

ETH zürich

Major in Biogeochemistry and Pollutant Dynamics

Master in Environmental Sciences

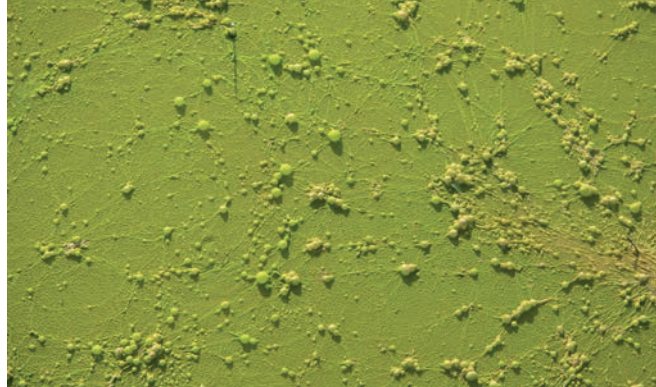


The scientific field

Biogeochemistry is an interdisciplinary science of physical, chemical and (micro)biological processes controlling the regional and global cycles of elements and their compounds. Biogeochemists analyse the functioning of natural aquatic, terrestrial, atmospheric and environmental systems as well as the responses of these environmental systems to impacts resulting from greenhouse gas emissions, nutrient loads and accelerated cycles of metals and organic substances.

Quantifying present and future methane emission rates to the atmosphere from wetlands, man-made reservoirs and coastal sediments is just one example where ETH scientists from biogeochemistry work together with colleagues from atmospheric, earth and plant sciences.

In the coming years this branch of science will advance on different scales: satellite remote sensing and coupled models will facilitate the identification of global trends. Micro-scale analysis with chemical sensors and X-ray spectroscopy open up the possibility of studying complex systems such as living biofilms and plant roots. The advances of molecular



Martin Ackermann
Professor of Molekular Microbial Ecology

“Our students learn about the ‘metabolism of the planet’ – for example how the activities of individual microbes scale up to give rise to the cycling of the elements on earth.”



Flora Conte
Environmental Consultant at Carbotech AG

“By studying Biogeochemistry and Pollutant Dynamics, I developed a larger and systemic understanding of the environment. This allows me to work in a very diverse set of projects.”

biology allow the precise identification of active microorganisms involved in processes like methane production and oxidation.

Pollutant dynamics is the key word for the analysis of the distribution and transformation and the effects of anthropogenic compounds. This integrative science follows an agenda to predict the pathways and the fate of organic and inorganic pollutants in environmental systems, quantify their biogeochemical transformations and assess their effects on terrestrial and aquatic life.

Scientists in this field are confronted with a huge number of organic compounds that are in commercial use. Studying the physical-chemical partitioning of compound groups allows the prediction of their transfer between different environmental systems. Integrative field studies based on trace analyses, stable isotope techniques and transport measurements help to identify the relevant transformation pathways. The development of smart test systems such as cell cultures for assessing the effects of pollutants is another active field of research.

We offer

We offer a four-semester programme which aims at:

- deepening the understanding of chemical, physical and microbial processes
- applying this knowledge to develop more sustainable solutions for critical environmental problems
- developing laboratory skills via hands-on experience with advanced analysis techniques such as isotope mass spectrometry, molecular biology or numerical modelling

Your career

We educate outstanding young scientists for careers in academia, public administration and the private sector. The range of positions of our graduates is diverse and goes from experts in the environmental consultancy and risk modelling in the insurance business to scientists working at academic institutions and universities. Graduates of our MSc programme hold leading positions in companies such as geological survey or engineering offices, in the re-insurance and financial sectors, or in business and policy consulting. Others work as project managers or teachers in a wide variety of positions in the private sector and public administration. Finally, many of our graduates successfully pursue an academic career.

Part of the MSc in Environmental Science

The Major in Biogeochemistry and pollutant dynamics is a specialisation of the MSc programme in Environmental Sciences. Environmental sciences are first and foremost natural sciences, but they have numerous links to the humanities, social sciences and engineering. Your profile will be similar to that of other graduates in physics, chemistry or biology – with added scope for thinking and acting in an interdisciplinary way, analysing complex systems and processes and developing concrete solutions to specific environmental problems. In short, environmental sciences are ideal for those with a wide range of interests and an ability to see the bigger picture.

“At IBP we strive for a better mechanistic understanding of Earth’s elemental cycles by investigating the physical, chemical, and biological processes that determine the production, transformation, and flux of chemical compounds within and between global reservoirs.”



Mark Lever

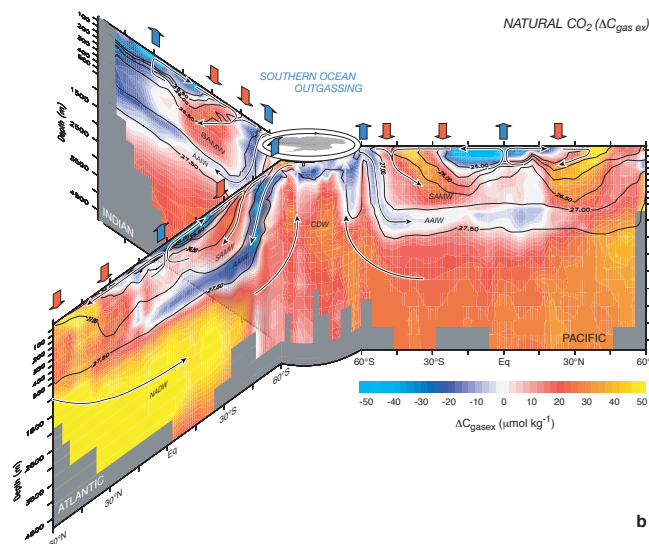
Professor for Environmental Microbiology

“The Major in Biogeochemistry and Pollutant Dynamics was a sound foundation for my present-day management of interdisciplinary projects such as international water and wastewater infrastructure projects.”



Tim Kempter

Project Manager Water & Wastewater, EBP Schweiz AG



Major in Biogeochemistry and Pollutant Dynamics – structure

The major in Biogeochemistry and Pollutant Dynamics is composed of 120 ECTS credits, of which 40 are devoted to the core of the major, 30 for an internship, 30 for the Master's thesis and 20 for elective courses and/or minors in Environmental Sciences.

The core of the major in Biogeochemistry and Pollutant Dynamics is structured in biogeochemical processes, applications, analytical laboratory courses, modelling courses, term paper and seminar series and elective courses.

Biogeochemical processes (five courses with three ECTS credits each)

The processes module offers the choice of a series of lectures with assignments run by experts in environmental physics, chemistry and microbiology. The credits are obtained by means of written examinations.

Applications (two courses with three ECTS credits each)

The applications consist of topical courses with strong student interaction. The goal is to develop solutions for relevant problems such as limiting chemical risks, securing water resources, managing conventional and radioactive waste and limiting non-point source pollution.



“Our students are exposed to theoretical and practical aspects of environmental measurements – they learn how to deploy sensor networks and acquire information from natural systems. Students are challenged to link theory with measurements and make inferences relevant to the real world.”



Dani Or
Professor for Soil and Terrestrial
Environmental Physics

“My studies in Biogeochemistry and Pollutant Dynamics formed the perfect basis for a career in climate change and sustainability. They provided me with a sound understanding of the scientific background of my work. And strengthened my ability to analyse and understand complex systems quickly and thoroughly.”



Florian Heeb
Director Consultancy &
Services, south pole group

Analytical laboratory courses (four courses with three ECTS credits each)

The analytical laboratory courses are organised as half-semester courses covering topics such as advanced organic and inorganic trace analysis, isotope tracer methods and molecular ecotoxicology. A block course during the semester break offers access to the synchrotron facility at the Paul Scherrer Institute.

Modelling courses (three ECTS credits)

These courses aim at an integral understanding of biogeochemical transformation and transport processes with the emphasis on conceptual thinking, risk assessment, uncertainty analysis and the critical evaluation of modelling results.

Term paper and seminar (seven ECTS credits)

All students write a term paper on a challenging biogeochemical topic and present their results in a seminar. The seminar provides a forum for intellectual exchange among the student group.



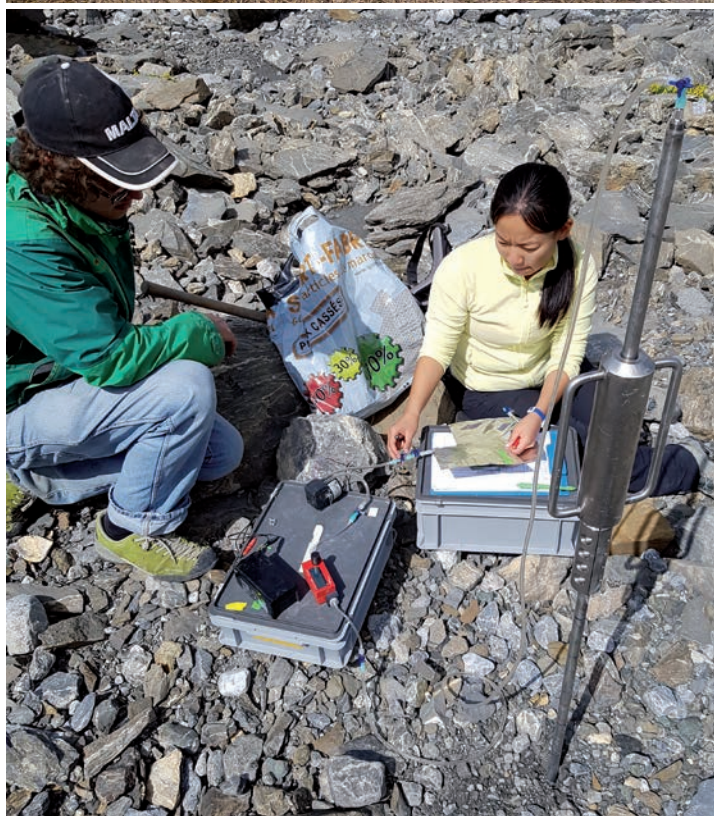
Lenny Winkel
 Professor for Inorganic
 Environmental
 Geochemistry

“Biogeochemical cycles of major and trace elements are of key importance to sustain life on our planet. Understanding these cycles and predicting how they change in a changing world is a complex and multifaceted process. In our program you will learn the essential tools and skills to tackle the environmental challenges that our society faces now and in the future.”



Lona Mosberger
 ZHAW, Research Assistant

“My studies in Biogeochemistry and Pollutant Dynamics have made me see organic waste and sewage as a valuable resource. They have qualified me to carry out research projects about the material and energetic use of those resources.”



Electives (20 ECTS credits)

Students can broaden and deepen their training by enrolling in courses across all departments at the ETH Zurich. For the major in Biogeochemistry and Pollutant Dynamics, the following courses are recommended: Biological Processes for Waste Treatments, Organic Geochemistry and the Global Carbon Cycle and Limnogeology.

Internship (30 ECTS credits)

The internship in a governmental agency, a consultancy, conservation or health organisation or other professional environment outside of academia provides valuable insight into potential careers and enables the students to gain work experience.

Master’s thesis (30 ECTS credits)

The Master’s thesis is an opportunity for students to apply their scientific knowledge to a six-month research project in their preferred field of science.

Faculty

The teaching staff includes experts from soil and aquatic sciences with research interests in environmental chemistry, physics and microbiology. In their research they strive to advance biogeochemical science and at the same time to develop solutions for real-world problems like the arsenic pollution in Asia, eutrophication in African surface waters, and the CO2 increase in the atmosphere.



Studying at ETH Zurich

Study programmes at ETH Zurich are intensive and demanding. Nevertheless, students find time to enjoy an active student life.

Get involved

Many students are involved in the Environmental and Forestry Studies Association (UFO) (www.ufo.ethz.ch) or the Association of Students at ETH (VSETH) (www.vseth.ethz.ch). As a member, you can contribute actively to the development of academic life.

Balancing your studies

The Academic Sports Association Zurich (ASVZ), one of the biggest sport associations in Europe, provides ETH students with a choice of more than 70 different sports, taught by 600 instructors. Students registered for academic studies are entitled to participate in the vast majority of these: see www.asvz.ch



Living in Zurich

Zurich is a fascinating city, offering a high quality of life and diverse recreational and cultural activities. Its proximity to lakes and mountains makes it a popular spot for water sports and alpine leisure activities.

Zurich is beautiful, but expensive. The approximate monthly fixed costs for a single person are at least CHF 1790. Personal expenses such as clothes, telephone calls, leisure activities etc. are not included in this amount. You may well spend CHF 2000 a month without living in the lap of luxury.

Accommodation

Several partner institutions of ETH Zurich and the University of Zurich rent out rooms in shared flats and studios:





- 1 ETH Zurich has built student houses on the Hönggerberg campus with rooms, studios and flats for 900 students: see www.livingscience.ch and www.studentvillage.ch
- 2 ETH Zurich provides a limited number of furnished single rooms for international Master's (MSc) and exchange students. These rooms can only be rented for one or two semesters: International Student Support, international@sts.ethz.ch
- 3 The Housing Office of the University of Zurich and ETH Zurich provides an index on privately run student residences in the "Wohnbulletin": see www.wohnen.ethz.ch/en.
- 4 The Student Housing Cooperative (Woko) rents out 2000 furnished rooms in student residences, student houses or flats throughout the city: see www.woko.ch/en
- 5 On the following websites you can check out other student accommodation ads and create your own room request for free: www.marktplatz.ethz.ch, www.wgzimmer.ch

Further information:

Institute of Biogeochemistry and Pollutant Dynamics, ETH Zurich
 Prof. Dr. Martin Ackermann, CHN H70.3,
 Universitaetsstrasse 16, 8092 Zurich
 Phone +41 58 765 51 22
martin.ackermann@env.ethz.ch
www.ibp.ethz.ch

ETH Zurich:

International Student Support
 HG F 22.3, Raemistrasse 101, 8092 Zurich
 Phone +41 44 632 20 95
international@sts.ethz.ch, www.ethz.ch

Admissions Office: master@ethz.ch

Financial Aid Office (scholarship):
studienfinanzierung@sts.ethz.ch

Zurich Tourist Office:

www.zuerich.com

Contact

ETH Zurich
Department of Environmental Systems Science (D-USYS)
Administration Office for Master Students
Universitaetstrasse 16
CH-8092 Zurich
env_master@usys.ethz.ch
Phone +41 44 632 58 90

www.usys.ethz.ch

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