University of Basel

Faculty of Science

Degree Profile

Master in Nanosciences

Organizational Unit	Swiss Nanoscience Institute (SNI)
Degree	MSc in Nanosciences
Range, Duration, Start	90 ECTS, 3 semesters (if full-time), autumn or spring semester
Language of Instruction	English

Program Goals

Students develop advanced scientific knowledge of current nanoscience fields and one of four subject areas (molecular biology, chemistry, medical nanoscience or physics). They also learn to take an interdisciplinary approach to current research questions.

Program Characteristics

Orientation	Scientific, research-oriented education
Majors	–
Program Structure	The curriculum consists of the following modules: Specialization module of student's choice in chemistry, molecular biology, physics or medical nanosciences (16 ECTS); two projects in different disciplines (20 ECTS); master's examination (10 ECTS); master's thesis (30 ECTS) and electives (14 ECTS).
Distinctive Features	Switzerland's only degree program in nanosciences is offered at the University of Basel by the Swiss Nanoscience Institute (SNI), which has an outstanding national and international network. The University of Basel was also the location of the former National Center of Competence in Research in Nanoscale Science (NCCR-Nano). The program offers students a research-oriented and practical education; this is made possible by its teaching staff, who are engaged in research, and its collaborations with various research groups in the fields of physics, chemistry, biology and biomedicine, the Paul Scherrer Institute, and the University of Applied Sciences and Arts Northwestern Switzerland (FHNW). Insights into the research activities of various disciplines teach students about the different areas in which nanosciences can be applied. Students can design a program that aligns with their interests by choosing to specialize in molecular biology, chemistry, medical nanosciences or physics.

Career Opportunities

Employment	Basic research at higher education institutions, research institutes or in industry, applied research in high-tech industry, chemical and pharmaceutical companies, teaching, consultancy firms and banks
Further Studies	Doctorate

Teaching

Approaches	Theory- and research-oriented learning, task-based learning, project work
Assessments	Oral and written examinations, master's thesis, master's examination

Competences

Generic Attitude / Communication Approach / Management	Students acquire the skills to … – develop hypotheses and experiments using suitable approaches and methods, both independently and in groups. – design their own questions and research. – carry out research projects independently, from the idea through to communication. – defend their results from criticism and critically reflect on the interpretation of their results. – develop new interdisciplinary and methodological approaches quickly and independently. – interact and work with a research team respectfully and responsibly. – critically evaluate scientific literature. – apply high standards of professional expertise, integrity, autonomy and self-management to their research activities. – evaluate research work critically and constructively through peer reviews. – write scientific research reports, reviews and project proposals in English. – determine, analyze and interpret data from independent scientific studies, incorporating computer-aided analyses. – present and discuss scientific results in oral and written form before specialist and public audiences using the terminology of the relevant subject area.
Subject-related Knowledge / Understanding Application / Judgment Interdisciplinarity	Students acquire the skills to … – deepen their theoretical knowledge of their chosen field (chemistry, molecular biology, medical nanosciences, physics). – carry out their own research projects focusing on a defined problem within nanoscience research. – select, collate, critically analyze and evaluate relevant research literature within nanosciences. – work with scientists from the fields of molecular biology, chemistry, medical nanosciences and physics, across disciplines and with a specific goal in mind. – integrate new developments in molecular biology, chemistry, medical nanosciences and physics into experimental research approaches. – apply selected subject-specific methods and techniques. – analyze nanoscience problems, develop solution proposals and identify solution strategies. – further develop and document standards for good laboratory practice. – solve complex nanoscience questions and problems based on sound methodological practice as part of their research work. – follow current trends in nanoscience research at higher education institutions and in industry. *Molecular biology* – understand and apply advanced scientific concepts within molecular biology. – describe simple and complex biological systems qualitatively and quantitatively. *Chemistry* – be aware of the latest theories, phenomena and complex concepts within chemistry. – recognize specialized theoretical and practical questions from various fields of chemistry. *Physics* – mathematically formulate physics questions and find suitable theoretical models and approaches. – plan physics experiments, execute them independently and document them. *Medical nanosciences* – understand and apply the principle of nano-bio interaction. – be aware of current problems in nanomedicine in connection with clinical implementation.

Learning Outcomes

Graduates of the master's program in Nanosciences...

- have an in-depth and nuanced understanding of complex nanoscience concepts, phenomena, theories and developments in molecular biology, chemistry, medical nanosciences and physics, are able to describe them in accordance with the current state of the science, and can apply this knowledge to existing interdisciplinary research approaches, laboratory techniques and analysis methods correctly and with specific goals in mind.
- are familiar with new and established nanoscience research approaches and with experimental research methods and laboratory techniques and are able to apply them appropriately and develop them continuously in order to formulate scientific hypotheses precisely and effectively.
- are able to investigate complex questions in independent research work that is methodologically sound and performed correctly and in collaboration with peers and scientists from related disciplines, and can communicate the results to a scientific audience clearly and concisely in written and oral form.
- are able to use their skills to evaluate the research work of others sympathetically and critically, deal with criticism constructively, and foster professional, respectful and responsible scientific discourse within the nanosciences.

Molecular biology

- independently select suitable advanced techniques and scientific concepts from molecular biology and are thus able to systematically develop a scientific hypothesis and test this using experimental methods.
- understand evolutionary mechanisms on a molecular and organismal level as the fundamental basis of biological diversity and are able to apply this knowledge appropriately and correctly.

Chemistry

- have in-depth knowledge of complex chemistry concepts, phenomena and theories in accordance with the current state of the science and can apply this knowledge appropriately to differentiate between and classify interdisciplinary research approaches, laboratory techniques and analysis methods.
- know about established and current subject-specific research approaches and experimental research methods and can use them to formulate and analyze relevant questions and precisely apply scientific hypotheses.

Physics

- can use their in-depth, nuanced knowledge of physics concepts, phenomena and theories to correctly classify physics as it interlinks with biology, chemistry and other scientific fields.
- are able to devise and conduct physics experiments independently, correctly record and analyze the results and data acquired and critically interrogate them by engaging intensively with specialist literature.

Medical nanosciences

- have the knowledge and abilities to plan and appropriately conduct a basic or applied research project within the vast field of biomedicine through experimental work and data analysis.
- understand the ethical aspects and considerations associated with research involving human subjects and are therefore able to reflect on their duties and responsibilities during their scientific practice.