rettby:
"I chose to come here because it is one of the best Life Sciences program that you can find in the world, with top scientists, very diverse classes and very nice students!"

Délphine Harduin

To learn more about Prof. Freddy Radtke's lab:

Combining synthetic biology with nanotechnology to target drug delivery

Watch the video:

Julie Scotton:
"It's really shown me that Cancer Biology has to do with personalized medicine and a lot of genetic analysis. It requires lots of technical tools that my studies allowed me to learn. And even if I am not an expert in Bioinformatics, Biophysics or Mathematics, I know what I have to ask if I need to ask something."

A women team composed of ten future engineers in Life Sciences have designed and built genetic circuits with novel functionalities and presented their project at the annual international Genetically Engineered Machine competition (iGEM). "Taxi.Coli: Smart Drug Delivery" was selected for the iGEM finals in Boston (MIT). The project aims at creating a highly adaptable smart drug delivery system, which could be used for several applications and alternatives in disease treatment. The design makes it so flexible that it could even be possible to adapt it to the patient's individual needs. By being highly adaptive, the proposed system would also reduce the cost of targeted drug delivery: instead of creating a new system for each drug and each patient, one could simply use the basic part that we made, modify them slightly and assemble them.

Using the principles of synthetic biology, an *E.coli* bacterium will be engineered that expresses streptavidin on its surface and contains a pH-sensing promoter controlling the expression of gelatinases. Those bacteria would be able to bind biotinylated gelatin nanoparticles and release the drug exactly where it is needed to treat the patient...

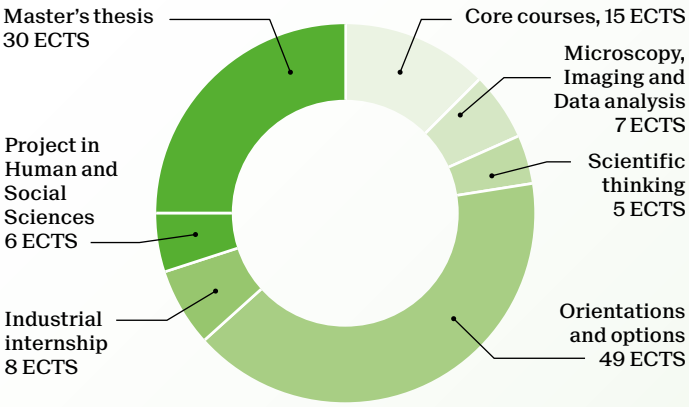
Testimonial of EPFL iGEM team:
"iGEM is a great opportunity for students to get involved in an international project and work closely as a team with other fellow students. It gives us a glimpse of what our professional careers could look like, especially in the industry sector where working in teams and meeting deadlines is essential to the success of the project. From concept to implementation, we get to see all the steps of a project in the Life Sciences, all in the space of a few months."

To learn more:

Master of Science in

LIFE SCIENCES AND TECHNOLOGY

2-year program - 120 ECTS



Validation of Orientation requires at least 25 ECTS with the same label (A or B) from the "Core courses" and the "Orientations and options"
Students must choose at least 3 ECTS in domain C.
A: Molecular Medicine and Systems Biology
B: Neurosciences and Neuroengineering
C: Law or Economics

Students can also opt for a 30 ECTS Minor.
Minors recommended with this Master:

- Biocomputing
- Computational Neurosciences
- Management, Technology, Entrepreneurship
- Neuroprosthetics

This program includes an 8-week compulsory internship in industry.

Target student profile

Students with a background in physics, engineering or mathematics who are interested in modern questions of the life sciences are particularly encouraged to apply.

Career prospects

The palette of skills that EPFL Life Sciences and Technology students acquire will prepare them to tackle biological problems quantitatively, to put together models of biological systems to help illuminate problems, and to come up with strategies for research and innovation.
Their combined expertise in biology and engineering will make them ideal partners for research and development in multidisciplinary groups in the academic world or in the pharmaceutical or biomedical industries such as Nestlé, Roche, Novartis, or Debiopharm.
International agreements for study exchange with universities in Europe, the US and Asia create a dynamic atmosphere and offer opportunities for future collaboration or employment.
EPFL has an important institutional commitment to technology transfer, and spin-offs from life science technology research located on campus (PSE) such as AC Immune SA, Mindmaze SA, or Biocartis SA offer internships, master projects and job opportunities for LST students.

School of Life Sciences
master.epfl.ch/lifesciences
contact: master-stv@epfl.ch

	Orientation			Credits
Core courses				**15**
Cancer Biology I	A			5
Cancer Biology II	A			5
Immunology	A			5
Infection Biology	A			5
Neuroscience I: Molecular Neuroscience and Neurodegeneration		B		5
Neuroscience II - Cellular mechanisms of brain function		B		5
Neuroscience III: Behavioral and Cognitive Neuroscience		B		5

Microscopy, Imaging and Data analysis				**7**
Biomicroscopy I				3
Data Analysis and Model Classification				4
Fundamentals of Biomedical Imaging				4
Image Processing I				3

Scientific thinking				**5**
Scientific literature analysis in bioengineering				5
Scientific project design in cell and developmental biology				5
Scientific literature analysis in computational molecular biology				5
Scientific literature analysis in Neuroscience				5
Scientific project design in Drug Discovery				5
Scientific project design in Integrative Neurosciences				5
Scientific project design in regenerative medicine and diagnostics				5
Scientific project design in Synthetic Biology (iGEM)				5
Scientific project design in Translational Neurosciences				5
Scientific project design in Translational Oncology				5

Orientations and options				**49**
Molecular Medicine and System Biology	A			
Neurosciences and Neuroengineering		B		
Law, Organization and Economics in LST			C	
Analog circuit for biochip				3
Applied biostatistics				4
Bioinspired approaches to engineering				2
Biological Modeling of Neural Networks		B		4
BioMEMS				2
Biomicroscopy II				4
Biomolecular Structure and Mechanics	A			4
Brain Computer interaction		B		3
Chemical Biology - Tools and Methods				3
Computational Motor Control		B		4
Dynamical System Theory for engineers	A	B		4
Economics of innovation in the biomedical industry			C	3
Fundamentals of biosensors and electronic biochips				3
Fundamentals of Neuroengineering		B		4
Genomics and Bioinformatics	A			4
Image Processing II				3
In Silico Neuroscience		B		4
Introduction au droit et à l'éthique en STV			C	3
Introduction à l'informatique visuelle		B		4
Lab Immersion I				8
Lab Immersion II				8
Lab immersion III (semester project)				12
Lab immersion academic (outside EPFL) A and B				22
Lab immersion in industry A and B				22
Lab methods: Animal Experimentation	A			2
Lab methods: Bioactive compounds screening	A			2
Lab methods: Biosafety			C	3
Lab methods: Flow Cytometry	A			2
Lab methods: Histology	A			2
Lab methods: Proteomics				2
Machine learning				7
Modèles stochastiques pour les communications				6
Molecular Endocrinology	A			3
Multidisciplinary organization of medtechs/biotechs			C	3
Nanobiotechnology and biophysics				3
New tools and research strategies in personalized medicine	A			4
Nutrition: from molecules to health	A			4
Pharmacology and Pharmacokinetics	A	B		5
Principles and Applications of Systems Biology	A			3
Sensorimotor Neuroprosthetics		B		4
Sensors in medical instrumentation				3
Signal Processing for Functional Brain Imaging		B		3
Single cell genomics				4
Statistical Physics of Biomacromolecules				4
Stem Cell Biology and Technology	A			3
Understanding statistics and experimental design				4
Unsupervised and Reinforcement Learning in Neural Networks		B		4
Other accredited courses				max. 10