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Welcome to the Faculty of Science at Lund University

In your hands is a publication that shows a few examples from the broad range of education and research at the Faculty of Science, Lund University. With our ten departments and other units we cover all the major academic fields in science.

For students, the Faculty of Science offers lots of study options, at both Bachelor’s and Master’s level. We have exchange agreements with many universities around the world and you are bound to find something to suit you.

Already a doctoral student or researcher? I am convinced that there is something for you too if you are passionate about science!

We have outstanding research groups in many different fields and this brochure aims to give you some examples of the research conducted at our faculty.

We hope to see you at the Faculty of Science!

Olov Sterner, dean
Lund University was founded in 1666. Today, the University is ranked as one of the world’s top 100 and is Sweden’s most international higher education institution. The University has 41,000 students and 7,500 staff based in Lund, Helsingborg and Malmö. We are united in our efforts to understand, explain and improve our world and the human condition.

Lund is Sweden’s most attractive study destination. The University offers one of the broadest ranges of programmes and courses in Scandinavia, based on cross-disciplinary and cutting-edge research. A degree from Lund University is a hallmark of quality both in Sweden and abroad. The compact university campus encourages networking and creates the conditions for scientific breakthroughs and innovations.

Lund is in a period of rapid development. We are intensifying our work to provide answers to the major questions and challenges facing mankind. ESS is under construction and MAX IV, which opened in 2016, is in use for researchers from all over the world. These research facilities will change our view of the world and the world’s view of us.
The Faculty of Science

Science at Lund University is characterised by high quality education and first-class research within all major scientific fields.

The wide spectrum of research, with several world-leading research groups, serves as a platform for outstanding higher education and much of the teaching is carried out in the laboratories connected to the research front line. Our lecturers are all recruited from among the active researchers, and our students are therefore particularly well trained in scientific methods.

For students who want to contribute to sound and sustainable development, studying science at Lund University is an excellent choice. An education in science is also a gateway to a great number of R&D companies and science parks within the surrounding Copenhagen-Malmö region – a hub for high-tech companies and research organisations, especially within pharmaceuticals/biotechnology, IT/telecommunications, food and the environment. The Copenhagen-Malmö region is at the forefront in Europe within these areas.

There are 900 employees and 3 600 students at the Faculty of Science. The Faculty is highly ranked both in Sweden and internationally for the quality of its research and education.

RANKING
For many of the subject areas at the Faculty of Science, Lund University is ranked among the top 100 in the world. You can find more information and current ranking statistics at: www.lunduniversity.lu.se/ranking
Departments and other units at the Faculty of Science

The Faculty of Science is organised into ten departments and other units, located towards the north of the university campus in Lund.

- Department of Astronomy and Theoretical Physics
- Department of Biology
- Department of Chemistry
  Shared with Faculty of Engineering
- Centre for Environmental and Climate research
- Department of Geology
- Centre for Mathematical Sciences
  Shared with Faculty of Engineering
- Department of Physical Geography and Ecosystem Science
- Department of Physics
  Shared with Faculty of Engineering
- Department of Medical Radiation Physics
  Shared with Faculty of Medicine
- MAX Faculty of Science
  – Research divisions at the MAX IV Laboratory

MORE INFORMATION
For links to the department websites go to:
www.science.lu.se/departments
Education offered in English

There are a number of different opportunities for international students to study science at Lund University. You can study part of your degree here as an exchange student or choose one of our degree programmes.

SUBJECT AREAS
We offer education in English within these subject areas:

• Astrophysics

• Biology

• Bioinformatics

• Molecular biology
  General molecular biology, medical biology, microbiology, molecular genetics and biotechnology.

• Chemistry
  Analytical chemistry, biochemistry, chemical physics, inorganic chemistry, molecular biophysics, organic chemistry, physical chemistry, theoretical chemistry.

• Geology
  Petrology, geochronology, palaeoclimatology, glacial geology, palaeontology, sedimentology, marine geology.

• Mathematics
  Pure mathematics, applied mathematics, mathematical statistics, numerical analysis.

• Physical geography, ecosystem analysis and geographic information systems

• Physics
  General physics, materials science, particle physics, theoretical physics, biological physics and computational biology, photonics, nanophysics.

• Synchrotron radiation based science
**PROGRAMMES AND COURSES**
If you want to study for a degree, we offer both Bachelor’s and Master’s programmes taught in English. A complete list of our degree programmes and courses can be found at: www.lunduniversity.lu.se

**EXCHANGE STUDIES**
If your university has an exchange agreement with Lund University, you can study part of your degree here as an exchange student. You may study our Master’s courses even if you are currently studying at Bachelor’s level, as long as you meet the admission requirements.

**HOW TO APPLY**
Apply to programmes and courses at: www.universityadmissions.se

For more information and admission requirements please visit: www.lunduniversity.lu.se

**Exchange students**
Please contact the International Office or international coordinator at your home university for instructions on how to apply for exchange studies.

For more information about exchange studies please visit: www.lunduniversity.lu.se/exchange
What students say

Riccardo Biella (Italy)
Bachelor’s programme, Physical Geography and Ecosystem Analysis

“Physical geography is the study of the relations of the processes and patterns in the various spheres that compose nature and, as such, has a very holistic vision that I love. The teachers are at close reach for everyone and they are glad to help you out.

Lund is an amazing city in its diversity and it embodies the idea of a college town, built around the students and their needs.”

Haomiao Zhai (China)
Master’s programme, Mathematical Statistics

“The curriculum is comprehensive and coherent. I also find that the teachers and assistants are very responsive to our questions. The student service is excellent. There are, for example, welcome weeks arranged to help us adapt to the new life in Sweden.

In my spare time I go to student nations, which are social clubs for students, and I think it’s amazing. I’ve made a lot of friends there.”

Kheyti Lopes (Brazil)
Exchange studies, Chemistry

“I really love doing science! My studies have covered many interesting areas and I’ve found them rewarding.

I think that Lund University is one of the best universities in the world. I am grateful that I’ve had the opportunity to study here as an exchange student.

My time in Sweden has been a great cultural and intellectual experience.”
Examples of our research

On the following pages we present a few examples from the faculty’s extensive research. Our intention is not to give a complete picture, but rather a few tasters that show our broad scope.
Bright prospects for international collaborations

Two major research facilities being built in Lund offer fantastic prospects for new discoveries, international collaborations and education.

The MAX IV synchrotron radiation source produces x-rays of world-leading quality that can be used to study many different types of sample. Examples include nano-structures, proteins, solar cells, fossils, cellulose and materials for catalysts. The high quality of the x-ray light makes it possible to see more detail and carry out new types of experiments that have not been possible before. There is also a short pulse facility at the MAX IV, where short flashes of light are produced to, for example, follow chemical reactions with a very high temporal resolution.

At ESS, it is instead beams of neutrons that will be used to study samples from many different fields, for example plastics, medicines or magnetic materials for data storage. The technology that will be used at ESS will make the facility the best in the world at producing neutrons for research. Since neutrons and synchrotron radiation have different properties, ESS and MAX IV complement each other. It will be possible to study different types of samples, or the same samples in multiple ways, for example at different scales. The close proximity between MAX IV and ESS is therefore a further advantage.
Our changing climate

At the Faculty of Science, state-of-the-art climate change research is carried out. Researchers from various disciplines work from different perspectives to produce models and scenarios of how the climate could change. They also study how we can best adapt to, and mitigate, climate change.

Lund University is an important partner in the ICOS Research Infrastructure; it hosts both the ICOS Sweden national network of observations and the ICOS Carbon Portal. ICOS has a network of more than 120 measurement stations, of which 10 in Sweden, for observations of the exchange of greenhouse gases between ecosystems and the atmosphere, and atmospheric concentrations. The stations gather data at various terrestrial and oceanic field sites, including several tall towers for atmospheric studies. All ICOS data is openly available at the Carbon Portal. With help of models, the data can be used for example to produce maps of how Europe’s greenhouse gas budget varies between regions and over time, from large scale to small scale. This type of information is important for politicians and decision makers, for example for evaluation of the progress on COP21 agreements on climate change mitigation, as well as helpful for scientists in understanding climate change.

The two strategic research areas MERGE and BECC focus on how the climate and ecosystems interact. MERGE focuses on modelling and predicting future climate scenarios while BECC focuses on how the climate affects biodiversity and thus the function of ecosystems. This knowledge can be used to understand how we can adapt agriculture and forestry to reduce their impact on the climate and maintain long-term sustainable production of food and bioenergy.

Researchers at five of our departments have joined forces around climate studies in the cross-disciplinary research environment LUCCI. Studies of physical processes in the natural environment, modelling, geological records, biology, biogeochemical cycling, and nuclear physics studies ranging from aerosols to nuclear structures, are all coming together in LUCCI to increase the understanding how the carbon cycle and climate system function and interact.
Searching for the origins of the Milky Way

Astronomy researchers in Lund are taking an active part in the hunt for the origins of the Milky Way. To help them they have the new Gaia satellite and some of the world’s most advanced telescopes at the European Southern Observatory.

Researchers from the Faculty of Science at Lund University are on the scientific team for the Gaia satellite, which is a collaborative European project. Our researchers are working to develop the software that will process the data collected by the satellite. Gaia provides the researchers with the possibility to measure with unrivalled accuracy the position and speed of a larger number of stars than was previously possible. The project will result in a three-dimensional map of the Milky Way and will offer new clues as to how our galaxy came into being.

Studies of the Milky Way and the other nearby galaxies are also carried out on the visits our researchers pay to the European Southern Observatory (ESO) in Chile. Among other things, the researchers analyse the light that the stars emit to see which elements they comprise. This makes it possible to draw conclusions about the origin of the stars and how the different parts of the galaxy have developed. The equipment available to the researchers includes the ESO’s Very Large Telescope (VLT).
Inspiring discoveries in the animal world

Several of our research groups in biology study fascinating super senses of everything from dung beetles to seabirds. The knowledge provides clues to animals’ behaviour and could lead to new inventions.

One of the projects studies how and why animals move. The researchers have access to a wind tunnel where they can release creatures such as swallows, butterflies or bats to study how their wings move when they fly. Another area of the research focuses on navigation, for example how seabirds find their way to their breeding sites. The birds are tracked using data loggers that register the length of the day or their GPS positions.

Another research group investigates the many types of eye that exist in the animal world. The researchers from the group have succeeded in showing that dung beetles use the band of light produced by the Milky Way to roll their balls of dung in straight lines at night. This is the first insect that has been found to use the stars for navigation. The group’s studies of night vision in insects have led to a collaboration with a major car manufacturer, which has used the findings to develop a colour night vision camera.

Scent signals are another exciting research project at our faculty. One research group is working with pheromones, the scent substances that insects, among others, use to find a partner or food. When the researchers have learnt how pheromones work, they can be manufactured artificially and used for environmentally friendly pest control in agriculture.
Revealing the secrets of prehistoric times

Some of the researchers at the Faculty of Science study the development of life on earth. Objects of study include the appearances of animals that lived millions of years ago and dramatic events that influenced their lives.

One of the research projects involves studying how meteorite impacts have affected life on earth. By examining the contents of fossilised meteorites, it is possible to draw conclusions on where the meteorites are from and what extra-terrestrial events caused them. In Sweden and China, 470 million-year-old meteorites have been found that all originate from the same major collision, when an asteroid was hit by a comet between Jupiter and Mars. The meteorite impact caused stress for the animals that lived on earth, which explains why many new species came into existence at that time.

In another project, researchers at the Department of Geology have used synchrotron radiation at MAX-lab in Lund to show that original biomolecules, such as the protein collagen and the pigment melanin, can be preserved in fossils of animals that lived 50–70 million years ago. Among other things, they have studied the remains of a prehistoric fish and a mosasaur, a type of marine reptile. By analysing the information encoded in the biomolecules, conclusions can be reached on the animals’ colour and other characteristics that are not revealed by their fossilised skeletons.
Describing what waves look like and what properties they have is a challenging and interesting mathematical problem. Among other things, the researchers are looking at what happens when a wave is subjected to different types of disturbance. For instance, during a storm an unstable wave could develop into a huge monster wave. Monster waves are not as well understood as other phenomena such as tsunamis. They occur apparently at random and cause major damage to ships and oil platforms. Better knowledge of why monster waves come about would enable better forecasting and defences.

Waves are a universal phenomenon and the models that the researchers work on are used in other fields such as fibre optics, elasticity theory or quantum mechanics. The work also leads to the development of new mathematical methods. At the Centre for Mathematical Sciences there is a long tradition of research on partial differential equations, which are used to describe waves.

Mathematicians want to understand ocean waves

One of the research projects at the Faculty of Science is about describing the properties of different types of water waves mathematically. The research will lead to better understanding of how huge monster waves come about.

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The fight against disease

Many people are affected by serious disease at some point in their lives. A number of research groups at the Faculty of Science are working to find methods to speed up diagnosis and to develop new effective drugs with fewer side-effects.

One of our research groups in biology is studying the processes that cause cells in the body to divide, grow, differentiate and die. A disruption in the balance between these processes can lead to disease. The researchers work to understand how the different processes are regulated in order to find drugs that can stop the excessive cell growth and division associated with tumour development. The group focuses in particular on finding drugs to treat the root of cancer – cancer stem cells.

A research group in chemistry is studying Latin American plants that have traditionally been used for medicinal purposes. They look at what active substances are found in the plants and search for substances that are anti-carcinogenic or have effects on the central nervous system. This group collaborates with researchers in biology to study how the substances affect cancer cells and cancer stem cells.

One group of researchers at the Department of Medical Radiation Physics develop methods to create the best possible medical images in order, for example, to investigate which parts of the brain are connected via nerve paths. The researchers use MRI methods based on strong magnetic fields to visualise these paths. Another group is utilising targeting molecules and antibodies to kill metastatic tumours. These molecules carry a radioactive element and target the tumour, allowing the energy released from the emitted radiation to induce cell death of the cancer cells. This method is used as a complement to conventional radiotherapy – another active research field at the department.

In this tractography image the nerve paths of a human brain have been visualised using data recorded with an MRI method called diffusion tensor imaging. The colours represent different directions of the nerve paths.
In pursuit of the smallest component parts

Studying nature’s smallest component parts requires large accelerators, efficient detectors and clever computer software. Several of the researchers at the Faculty of Science work at the experiment stations at the Large Hadron Collider at CERN.

One of the experiment stations that the researchers use is ATLAS, where they have been involved in finding the much talked-about Higgs boson. Several hundred research projects are carried out at ATLAS and the researchers from our faculty are also involved in looking for other unknown particles that could form clues to the mystery of dark matter.

Some of the researchers work on the ALICE experiment, which is specially designed to study the conditions at the universe’s beginnings. Matter existed then as a plasma of free quarks and gluons. When atomic nuclei are collided at high energy, it is possible to recreate this plasma and study its properties. The researchers have observed that the extremely hot plasma behaves like a liquid.

In order to interpret the findings from the various experiments, advanced computer software is needed. The researchers from Lund are world-famous for the theoretical calculations and models they have developed, and the ‘Lund model’ is a well-known concept. Among other things, they have written programs to simulate expected results of experiments at ATLAS.
New materials help the environment

At our faculty, a number of research groups are working to develop the materials of the future. The research leads to more environmentally friendly and efficient solutions to challenges in everyday life and industry.

One of the research groups works on green chemistry – chemical processes and materials that are kind to people and the environment. The researchers have identified a way to produce self-cleaning, water-resistant surfaces like those of lotus leaves. This is achieved by spraying a thin layer of wax over the surface. Possible areas of application for the protective covering could be window panes, boat hulls and fabrics.

Research groups in physics study the surfaces of different materials at the atomic level. The surface is important because it is there that the material interacts with its surroundings. Metal surfaces and nanostructures are used for catalysis, among other things. Catalysts are important in the chemical industry and for cleaning car exhaust fumes. Some of the researchers are also involved in the Scandinavian project ALUX, where they are looking at how aluminium can be oxidised to make it stronger.

Lotus leaf from the Botanical Garden at Lund University
In conclusion

Much of our research and education is carried out in collaboration with other faculties at Lund University, as well as with various universities in Sweden and around the world. This means that, regardless of whether you want to study or do research, you will have a broad network and the possibility to work with some of the most important scientific subjects of our time.

If you have any questions about the Faculty of Science, its education or research, please do not hesitate to contact us.

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PROGRAMME STUDY ADVISORS
For more information about a specific degree programme or course, please find contact details with the programme/course descriptions at: www.lunduniversity.lu.se

INTERNATIONAL COORDINATORS
For more information about exchange studies - please find contact details for our international coordinators at: www.science.lu.se/coordinators