



UMEÅ UNIVERSITY
FACULTY OF SCIENCE & TECHNOLOGY

Knowledge and ideas lead to success

THE SUCCESS OF A FACULTY is completely dependent on its staff and their knowledge, skills and ideas.

One of the major challenges lies in recruiting qualified employees who are able to carry out competitive research, education and collaboration of the highest class. Our activities will also be characterized by well-developed and effective support functions and access to good infrastructure. Our staff and students must have the best conditions for research, teaching and studies, which leads to our research gaining national and international attention and that the students after completing their education are attractive in the

labor market. Today the faculty is successful and we strive to continuously improve.

IN THIS BROCHURE we present some examples of the research and education at our faculty; with both width and depth. We hope it will be a source of inspiration for all those who are passionate about research and higher education and show that Umeå University and the Faculty of Science and Technology are a choice for the future!

MIKAEL ELOFSSON, DEAN

SARA SJÖSTEDT DE LUNA, PRO DEAN



SHORT FACTS ABOUT THE FACULTY

STUDENTS: 3 200

STAFF: 1 000

DOCTORAL STUDENTS: 240

Departments:

- Applied Physics and Electronics
- Chemistry
- Computing science
- Ecology and Environmental Science
- Mathematics and Mathematical statistics
- Molecular Biology
- Physics
- Plant Physiology
- Science and Mathematics Education
- Umeå Institute of Design
- Umeå School of Architecture

Research centres and work units:

- Centre for Biomedical Engineering and Physics – CMTF
- Centre for sustainable cement and quicklime production – CHECK
- Climate Impacts Research Centre – CIRC
- European CBRNE centre
- High Performance Computing Centre North – HPC2N
- Industrial Doctoral School for Research and Innovation
- Umeå Marine Research Centre – UMF
- Umeå Mathematics Education Research Centre – UFM
- Umeå Plant Science Centre– UPSC



Highly ranked education

SEVEN DEPARTMENTS COMPRISE the faculty's research and education. The faculty of Science and Technology at Umeå University has 3 200 students and around 240 doctoral students. Collaboration between departments and close proximity to the University hospital and the Swedish University of Agricultural Sciences, SLU, builds a strong basis for creative research and education. Many internationally renowned researchers have made a career with us. For example, the research in plant biology conducted at Umeå Plant Science Centre, UPSC, is world leading. In 2020 Emmanuelle Charpentier was awarded the Nobel Prize in Chemistry for the discovery of the genetic scissors Crispr-Cas9, which she did while working at Umeå university.

THE FACULTY'S EDUCATION programmes are characterized by proximity to research, quality pedagogy and a relaxed atmosphere. In addition to a preparatory one year course in science we offer 23 programmes for future engineers, industrial designers, architects, scientists and pharmacutists. The five-year engineering programme in technical chemistry is the latest addition.

A Bachelor's exam can be followed up with a Master's exam in everything from architecture to plant and forest biotechnology. The faculty has a long experience in offering education in other cities and as online courses. Both the Bachelor's and Master's programmes in pharmacy has been given the highest appraisal in evaluations by the Swedish Higher Education Authority. These programmes are both offered as online education. The faculty is actively providing the students insight into their future professions



in order to increase their opportunities for employment after graduation. For example some courses are given in collaboration with companies and industries, guest lectures are frequent as well as thesis projects carried out together with industrial partners. In some of the engineering programmes this is organized through Co-op, Cooperative Education, where regional companies offer students an internship during their entire education.

THE ART'S CAMPUS by Umeå River hosts Umeå Institute of Design and Umeå School of Architecture. Our industrial design education is ranked among the best in the world, a fact

– close to strong research



constantly proved by the students who time after time win prestigious prizes in international design competitions. The School of Architecture is the only architectural education in Sweden built on artistic grounds.

Several education programmes, mainly master's programmes are taught in English. A Bachelor's programme in Life Science is also taught in English. We receive about 280 foreign students yearly and about 80 of our own students study abroad for a term or a year. Evaluations through the International Student Barometer shows that the foreign students thrive very well at our university.

Sweden's fifth largest university

- Umeå University is Sweden's fifth largest university and has over 36 000 students. It was founded in 1965.
- The main campus comprises the four faculties of science and technology, humanities, medicine, social sciences and Umeå School of Education.
- Close to the main campus are two important partners, The University hospital of Umeå and The Swedish University of Agricultural Sciences.
- Umeå municipality has around 126 000 inhabitants and is a bicycle-friendly city.
- Umeå has 5 000 birches.



OUR EDUCATION PROGRAMMES

• Foundation year programme

Bachelor of Science programmes (180 ECTS)

- Biology and Earth Science
- Computer Science
- Environmental Health
- Industrial Design
- Life Science (in English)
- Mathematics

Bachelor of Science programmes in Engineering (180 ECTS)

- Civil Engineering
- Electronic- and Computer Engineering
- Electrical Power Engineering (online)
- Energy Engineering
- Mechanical Engineering

Master of Science programmes in Engineering (300 ECTS)

- Computing Science and Engineering
- Energy Engineering
- Engineering Biotechnology
- Engineering, Common Entrance
- Engineering and Management
- Engineering Physics
- Interaction Technology and Design Engineering
- Technical Chemistry Engineering (online)

Pharmacy

- Bachelor of Science programme in Pharmacy (180 ECTS, online)
- Master of Science programme in Pharmacy (300 ECTS, online)

Architectural programme (300 ECTS)

Master of Science programmes in English (120 ECTS)

- Advanced Product Design
- Architecture and Urban Design
- Artificial Intelligence
- Chemistry
- Computational Science and Engineering
- Computing Science
- Earth Science
- Ecology
- Environmental Science with focus on sustainable development
- Interaction Design
- Mathematics
- Mathematical Statistics
- Molecular Biology
- Physics
- Plant and Forest Biotechnology
- Robotics and Control
- Transportation Design

POWERFUL RESEARCH

- from climate to artificial intelligence

New knowledge is the key to managing the major challenges we face in today's society. Our faculty's research covers a broad field from chemistry, biology, physics, computing science and mathematics to didactics, design and architecture. Our ten largest research areas are described on the following pages.

One strategic area of research is **the effects of climate and environmental changes** on Arctic and Alpine ecosystems. The Climate Impacts Research Centre, CIRC, serves as a scientific platform for research, teaching and outreach activities in Abisko in Northern Sweden and has a key role in Umeå University's activities in the Arctic.

Another area we focus on is **artificial intelligence, AI**. The development to a society where AI deeply influences work, education and people's lives has so far only taken a few initial steps. We are now focusing on strengthening the university's role on this journey. This includes intensifying our research in system development - machine learning and so-called explainable AI. We also want to be a driving force in the development of using AI in a wise way and about regulations that handle how AI can be used.



Environmental Science

Environmental science plays a prominent role at our faculty. The research covers a broad range of fields, e.g. plant ecology, environmental biogeochemistry, integrated structural biology, molecular geochemistry, environmental organic and inorganic chemistry, oceanography, hydrology, ligno-cellulosic biopolymers, aquatic and riverine ecosystems, and water resources.

Evolutionary Biology with Genomics

This field comprises plant cell and molecular biology, including photosynthesis and metabolism, developmental biology, and genomics approaches to understand how genomes function to enable plants and organisms to perceive, respond, adapt and survive in response to fluctuating external environmental conditions. A major aim is to link genomic variation to biological function.



Material Science

The field of material science comprises the development of novel types of materials, e.g. carbon-based nanostructures and organic electronics for new types of applications, functional materials for natural and artificial photosynthesis, and catalytic and ionic materials that have the potential to replace fossil fuels. It also includes simulations of material properties e.g. critical phenomena.

Mathematics, Computer Science and Networks

This field encompasses, but is not limited to, computational and applied mathematics, mainly based on partial differential equations, discrete mathematics, parallel and scientific computing in multicore architectures, network sciences, to address concepts such as autonomous management in distributed systems, and mathematical statistics for analysis of random phenomena.

Microbiology with Metabolomics and Chemometry

The research performed in this field comprises, but is not limited to, plant cell and molecular biology, in particular for studies of photosynthesis and metabolism in plants, metabolomics, chemometrics, anti-infective drug therapies, and natural and artificial photosynthesis.

Didactics of Mathematics and Natural Science

The research performed at Umeå School of Education is focused on didactics of mathematics and the natural sciences, mainly focused on aspects related to identification, characterization, and understanding phenomena and processes involved in teaching and learning.

Theoretical Plasma and Space Plasma Physics

The research in this field is mainly focused on plasma physics, targeting high plasma densities and high power light matter interactions, aiming for new applications of particle acceleration and magnetospheric physics. It also comprises space plasma physics for studies of processes in the Earth's magnetosphere and the coupled solar wind-magnetosphere-ionosphere system.

Artificial Intelligence, Automation and Digital Systems

The activity in this field embraces artificial intelligence, in particular related to human-centered computing, automata, grammars and language, including its societal, ethical and cultural consequences. It also comprises industrial robotics and control systems, autonomous management in distributed systems, network sciences and complex system.

Structural Biology with Organic Synthesis

This area includes both research aimed at finding new ways to understand and treat infectious diseases and amyloid formation and addressing marine microorganisms that have adapted to extreme conditions with regard to, e.g., temperature and light variations. The research is carried out with a number of modern techniques, including unique force measurement instrumentation based on optical tweezers.

Architecture and Design

The research performed in this field comprises of a broad spectrum of topics included the design and functions of cities, buildings, systems, services and digital products. The research is connected to a practice-driven approach oriented towards envisioning and materializing alternatives for the future.



Research in energy and marine ecosystems – on behalf of the Swedish government

The Government has given Umeå University the main responsibility for National strategic research initiatives in the areas energy and marine ecosystems:

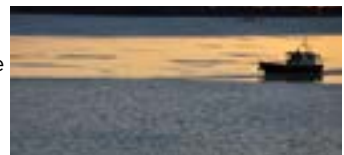
Bio4Energy

Bio4Energy is a strategic research programme within bioenergy and biorefinery. The research environment includes Umeå University, SLU in Umeå, Luleå University of Technology, research institutes, and many industrial partners.



Ecochange

The strategic research programme EcoChange focuses on the effects of climate change on marine ecosystems. Collaboration between several universities enables unique possibilities to perform holistic syntheses of the effects in the Baltic Sea. The research includes different thematic areas, with the Baltic Sea ecosystem as a common denominator.



Important infrastructures for successful research

To conduct successful research, access to state-of-the-art research infrastructure is required. A number of local and regional research infrastructures are available at the faculty's departments. In some cases they are organized in centres, such as at the Chemical Biological Centre (KBC). Some of these infrastructures are:



High Performance Computing Center North (HPC2N)

HPC2N forms a competence network for high performance and parallel computing, grid and cloud computing, scientific visualization and virtual reality (VR), as well as effective mass-storage solutions, in Northern Sweden.



Laboratories for Chemical Biology Umeå (LCBU)

LCBU is a node in the national infrastructure Chemical Biology Consortium Sweden (CBCS), which is part of Science for Life Laboratories. LCBU / CBCS provides infrastructure and personnel for studies of chemical biology with a focus on screening of small organic molecules.



Nuclear Magnetic Resonance (NMR)

The NMR Core Facility is based on several spectrometers (360-850 MHz) providing support for analysis of different types of biological samples. Our instrument is equipped to perform most types of NMR analysis, both in solution and in solid phase. The infrastructure is part of the national network NMR for Life.



Swedish Metabolomics Centre (SMC)

SMC is a national infrastructure that is shared between Umeå University and the Swedish University of Agricultural Sciences, SLU. The centre offers an important infrastructure for researchers who are active in different areas of molecular medicine. Since 2016, SMC is a satellite under Science for Life Laboratory.



Umeå Marine Sciences Centre (UMF)

UMF supports marine research and education and performs environmental analysis for Swedish environmental monitoring. They also disseminate information on research and environmental status in the sea, with particular focus on the Gulf of Bothnia.



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