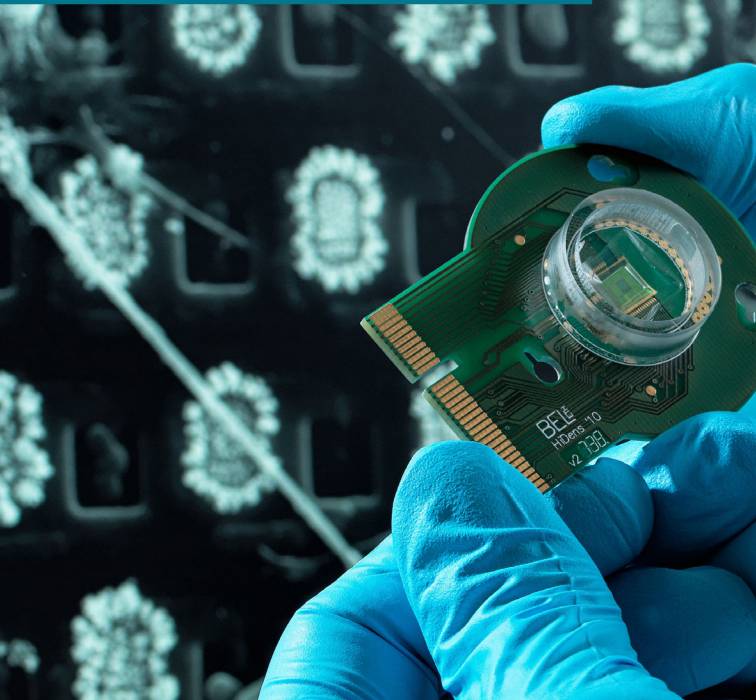


Department of Biosystems Science and Engineering

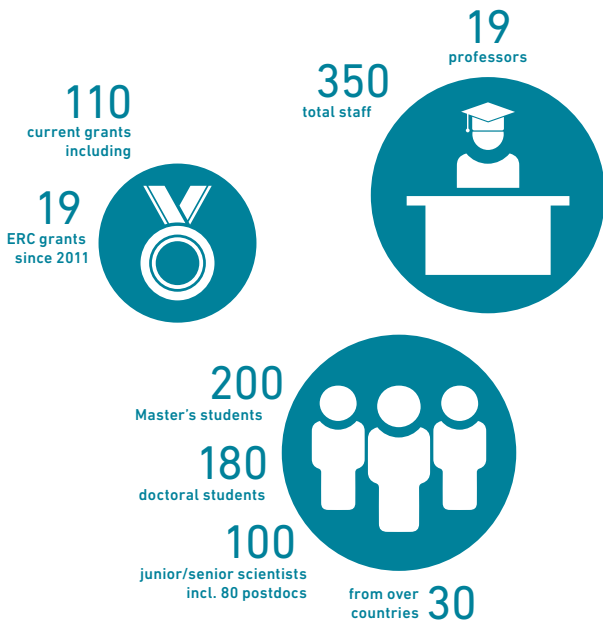


Department of Biosystems Science and Engineering

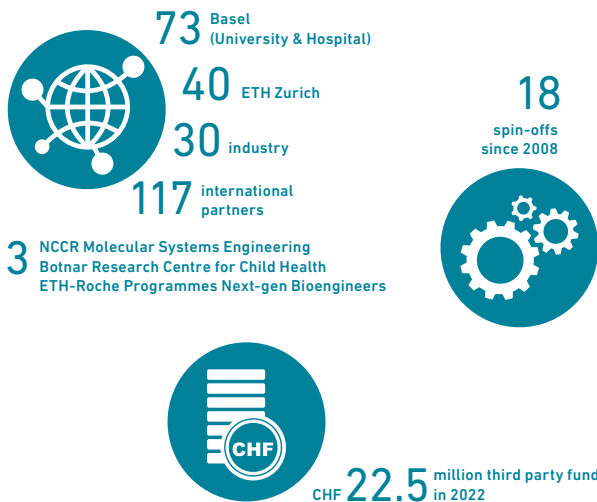
From the Theory of Biosystems
to Understanding and Engineering Cells
and Organisms

Research in life sciences is central to overcoming the challenges of human health and disease, production processes in industry and their impact on the environment. The magnitude and complexity of these challenges call for a paradigm shift towards holistic, systems-based and interdisciplinary approaches.

At the Department of Biosystems Science and Engineering (D-BSSE), experimental and computational biologists and engineers work together in an interdisciplinary team in order to conduct comprehensive analysis of complex processes in cells and organisms. They develop strategies and techniques for the programming and rational design of cell functions, and implement these in complex biological systems. D-BSSE research is driven by open scientific questions and unmet societal needs in biotechnology and life sciences.



Collaborations



D-BSSE Professorships

Fostering Interdisciplinarity in Research

Together, experimental and computational biologists and engineers analyse, program and design biosystems in a new interdisciplinary manner. All three disciplines are represented in the department and work in close collaboration in order to develop novel approaches to biosystems science.



Dagmar Iber
Computational Biology



Jörg Stelling
Computational
Systems Biology



Tanja Stadler
Computational
Evolution Group



Mustafa Khammash
Control Theory and
Systems Biology Laboratory



Computation



Niko Beerenwinkel
Computational
Biology Group



Timm Schroeder
Cell Systems
Dynamics Group



Georg Holländer
Developmental
Immunology



Andreas Moor
Systems Physiology



Sai Reddy
Laboratory for Systems and
Synthetic Immunology



Renato Paro
Epigenomics Group
(Prof. em.)



Barbara Treutlein
Quantitative Develop-
mental Biology Lab



Randall Platt
Laboratory for
Biological Engineering



Yaakov Benenson
Synthetic Biology Group



Martin Fussenegger
Biotechnology and
Bioengineering Group



Petra Dittrich
Bioanalytics Group



Sven Panke
Bioprocess Laboratory



Andreas Hierlemann
Bio Engineering Laboratory



Michael Nash
Lab for Molecular Engineering
of Synthetic Systems



Daniel Müller
Biophysics Group



Konrad Tiefenbacher
Synthesis of Functional Modules



Biology



Engineering

D-BSSE Scientific Facilities

High-tech for Scientific Advances

At D-BSSE, researchers, students and partners benefit from high quality instrumentation, laboratory work space and expertise in state-of-the-art scientific facilities.

The **Single Cell Facility** provides a broad range of high-end flow cytometry and advanced microscopy solutions. It specialises in automated life cell imaging with intelligent microscope control by customised image analysis programming, and in the integration of other technologies, such as microfluidics, into cellular analysis.

The **Basel Genomics Facility** is operated jointly with the University of Basel and grants direct access to cutting-edge next-generation sequencing (NGS) technologies, thus facilitating the systematic quantitative investigation of genome-wide experiments, including single-cell measurement.

The Microtechnological **Cleanroom Facility** provides services and processing capabilities to develop and fabricate complex microstructures and microfluidic devices, with all the required process steps to fabricate state-of-the-art devices.

The **Laboratory Automation Facility** offers a wide range of automated, robotics-based experimental process workflows, including fully automated cloning, cell culture production and life cell assays.

The **Animal Facility** is shared with the University of Basel and provides infrastructure and support for *in vivo* experiments using rodents.

**ETH technology
platforms located
at D-BSSE:**

- _Good Manufacturing Practice Facility (*ramp up*)
- _NEXUS Personalized Health Technologies



D-BSSE Spin-off Companies

Enabling Entrepreneurial Ventures

D-BSSE researchers have made numerous prominent contributions to science, engineering and business development over the years. A total of 18 D-BSSE spin-off companies have been launched in the Zurich and Basel areas since the foundation of the department in 2007.



novel chemical matters for unmet medical needs (2021)



high-throughput screening for T-cell receptor therapies (2021)



therapeutic antibody discovery (2019)



tailored machine learning solutions (2018)



laboratory automation systems (2017)



high-throughput, high-resolution functional imaging (2016)



computational genomics, statistics and visualisation (2014)



high-throughput analysis of cellular libraries (2011)



3D cell culture technology for predictive compound classification (2009)



cell therapies for the treatment of metabolic diseases (2022)



innovative xeno-nucleic acids (2021)



next-gen gene and cell therapies (2018)



immune-informatics for the discovery of therapeutic antibodies (2017)



education and services in blockchain technology (2016)



personal hardware devices to secure digital assets (2015)



antibody discovery and immune repertoire analysis (2012)



anti-bacterial drug discovery (2010)



high-frequency and ultra-high frequency instrumentation (2008)

D-BSSE Teaching

Investing in Next Generation Biosystems Scientists

Teaching is a cornerstone of the department's activities.

At D-BSSE, the interdisciplinary mindset in biology, engineering and computational science is mirrored in its teaching programmes.

D-BSSE offers two Master's programmes:

MSc Biotechnology

The MSc in Biotechnology is a two-year programme (120 credit points) with the objective of giving highly qualified students an excellent research-focused education in the crucial field of modern biotechnology and its biomedical and industrial applications. Find more information at **www.master-biotech.ethz.ch**.

MSc Computational Biology and Bioinformatics

The MSc in Computational Biology and Bioinformatics (CBB) is a two-year programme (120 credit points), offered in cooperation with the University of Basel and the University of Zurich. Students are trained in the development and application of computational methods for biological systems analysis. It includes practical course work in biology and computer science methods and their combination, and places particular emphasis on the systematic integration of experimental biology and data generation into computational approaches. Find more information at **www.cbb.ethz.ch**.



D-BSSE doctoral programmes:

Doctoral studies are an important pillar of the educational efforts at D-BSSE, as they represent the transition from learning to original scientific research. Departmental efforts are complemented by the Life Science Zurich Graduate School. Find more information at www.bsse.ethz.ch/doctorate.html.



"When I first joined the D-BSSE for my master thesis, my colleagues' quality and devotion to scientific research impressed me substantially. Now that I am a doctoral student, I am realising how communication between the different research groups fosters an interdisciplinary environment

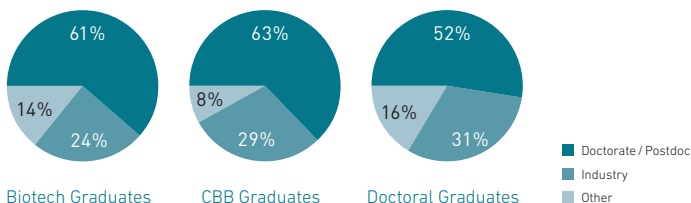
which strongly contributes to my scientific and personal development. In addition to that, the department offers excellent seminars and events from both academia and industry, which is helping me to find my personal career path."
Silvia Ronchi, doctoral student in Andreas Hierlemann's group.

"As an engineer inspired by the possibilities of designing and building DNA, I was attracted to the D-BSSE Master's programme, which includes comprehensive courses and great opportunities to conduct research. At the end of my studies, I was keen to become an entrepreneur for which I received invaluable support from D-BSSE, ieLab and the ETH Zurich Pioneer Fellowship."



Oskari Vinko, alumnus of the MSc Biotechnology programme and co-founder of the ETH spin-off UniteLabs AG.

Where do our graduates go after completing their studies at D-BSSE?



Department of Biosystems Science and Engineering

Interdisciplinary Research in Europe's Life Sciences Capital

The mission of the Department of Biosystems Science and Engineering (D-BSSE) is the understanding, rational design and programming of complex biological systems from the nanoscale up to whole organisms.

The department advances basic and applied biological sciences with the overall goal of translating its research into biomedical and industrial applications, and promoting the development of new processes and products in the biotech, pharmaceutical and chemical industries.

To maximise the impact of this ambitious endeavour, the department is located in Basel, the life sciences capital of Europe. In collaboration with partners from industry, hospitals and other academic institutions, the Basel location facilitates research applications in the emerging fields of precision medicine and personalised health, molecular systems engineering and data science. Education, research and entrepreneurship at D-BSSE in Basel strengthen collaboration in life sciences internationally and in the Zurich and Basel areas.



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Department of Biosystems
Science and Engineering**

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4056 Basel

