Neural Systems and Computation
A specialized Master’s program in which brain sciences meet technology

- How does the brain perform computation?
- How does computation support and give rise to behavior?
- How can we translate insights about neural systems into usable technologies?
A SPECIALIZED MASTER IN NEURAL SYSTEMS AND COMPUTATION
Understanding the principles underlying brain function and discovering how to develop artificial systems that use the same principles are key issues for the future success of medical sciences and for the development of artificial intelligent systems. Answering these questions requires expertise that extends across multiple academic disciplines. To approach these questions, researchers must work at the interface between physics and medical sciences, engineering and cognitive sciences, mathematics and computer science.

GOALS OF THE PROGRAM
The M.Sc. in Neural Systems and Computation (NSC) is an interdisciplinary program offered jointly by the University of Zurich and the ETH Zurich. The program provides trans-disciplinary knowledge, skills, and a mindset to prepare researchers for their first decade of independent research and development. Students have the opportunity to be trained and mentored in the following areas:

- Systems neuroscience and the current understanding of how neural architectures give rise to sensory, motor, and cognitive functions
- Neural computation and how theories of neural computation relate to the classical theory of computation and modern machine learning techniques
- Experimental techniques in neurobiology such as electrophysiology, optical imaging, and electron microscopy
- Physiological and computational principles of cognition, including mathematical models of brain diseases and decision making from measures of behavior and neuronal activity
- Theories, methods, and algorithms employed in the computational analysis of neurobiological data
- Theory and design principles for the construction of neuromorphic hardware and of systems that interact intelligently with the world

The training covers how to:

- Conduct independent scientific research and complete a research project
- Analyze, evaluate, and summarize scientific literature and write a research proposal
- Present scientific research results in talks and written reports targeted at specialist, trans-disciplinary, and general audiences

RESEARCH FOCUS
The main contributing institutes of the program are the Institute of Neuroinformatics, the Brain Research Institute, and the Institute of Biomedical Engineering:

The Institute of Neuroinformatics is concerned with discovering the key principles by which brains work and implementing these in artificial systems that interact intelligently with the real world. The institute hosts experts that investigate computational neuroscience, neuroanatomy, neural computation, neurotechnologies, neurorehabilitation, and neuromorphic engineering.

The Brain Research Institute focuses on basic research topics ranging from molecular and cellular processes to network functions in the nervous system. The four laboratories focus on neural circuit dynamics, neural plasticity, neuroepigenetics, and neural regeneration and repair.

The associated laboratories of the Institute of Biomedical Engineering focus on neurotechnologies and Translational Neuromodeling, a new field that investigates mathematical models of human cognition, decision making, and computational psychiatry.
REQUIREMENTS FOR ADMISSION

We offer a specialized full-time Master’s program open to students with a Bachelor’s degree in the following disciplines: neurosciences, information technology, electrical engineering, biology, physics, computer sciences, chemistry, mathematics, and mechanical/chemical/control engineering. Admission for students from other disciplines or Universities of Applied Sciences is possible, but the minimum average grade required is 5.0 (based on the Swiss Grading System), and admitted students will need to complete additional coursework in the fields of neuroscience, physics, computer science, engineering, or biology. To apply, written applications including application form, CV, motivation letter, transcript of academic records, and for non-Swiss students a financial statement have to be submitted by email to nsc@ini.uzh.ch, and will be evaluated by the admission committee on a case-by-case basis. All admission decisions are based on an interview with the applicant. Application deadlines are February 15th to apply for the Fall semester of the same year, and September 15th to apply for the Spring semester of the following year. Further details can be found on the program website: www.nsc.uzh.ch
PROGRAM OVERVIEW

Students must accumulate a total of 90 ECTS Credits within the recommended duration of 3 semesters (1.5 years). The language of the program is English. The program consists of a set of core modules, elective core modules, elective modules, and a Master’s thesis. Students are assigned to individual mentors who assist them in choosing core and elective modules that suit their backgrounds and goals. The Master’s thesis is mandatory and students have the option to reduce the duration of the thesis project in favor of two short research projects. The core modules provide a common foundation for students with different educational backgrounds. They include a practical education in instrumentation, measurement, and data analysis relevant to neuroinformatics as well as an opportunity to study, discuss, and report on a list of foundational research papers in neuroscience and computation. In addition, a journal club provides a forum for the analysis and evaluation of recently published high-profile research to maintain a state-of-art awareness of progress in the field. The set of elective core modules cover the following:

- Systems Neurosciences
- Neural Computation and Theoretical Neurosciences
- Neurotechnologies and Neuromorphic Engineering

Students must attend elective core modules from at least two of the three above listed disciplines. In addition, elective modules are chosen together with the mentor from the course catalog of the University of Zurich and ETH Zurich.
CAREER PROSPECTS

The NSC program is internationally recognized for providing excellent interdisciplinary and research-oriented education. It thus provides an excellent foundation for academic careers and careers in industrial research and development in neuroscience and related fields. Neuroscience is one of the fastest growing research disciplines, and graduates of NSC will have the skills and knowledge to succeed in fields such as computational and theoretical neuroscience, experimental neuroscience, cognitive neuroscience, computational psychiatry, neuromorphic engineering, neurotechnologies, neurorehabilitation, machine learning, and in clinical disciplines.

A JOINT M.SC. PROGRAM AT TWO LEADING INSTITUTIONS

The specialized M.Sc. program in Neural Systems and Computation is jointly offered by the Faculty of Science of the University of Zurich (UZH), and the Department of Information Technology and Electrical Engineering of ETH Zurich. Both universities consistently rank among the top universities in Europe and worldwide, and students have great freedom to choose their elective courses from a wide variety of courses offered by both institutions. The NSC program is unique in its focus on understanding computation in the brain, and developing technological applications that are grounded in these principles. The faculty associated with the NSC program consists of well-known experts in all relevant disciplines, ranging from experimental neuroscience to engineering. NSC attracts students from all over the world, and embeds them in an interdisciplinary environment, allowing close interaction with ongoing research.
INFORMATION ON THE NSC PROGRAM

For general questions regarding the program
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NSC PARTNER INSTITUTES

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Program website
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