Stockholm University

Strategies for Stockholm University 2023–2026

Woolly mammoth tusk emerging from permafrost on central Wrangel Island in northeastern Siberia. Research at the Center for Paleogenetics and the Department of Zoology.

Photo: Foto Love Dalén

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FUNDAMENTAL VALUES AND MISSION —KNOWLEDGE, ENLIGHTENMENT AND THE PURSUIT OF TRUTH

The idea of the modern university, shaped in the spirit of the Enlightenment, has characterised Stockholm University ever since its inception. Rooted in a millennial European tradition, universities drive the emergence of new knowledge and the future society. Europe's multifaceted cultural and educational heritage is a common ground for this. The modern research university, with its collegial governance and research-based education, has a central place here.

The university will actively promote the fundamental academic core values of autonomy and academic freedom, as enshrined in the *Magna Charta Universitatum*. Stockholm University has identified knowledge, enlightenment and the pursuit of truth as its additional core values as a higher education institution. These values shape the university's activities and are expressed through both research and education. The university upholds these core values, not only for its own activities, but also due to the importance of research and education in society at large. The core values are based on the conditions for academic work and on the university's fundamental mission—to contribute science-based knowledge. The core values create a common foundation for everyone working at Stockholm University; a continuous and lively discussion about the values that drive research and education forward is therefore important. In times of global unrest, it is particularly important to safeguard the open society, where science contributes to explaining and developing knowledge about events in the world around us. Through its broad activities and its strong position nationally and internationally, Stockholm University will contribute to the development of fundamental knowledge, open academic discourse and democracy.

PURPOSE AND IMPLEMENTATION OF THE STRATEGIES IN THE ORGANISATION

Stockholm University's strategies clarify the core values, direction and ambition for the future within the framework of four identified strategic areas.

The strategies also include the university's 16 profile areas, each of which comprises strong and broad research environments with high-quality education, that collectively characterise the university. The strategies guide the area-specific strategic plans in human science and science, and provide a common framework for other governing documents within the university.

The strategies clarify, at an overall level, what the university wishes to achieve and the direction in which this is to be implemented. The strategies are implemented in close dialogue between the different levels of the university, through layered leadership in which departments have activity-centred operational responsibility, disciplinary domains and faculties are responsible for recruitment and strategic development within the disciplinary domains and faculties, and the senior management team has overarching responsibility for the strategic direction of the university. Through the short communication and decision-making paths of layered leadership, the university applies trust-based governance based on confidence in academic autonomy. This is a principled position based on the premise that academic activities need a strong mandate. The organisation creates conditions for strategic discussions as well as collegial cooperation and accountability. Hence, the different parts of the university can further develop their activities in coherence. The implementation of the strategy is a joint task and responsibility involving the senior management team, teachers and researchers, university administration and students. Collegial influence, student participation, gender equality and equal treatment should characterise the work.

STRATEGIC AREAS

The university has a broad mission. The university plays a central part in knowledge development and *Bildung* through free research and doctoral education, and through the development of courses and study programmes. The main role of research is to develop knowledge within both new and traditional disciplines, and in the intersections between the two. Universities play a crucial role in finding solutions

to, and disseminating knowledge about, climate change and environmental sustainability—major challenges of our time. The world is at a critical stage where free research and higher education are key contributors. Science is crucial to achieving the UN 2030 Agenda for Sustainable Development. Through collaboration within academia, and with other societal actors, the university will increasingly contribute with scientific analysis in the strife for a better world. It is particularly important to collaborate with other higher education institutions, for example within university alliances such as the Stockholm Trio (consisting of Karolinska Institutet, KTH Royal Institute of Technology and Stockholm University) and the European collaboration CIVIS, or in strategic partnerships with individual universities, as well as in forums such as the University Reference Group for Research Infrastructure (URFI). Based on the university's mission, the following strategic areas have been formulated to set the long-term framework and direction for the university's activities.

- Stockholm University's research shall be internationally leading and a driving force in the development of new knowledge.
- Stockholm University's education shall be broad, research-based and of high international quality for the development of individuals and society.
- Stockholm University shall have a well-functioning organisation with strong academic environments, and work strategically with recruitment and skills provision.
- Stockholm University shall be a force in society that contributes to democracy and sustainable development.

INTERNATIONALLY LEADING RESEARCH THAT DRIVES THE EMERGENCE OF NEW KNOWLEDGE

Stockholm University is a prominent research university characterised by both basic and applied research in its two disciplinary domains, Science and Human Science, which includes the humanities, law and social sciences. Through its research, the university is involved in a wide range of international and national collaborations. The university shall actively participate in international research arenas and create conditions for vibrant and internationally outstanding research environments, where the commitment and competence of teachers, researchers and doctoral students are crucial. Doctoral students play an important role in building strong long-term academic environments. The university will therefore ensure the future growth of research environments by increasing the number of doctoral students.

Freedom in research requires that researchers are free to formulate research questions, choose methods and publish. Free research has an inherent innovative power, and is crucial to the breadth, diversity and excellence of research. It creates progress; free basic research produces future innovations. Stockholm University will continue to emphasize its strong basic research profile, and the importance of research for knowledge development, research utilisation and solving societal challenges.

Research at Stockholm University shall safeguard quality, integrity and independence, which requires that it is conducted in accordance with good research practice. The research culture creates an environment for open and well-informed conversations about research ethics. The university's research must be continuously scrutinised through both internal and external review processes. Within the framework of the university's research quality assurance system, research conditions and outcomes are reviewed through inter alia, external research grants, publications, recruitment follow-ups and external focus evaluations. Based on the evaluations, the university identifies research areas that need to be strengthened and further developed or that can inspire others through good examples. The goal is to achieve even higher international quality in research. Stockholm University will safeguard its strong research culture, which contributes to deep subject knowledge and excellent research.

External research funding is of great importance to Stockholm University. The university is successful in attaining both national and international grants. Through competitive national and international projects that involve the vast majority of the university's faculty, the university will raise the ambition level in its efforts to obtain external funding, both from European funders and from Swedish research councils and private research foundations.

Research and doctoral studies are conducted all through the university; the subject-related development that takes place in the departments represents deep disciplinary knowledge with the potential to lead to scientific breakthroughs. Cross-disciplinary and multidisciplinarity research contribute to the scientific breadth of the university and involve collaboration across faculties and departments. Several of the university's centres have an cross-disciplinary or multidisciplinary basis. The research-intensive environments of these centres, which are subject to continuous collegial quality review, are a complementary strength within the broad research university. The subject-related breadth and depth of the research is part of Stockholm University's profile, and shall be specially promoted and made visible.

Research on climate, the environment and sustainability is one of Stockholm University's areas of strength. Most of the research is conducted within the departments, but there are also a number of collaborations and centres of relevance to climate work, such as the Bolin Centre for Climate Research, the Baltic Sea Centre, the Stockholm University Centre for Circular and Sustainable Systems (SUCCeSS), the Stockholm Resilience Centre (SRC), the Stockholm Environmental Law and Policy Centre and the human science collaboration between the humanities, law and social sciences in relation to the environment. Through its strong research environments, Stockholm University will develop its position at the forefront of international research in climate, the environment, sustainability and biodiversity.

Access to and development of relevant research infrastructure is key to conducting internationally prominent research and to recruiting outstanding researchers. Research and advanced research infrastructure are developed in close interaction; access to infrastructure and the development of powerful new instruments and methods enhance the potential for innovative research. Stockholm University's successful efforts to strategically and efficiently use existing, and develop new, infrastructure through international, national and regional collaborations will continue to be developed. The national collaboration within URFI is central to this. Collaboration within the Mälardalen Region and the national infrastructure Science for Life Laboratory (SciLifeLab) should also be highlighted in particular. Experiences from the successful establishment of SciLifeLab show the importance of cooperation between universities in developing a complex national research infrastructure. Furthermore, the large databases are of great importance for the development of social science research. The university has also made significant investments of its own in infrastructure, for example in transmission electron microscopy and the establishment of the Stockholm University Brain Imaging Centre (SUBIC) and the Centre for Palaeogenetics (CPG). Another example of necessary research infrastructure of a somewhat different nature is Stockholm University's field stations, where teachers and researchers can collect data, carry out analyses, teach and initiate dynamic collaborations for periods of time. The geographical spread of the field stations—from Tarfala in the Kebnekaise massif in the north to the solar telescope on La Palma in the south—provides unique opportunities for observations. Based on the evolving needs of research, the university will continue to pursue collaborations on national and international infrastructure, and further develop the skills needed to develop new infrastructure and exploit the opportunities offered by existing infrastructure.

The Stockholm University Library is an infrastructure that encompasses both the physical book and periodical collections and electronic resources. The library is central to both disciplinary domains and has a nationally and internationally leading role in how data and open science are stored and made accessible. Through this, the university contributes to an open research society. The university will continue to be a driving force and a frontrunner in the transition to open science, in terms of access to both publications and research data. This includes encouraging collaboration and participation in national and international contexts to promote sustainable development in open science.

BROAD RESEARCH-BASED EDUCATION OF HIGH INTERNATIONAL QUALITY FOR INDIVIDUAL AND SOCIETAL DEVELOPMENT

As a university in the capital, Stockholm University operates locally, nationally and internationally. The wide range of general programmes, professional education and training, and freestanding courses is unique. It is a central aspect of Stockholm University's identity and is part of the transformative power required in society. The academic breadth creates the conditions for a wide range of collaborations and helps to make the university attractive to students with different backgrounds, both nationally and internationally. In particular, the university shall strive to further increase the number of students enrolled in second-cycle courses and study programmes. The university shall also continue to offer a broad range of programmes aimed at imparting basic knowledge, relevant professional skills and *Bildung*.

The university campus shall provide a place for education and research with beneficial opportunities for interaction, collaboration and a vibrant student life. A long tradition of campus life has demonstrated the value of people-to-people encounters—an interaction that contributes to understanding and community between colleagues, between teachers and students and between students. Physical encounters create the conditions for knowledge sharing and social interaction that are central to the organisation as a whole.

Education at the university shall be of high international quality in content and performance. The

strong commitment of the teachers, combined with a high level of pedagogical and subject expertise, will further contribute to an educational environment focused on student learning. Inherent in this is that education should convey international perspectives and provide opportunities for international experiences. In this way, students will be well prepared for a national and global labour market. Stockholm University shall pursue active pedagogical development. The university shall attract the best students, regardless of their background. A broad student base contributes positively to the study environment by providing a forum for more perspectives and experiences to be expressed.

The active participation of students in the development of the courses and study programmes is an important part of the quality work at Stockholm University. Responsibility for effective student participation is shared between teachers and students, and between the student unions and the university's collegial boards and management. The student faculty associations also play an important role. Students shall be given good conditions for student influence with a focus on the highest quality in education, a high student completion rate and a good study environment.

An important task for universities is to contribute to lifelong learning and the opportunities for individuals to return to the university for further education. Labour market relevance shall be continuously taken into account and developed through dialogue with various societal actors and alumni.

The range of courses and study programmes offered at Stockholm University reflects the university's strength and breadth of subjects. The education is characterised by in-depth subject knowledge and the possibility of independent work with close links to ongoing research, where students are supervised by prominent researchers. This builds on a strong research culture where teachers work in academically rigorous environments with both education and research. As part of the living culture of quality, the research basis in education shall continue to be ensured.

The focus of Stockholm University's internal quality system for education is on strengthening and developing the academic quality of its activities through collegial processes. These include supporting initiatives for the quality development of academic activities, as well as regular reviews of the conditions and enactment of the education. The quality system shall also ensure that the quality requirements and expectations that students and society have on education are addressed.

The transition to a more sustainable and resource-efficient society requires changes at many levels. Progress in this direction is possible through research-based education. Here, education in both human science and natural science contribute to relevant knowledge in relation to the broad scope of the Sustainable Development Goals. Knowledge about climate, the environment and sustainability is needed for society to achieve the overall goal of climate neutrality. Stockholm University shall continue to develop environmental and sustainability courses and study programmes across disciplinary boundaries; education that prepare students for a working life in which these issues play a crucial role.

A WELL-FUNCTIONING ORGANISATION WITH STRONG ACADEMIC ENVIRONMENTS THAT WORK STRATEGICALLY WITH RECRUITMENT AND SKILLS PROVISION

Stockholm University has a well-functioning organisation with delegated decision-making, where collegiality, responsiveness and communication are leading principles. The collegial organisation has a long tradition and is based on the understanding that collegial influence is key to maintaining and developing academic integrity and quality. The collegial bodies and academic leaders in the line-management interact through the layered leadership in close dialogue between the different levels of the organisation. This leads to a constructive management with clear forms for communication and knowledge based decision-making. These management principles are central to Stockholm University and must be preserved.

Employee competence is the most important factor in creating success within the university. Teacher recruitment is the single most important decision made and a key to creating strong academic environments; the teacher recruitment processes of the faculties must be internationally aligned and lead to the strongest possible recruitment. Recruitment and promotion processes should increasingly be based on a broad assessment of qualifications, rigorous vetting and the long-term and strategic development of university activities.

Good leadership, both academic and administrative, is a high priority and shall be given great attention. Stockholm University shall be an attractive workplace by offering competitive working conditions and a working environment characterised by collegiality, social equality, gender equality and equal

treatment. This means that leaders and managers must have sufficient knowledge and prerequisites to carry out active and systematic work on equal opportunity and work environment. The work environment must make use of the resources that employees with different backgrounds, life situations and skills bring to the university.

A well-functioning operational support, both within the core operations and the administration, is required to conduct education and research of high international quality. Operational support shall be based on an understanding of the needs of education and research; an organisational culture with good communication and a climate receptive to new ideas is essential in order for the operational support to handle the many complex issues within its remit, such as support for quality development and communication, research and innovation support, student and staff support, financial management and the exercise of public authority. The provision of premises is a key strategic issue for which the administration is responsible, but one that covers the whole university. All activities must increasingly strive to optimise the use of premises. Data protection and information security, including information technology, are further examples of strategic issues affecting the organisation as a whole, where the efforts and skills of operational support are becoming increasingly important and need to be developed. Systematic information security and compliance with regulations shall be strengthened, and staff knowledge of the issues shall be increased.

The digital working and study environment is of great importance to the entire university, whether work or teaching is carried out on campus or online. Digitalisation work shall be based on an analysis of the needs of education and research and the potential of digitalisation to create added value and increased quality. Students and staff must be met by effective digital services and systems. Similarly, research must be supported by appropriate digital services for data processing, storage of research data and making research results accessible. In order to develop working methods and pedagogy, and as part of reducing the university's carbon footprint, the positive experiences of a more digitalised approach will be harnessed.

A FORCE IN SOCIETY THAT CONTRIBUTES TO DEMOCRACY AND SUSTAINABLE DEVELOPMENT

Since its founding in 1878 as a higher education institution in the capital, Stockholm University's relationships with other parts of society have been characterised by openness. In a complex society, the university has a key function in being a resilient bearer of academic values. This includes actively promoting open academic discourse that rests on a scientific foundation, consolidates knowledge and develops critical thinking. Research communication is an important part of this, making clear the university's contribution to society. Communication shall be developed to further highlight and disseminate research results, and explain how knowledge can be used today or in the future. Communication also involves conveying the importance of scientific methods and perspectives to increase public understanding and confidence in scientific practices and approaches.

Stockholm University's climate work, the objectives of which are expressed in the Climate Roadmap, has a broad societal perspective. As part of its climate work, Stockholm University is committed to being carbon neutral by 2040. The target reflects the university's strong profile in these issues. Stockholm University's activities will be characterised by a clear and developed sustainability profile, which contributes to sustainable development primarily through its research and education, as well as through a reduced environmental and climate footprint from its own operations.

As the largest education provider in Sweden and with its strong basic research and location in the capital, Stockholm University has a unique societal mission. It is close to important societal functions and offers opportunities for extensive interaction with other parts of society. The university's departments work with a large number of external partners. Collaboration is part of the development of activities and involves an interaction in which flows of ideas, problems, knowledge and resources between the university and external actors lead to mutual development. These broad forms of collaboration will further develop. They benefit society through the education of students and doctoral students, adjunct teachers, research communication, contract research, expert assignments, statements of opinion, centres and institutes, and through innovation and support for ideas in the early stages of development. The university shall promote open dialogues and create conditions for knowledge exchange, innovative solutions to problems and a better understanding of how research results develop new knowledge and provide benefit in multiple ways. Thus, society is positively influenced while education and research are advanced.

Stockholm University engages in a wide range of collaborations with other higher education institutions; collaborations with other research universi-

ties offer great potential for the organisation and should be further developed. The recent Wallenberg initiatives on data-driven life science and on research on sustainable materials are two examples where Stockholm University actively participates and recruits researchers. In recent years, collaborations and networks have also been strengthened through partnerships in the Stockholm Trio and CIVIS university alliances, which are strategically important for the university and create opportunities for staff and student exchange. The work within Stockholm Trio is being developed, for example, by identifying priority subject areas and developing master's programmes with close links to strong research environments. CIVIS, a European university alliance funded by the European Commission, involves universities on two continents—Europe and Africa—and is based on collaboration on jointly identified societal challenges. Strategic partnerships with individual universities, notably with the University of Helsinki and the University of Tokyo, will be further developed. Based on an analysis of the development of research and education, the university will also build on collaborations and dialogues with other academic institutions.

Wars, political unrest and authoritarian repressive regimes in the world have devastating consequences for individual citizens, civil society and social institutions. In this perspective, responsible internationalisation is key. Academic activity is transnational, and its strength lies in the exchange of knowledge between people around the world. At the same time, informed, research-based assessments of when and how academic collaboration may need to be limited in the light of geopolitical changes, security concerns and politically authoritarian tendencies in an international context are required. Stockholm University, with its broad expertise, will further contribute actively to the work on these issues, which are complex but highly pressing for the whole sector.

APPENDIX

Profile areas at Stockholm university

Human science

WORLDS & CONDITIONS OF CHILDREN AND YOUNG PEOPLE

This profile area includes the study of children and young people as actors in school, peer life and family life, and their worlds of ideas, rights and vulnerability. Learning, communication and identification are studied from the perspective of children and young people. The area also includes the study of children's culture: literature, music, film and theatre productions targeting children, as well as the representation of children and young people in various artistic expressions, including style and fashion. A practice-oriented collaboration takes place with Stockholm County schools and an open seminar activity is conducted.

INTERNATIONALISATION & MIGRATION

The profile area studies the economic, cultural, linguistic, social and environmental consequences of global flows of individuals, goods and information. The infrastructure and networks resulting from internationalisation and globalisation are also examined. In addition, changes resulting from population movements, both in the present and in the past, are studied, as well as the multilingualism that is a consequence of migration. The research examines how the world is affected and changed by international flows, contacts and exchanges of ideas and services.

CULTURAL HERITAGE & HISTORICAL PROCESSES

The profile area examines how tangible and intangible remains from the past are preserved and attributed meaning in interactions between people over time. Central partners include nations, states and their institutions as well as international organisations and, increasingly, local and regional actors. The area studies how different forms of conservation include both passing things down and reinterpretation, and how the creation of designated cultural heritage is a political process. The proximity to national archives, museums and other institutions in the region provides favourable conditions and particularly good access to empirical material.

POWER, DEMOCRACY & WELFARE

This profile area studies power, democracy and welfare and how these fields interact with each other. Research includes the study of major societal challenges such as climate change, migration and globalisation. Key research themes include digitalisation and a reformed education system, an ageing population and a changing media landscape, and how these affect and are affected by management and governance at different levels. Proximity to government agencies and national policy feeds the area, and both education and research take place in collaboration with public and private organisations at the local, national and international level.

NORMS, LAW & ETHICS

The profile area studies norms, legal rules and regulations, as well as the limits and possibilities of norms. Research and education in this area include ethical issues of human and social behaviour. Research on crime and punishment occurs in a variety of disciplines. For example, the profile area includes issues of human rights, international conflict management and norm-critical perspectives. There is extensive outreach in the form of expert assignments, dissemination of knowledge through the media and the drafting of consultation documents on legislative issues.

SOCIETY, ORGANISATIONS & INDIVIDUALS

Societal institutions are created by individuals with both shared and conflicting desires. The challenges faced by human societies change over time and are subject to continuous analysis and discussion. The research and education in this area deals with the well-being, attitudes, values and behaviour of individuals both alone and in social contexts. This profile area studies different goals and forms of governance in nations, regions, companies and other organisations, as well as the media. There is a long-standing and well-developed collaboration with, for example, governmental agencies and international organisations.

LANGUAGE & LEARNING

Language is a prerequisite for thinking, communication, learning and identity creation, as well as for various aesthetic and cultural expressions. Stockholm University conducts research and education in some thirty languages. The profile area focuses on issues in a broad field that includes language learning and language didactics, multilingualism and social interaction, as well as language history and philosophy of language. Language is central to e.g. law, literature, media, politics and various aesthetic experiences, which means that research in the area focuses on both the instrumental functions of languages and their cultural, representational and meaning-making expressions. Contact between languages is also explored in the form of interpretation, translation and other multilingual practices. Researchers in the area move between millennia-old written remains and the problems and opportunities of the digital age.

VISUAL REPRESENTATIONS & INTERFACES

Today's research and education in human science increasingly uses various forms of images and visualisations to convey, visualise, interpret or illustrate complex phenomena and contexts. Examples of this include graphs, charts, diagrams, illustrations and aesthetic expressions and, increasingly, various forms of digital interfaces. In addition, there is research on how people relate to, interact with and create visual representations. All of this places great demands on continuous methodological and theoretical development and also creates the conditions for new types of interdisciplinary meeting places within the university and between the university and various external actors—ranging from cultural and research institutions to companies and government agencies.

Natural science

ASTROPHYSICS, COSMOLOGY & PARTICLE PHYSICS

The research in particle physics and astronomy at Stockholm University covers a wide area: from the smallest building blocks of the universe to the formation and evolution of galaxies over billions of years. How do particles get their mass, and will the Higgs boson provide the final answer? Why is there more matter than antimatter in the universe—is this related to hypothetical axions or the processes that are responsible for neutrinos mass? What happens when compact stars—such as neutron stars and black holes—merge, and how are the gravitational waves that are generated by this process linked to other signals of light and neutrinos? How can energetic particles that reach the Earth provide us with information about processes in distant galaxies? How are galaxies and stars formed? What is the dark matter and the dark energy that dominates the universe? Research at the Departments of Astronomy and Physics seeks to answer these and related questions. The research area includes theoretical research as well as large-scale experiments and observations.

ATOMIC, MOLECULAR & COMPLEX QUANTUM SYSTEM PHYSICS

This profile area covers a wide range of research: from studies on the properties of isolated atoms, molecules and dynamic processes when such systems interact with photons or each other, to studies of entangled photon and particle states, quantum encryption, quantum information, cold atomic gases and topological quantum materials. In addition, the profile area includes studies of clusters, the properties of liquids—especially water—and catalytic reactions on surfaces. The research is pursued with development of new theoretical and experimental methods, in the latter case often with strong elements of instrument development. Atoms, molecules and clusters are studied and manipulated using ion traps and ion storage rings; laser radiation is used to control the properties of individual photons, and the time structure of the radiation is used to study ionisation dynamics and achieve intertwined photon states and the teleportation of quantum states, as well as manipulate quantum materials out of equilibrium on ultra-fast time scales. Free-electron lasers and synchrotron light facilities are crucial for catalysis studies, studies on new properties of water in various forms, as well as studies of other materials. Using ion storage rings, ion-ion collisions are studied with new powerful methods—including applications in astrophysics.

BIOLOGICAL MEMBRANES

Cell membranes have a central function in biochemical processes inside the cell. Stockholm University conducts unique research on the proteins that constitute a large part of the cell membranes. Many central processes in the cell are dependent on membrane proteins, and a majority of future pharmaceutical drugs are expected to target these proteins. Cellular processes are closely tied to the function of membranes to regulate what substances pass in and out of the cell. Membrane proteins, which control these processes, are thus the focus of many research groups, both in Sweden and internationally. What makes the research at Stockholm University unique is its breadth. There are more than twenty research groups that use both experimental and theoretical methods within areas such as biochemistry, biophysics, cell biology, molecular biology, structural biology, neurochemistry, bioinformatics and biotechnology. Studies include how membrane proteins are structured, how they are produced inside the cell, how they function, and what role they play in the cell's energy metabolism.

CATALYSIS IN ORGANIC CHEMISTRY

Stockholm University conducts successful research on new, efficient and selective synthetic methods to construct organic molecules through catalysis. The reactions that are developed contribute to a sustainable production of pharmaceuticals, agrochemical products and other products of importance for our society.

The research includes the development of catalysts based on organic and organometallic compounds, as well as on metal nanoparticles. Modelling with computational chemistry is an important component to understand the mode of action of the catalysts, thus facilitating the design and synthesis of new, and improved catalysts. Catalysis is an important principle within Green Chemistry, and catalytic methods are also essential in the synthesis of complex molecular systems that are needed in other research areas, such as material science, energy production (solar cells) and in life sciences.

CLIMATE, SEAS & ENVIRONMENT

How the oceans and Earth's natural climate and ecological systems have developed over time and function today and how they are affected by human activities are central questions to this profile area. Impacts of climate and land use change on biodiversity and ecosystem services as well as sources of pollutions and their toxic effects are other important fields of research within the profile area. The broad research being conducted at Stockholm University comprises specialised studies and interdisciplinary approaches to advance our understanding of these complex systems and help supporting a sustainable development. The research is carried out at individual departments, at centres and in major interdisciplinary research programmes. The University's Bolin Centre is an important forum for climate science organized in collaboration with SMHI and KTH. The climate development and climate-related processes in the Arctic comprise some of the Bolin Centre's research areas. At the Baltic Sea Centre, the research ranges from individual bays to the open sea as well as from large-scale modelling to practical actions. Central research questions are the importance of coasts for the climate and what role biodiversity plays in the absorption and emission of greenhouse gases. Stockholm Resilience Centre (SRC) focuses on sustainable development and resilience of social-ecological systems and integrates social and natural sciences. The centre for broad transdisciplinary research on circular and sustainable systems, SUCCeSS, is also a part of the profile area. The research within Climate, Seas and Environment provides a basis for decision makers at local, regional and international levels and contributes to a sustainable development of our society.

INTERACTIONS BETWEEN GENES, ORGANISMS & ENVIRONMENT

The interaction between genetic heritage and the environment affects all life, at species, population and individual levels. Environmentally induced selective pressure causes changes in genetic frequencies, resulting in geographic variation in individual characteristics and the emergence of new species. These factors can with time lead to large-scale alterations of the biodiversity and ecosystem compositions. Environmental variation also leads to physiological adaptations and can cause rapid changes in gene expressions by modifying regulatory proteins and non-coding RNA, but it can also cause global and more long-term changes. The latter include changes to the genome, changes in its organization and function through so-called "epigenetic mechanisms", and the evolution of plastic traits that adapt the individual to expected environmental variation through natural selection. At Stockholm University, interactions between genes, organisms and environment are studied extensively, including how organisms adapt to their surroundings and cellular responses to environmental change at the mechanistic level. How genes, organisms and environment interact is central for all life on Earth, not least when it comes to our own health.

MATERIALS CHEMISTRY

In the field of Materials Chemistry at Stockholm University, important research is conducted with the aim to produce and study materials with desirable properties and functionalities stemming from understanding of atomistic details and control of molecular, mesoscopic and macroscopic structures. The results are important for sustainable systems and reduced energy use, as well as for the environment and health. Hybrid materials derived from earth-abundant raw materials and biomass or high-performance polymers are central for applications in e.g. chemical processes, the built environment, and for climate action including water and air purification. Porous materials are studied for applications in, for example, gas separation and (electro)catalysis for mitigation of greenhouse gas emissions and the

development of enabling technologies for hydrogen production and storage. Nanocellulose, lignin nanoparticles, and other nanomaterials are tailor-made for new and improved functions in adsorption, catalytic, mechanical, heat-insulating, magnetic and optical applications. Understanding the structure of a material is crucial in order to explain its properties and to optimize it for specific applications. Electron microscopy, diffraction, NMR spectroscopy and scattering studies using synchrotron light or neutrons are being developed and used for structural characterization. In addition, theoretical tools are being used to explore the structure-property-function correlation of materials.

MATHEMATICAL THEORY DEVELOPMENT & MODELLING

Mathematical structures are a cornerstone of many scientific theories. In physics, mathematical theories and models are absolutely central tools, in addition, new important mathematics has developed from ideas originating from physics. In astronomy, chemistry and Earth science, mathematical modelling is becoming more and more important, and in some areas, such as quantum chemistry and meteorology, it is a fundamental tool. A new and important development is that mathematical modelling is becoming increasingly important in life science and in the social sciences. There is reason to believe that mathematical theories will become even more important than today in both the natural sciences and in other fields. This means that mathematical tools will need to be developed in collaboration with other researchers to a greater extent. This includes numerical aspects and needs identified when analysing new types of high-dimensional data. Such cross-fertalization means that new advanced mathematics, and mathematical intuition, will become useful in other scientific areas. In turn, questions in these areas will inspire mathematicians to formulate, and gain insight into, new mathematical concepts and structures. Stockholm University has strong theoretical research in many scientific disciplines, and the links between these disciplines and mathematics are becoming more important with time.

Students and visitors use the study spaces in the Bergdahl room at the Stockholm University Library. Here you can read and study in peace and quiet (quiet zone).

Photo: Lena Katarina Johansson

Stockholm University 106 91 Stockholm Sweden
Tel +46-8-16 20 00 www.su.se

Stockholm
University