FEATURES

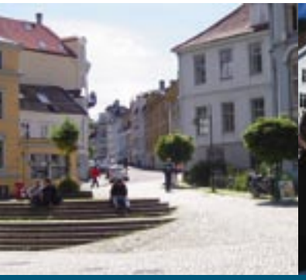
University of Bergen 2005-2006

Research - Education - International cooperation

Welcome to the University of Bergen

With this magazine, the University of Bergen hopes to offer a few glimpses of its range of activities in research, education and international cooperation. We have a distinctly international profile that involves close cooperation with other universities all over the world. Our aim is to increase international recruitment and exchanges of both academic staff and students, and to maintain open, wide-ranging and fruitful relationships with professional colleagues in a multitude of nations.

A single issue of a magazine is incapable of covering the whole range of activities of the University. Nevertheless, we hope that the sample we offer here will tempt our readers to become better acquainted with this important centre of research and education on the west coast of Norway, in the heart of Norway's second-largest city. A good place to explore our universe a little further is our web site: *www.uib.no*



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The University of Bergen is a young and modern university. Nevertheless, we offer the same traditional, classic programmes of study as most institutions throughout Europe.

The "blue" university

With around 17,000 students and 2,500 academic and administrative staff, we are a medium-sized university, while our city-centre location means that we are also an urban university, with our activities intimately woven into the geographical, historical and cultural tapestry of Bergen.

Universities have a two-fold role. On the one hand, they must satisfy society's need for highly educated academic professionals. On the other, they should act as arenas for the voicing of independent critical observations of that very same society.

The University of Bergen

- aims to be a meeting place where ideas and knowledge can be exchanged, as well as a gateway to new thinking and development
- recognises that knowledge crosses all borders - between countries and cultures and between traditional disciplines
- commits itself to achieving and maintaining an international reputation of high standard.

We focus in particular on the marine environment. This point of interest derives naturally from the University of Bergen's geographical location and the University has gained international recognition in this field. Since marine science is one of our main priority areas we are often described as the "blue" university. Other areas in which the University of Bergen is particularly active are informatics, including bioinformatics, and development projects in medicine and social sciences, as well as cancer, virology and vaccine research in medicine.

We participate in a number of cooperative programmes at national and international level, and we are particularly well known for our collaboration with universities in developing countries. Our commitment to international cooperation involves participation in networks and collaborative projects, as well as exchanges of academic staff with a number of respected institutions in Europe and North America. Since the 1980s, the University has also prioritised development -support programmes in third-world countries.

We also participate in a number of interdisciplinary cooperative projects with institutions in Africa, Asia and Latin-America. The principal topics of these areas are water and natural resources management, epidemiology, health and poverty research.

Since 1992, Makerere University in Uganda and the University of Bergen have put a great deal of collaborative effort into rebuilding Makerere's scientific competence and capacity. We have committed ourselves to a wide-ranging cooperative programme with Makerere University, which will continue until 2014.

The University has seven faculties, each of which comprises several departments, centres and research institutions. The University is spread over two main campuses. One of these, Årstadvollen, is our health sciences campus, which includes Haukeland University Hospital and Haraldsplass University Clinic. The other is Nygårdshøyden, which lies on a hill close to the city centre.

UNIFOB is the University of Bergen's research company. It is the University's principal mechanism and preferred partner for running externally financed research and development projects. UNIFOB's centres perform research and related activities that span all the disciplines studied by the University's departments.

The University of Bergen and the Institute of Marine Research have been designated European Research Centres in marine biology. From 1996 until 1998 the University was a Centre of Excellence for post-doctoral training in marine biology.

Many of the research laboratories and facilities of the University and the Institute of Marine Research form part of the European Research Infrastructure (Large-Scale Facilities) Programme, which gives scientists from other countries access to high-quality research facilities.

The Bergen Open Research Archive, BORA, ia digital repository of research output from research institutions in the Bergen area (https://bora.uib.no/index.jsp). Contained here are full-text peer-reviewed journal reprints, theses, dissertations and other digital research materials. BORA is part of a world-wide network of Open Access Archives.

Faculties

The Faculty of Mathematics and Natural Sciences
The Faculty of Mathematics and Natural Sciences does research in all traditional scientific disciplines. Using a prime natural setting to build international level expertise, the Faculty has chosen to concentrate particularly on the following fields: marine and climatic research, petroleum research, and informatics.

The faculty has around 2700 students. Teaching is offered at undergraduate and graduate (M.Sc. and Ph.D.) levels.

Faculty of Law
A master's degree in law requires five years of full-time study. Each year of study is followed by examinations at the end of each course. In addition to a doctoral programme, the Faculty also offers a number of courses that are open to all university students, some of which are offered in English. The Faculty employs about 80 academic and administrative staff and around 2000 students are currently studying for their master's degree in Law.

Faculty of Psychology
The Faculty offers a number of courses of study that lead to a wide range of academic and professional qualifications. These range from the two-semester introductory course in psychology, to the selective-entry programme of professional studies which leads to the degree of Cand.psychol. and which qualifies graduates to practise as psychologists in Norway. This course may be followed by a period of research training leading to a doctorate. The Faculty also offers a number of other specialist courses.

More than 1,800 students are currently registered for courses at various levels in the Faculty.

Faculty of Medicine
The Faculty has about 1400 students including 212 PhD-candidates and offers professional studies in medicine (MD), master's degrees in biomedicine, pharmacy, nutrition, and health sciences, and a research course for medical students. In its research, the Faculty covers a broad spectrum of clinical medicine, biomedicine and health sciences, and is also in the process of establishing research schools in five of its strongest fields of research. The Faculty has a high level of competence in research and has established research groups in experimental cancer studies, neurosciences, cardiology and circulation, epidemiology and vitamins, molecular biology, translational biological and clinical research as well as global health issues.

Faculty of Dentistry
The Faculty, which currently employs 230 staff and teaches 355 students, educates dentists and dental nursing staff to first-degree level and provides specialist training for qualified dentists. The research interests of the Faculty range from basic to clinical research, involving master's and doctoral students in the research programmes of the Faculty's research groups. The master's and doctoral programmes also offer organised training for researchers. The Faculty runs its own dental clinic in support of its teaching and research activities.

Faculty of Social Sciences
The Faculty offers training in management and organisational sciences, film and television production, visual culture, information sciences, journalism, media studies, political economy, social economics, comparative politics, geography, sociology and social anthropology. The Faculty's research activities cover a wide range of subjects, of which development research and poverty studies are two important fields. For some years, studies of international migration and ethnic relations have been areas of special interest.

Faculty of Arts
The Faculty concentrates on European languages and culture, and on aesthetic disciplines with a national or European orientation. Several subjects focus on the Middle East, while in Spanish, the orientation is clearly towards Latin America. The 11 institutes of the Faculty represent more than 20 different disciplines in culture and society, linguistics and aesthetics. The Faculty is strongly committed to research both in its individual disciplines and in the form of cross-disciplinary programmes and projects in cultural subjects and in information and communications technology in the arts.

Bergen Museum
In addition to the faculties, Bergen Museum is a major academic department of the University of Bergen

The academic activities of Bergen Museum are organised in two multidisciplinary departments: the Natural History Collections and the Cultural History Collections. Its primary objectives are to perform research and to gather, document, maintain and provide information about the collections of the disciplines that form the Museum.

Pro-active commercialisation work

The University of Bergen, together with Haukeland University Hospital and the Institute of Marine Research, has established the company Bergen Techtrans Office AS (BTO AS). The company will provide a common approach towards the development and organisation of commercialisation activities. This includes the follow-up and management of Intellectual Property Rights (IPR) related to commercially interesting research results, arising from the respective institutions.

• BTO AS builds upon the former Technology Transfer Office of the University of Bergen and other commercialisation activities in the respective institutions.
The firm is financed by the owner institutions as well as national, public technology transfer initiatives.

• BTO AS provides researchers independent and objective evaluation of commercial ideas stemming from research results.

• BTO AS is in a development phase. Initially, the BTO AS will emphasise information and networking, with the goal of ensuring that commercially interesting ideas have access to the resources necessary to succeed in the market.

www.bergento.no

Expanding cooperation with the Worldwide Universities Network

The University of Bergen is a member of the Worldwide Universities Network (WUN). This is primarily a research network which has the objective of creating a global research base through the joint efforts of its member universities.

Universities in the USA, the UK and China make up the bulk of the membership of the network, which does not wish to grow to more than about 20 to 22 member institutions.

Valuable opportunities
Via its global exchange programme, of which the University of Bergen is a member, the WUN has provided exchange fellowships and travel funds for around 200 PhD and postdoctoral fellows at its member universities in the course of the past few years. Through the WUN network young researchers are given a valuable opportunity to study for periods of up to six months at some of the most prominent universities in the USA and the UK.

In 2003, the Universities of Bergen, Oslo and Utrecht were the only three European universities to be offered membership of the WUN. This alliance will offer a wider range of possibilities of exchange visits for both university staff and students.

The aim of the WUN is "to develop a global research alliance and virtual graduate school in rapidly developing interdisciplinary areas of worldwide significance".

Research of high quality
The network is particularly oriented towards the fields of globalization, bioinformatics, informatics, geographical information systems, oceanography and climate, geosciences, as well as social sciences and mediaeval studies, fields which match the University of Bergen's areas of special interest very well. However, the WUN does not set any limits on research cooperation, as long as the research involved is of high quality.

"It has been important for us to think in terms of networking in order to increase the volume of our exchange programmes," says university director Kåre Rommetveit, who has long been working to bring the University into the network.

www.wun.ac.uk

Photo: Hilde K. Kvalvaag

EDUCATION: Mobility and international standards

Since 2003 the University of Bergen, like all the other Norwegian universities as well as many European universities, has been undergoing a wide-ranging reform process.

The aims of this process have included increasing cross-border student mobility, improving the transition from university education to the labour market, and assuring the quality of the education offered.

More courses in English

We offer some 60 Bachelor's and about 100 Master's programmes in all the traditional academic disciplines. A growing number of courses and programmes are taught in English. These currently comprise 42 full Master's programmes and about 370 individual first- and higher-degree courses with the widest selection being available in biology, biochemistry and biotechnology, informatics, geology and climate studies, marine studies, informatics and information sciences, medicine and health sciences, mathematics and physics, languages and social sciences. We intend to increase the range of courses offered in English over the next few years.

The University of Bergen puts a high priority on raising the quality of its courses of study. All aspects of teaching will be evaluated with respect to their quality, efficiency and relevance. In February 2004 we established our own teaching quality assurance system in accordance with guidelines set out by the authorities. The system comprises a number of processes, sub-areas and measures that will provide a basis for systematic efforts in teaching quality and maintenance. The system is based on an iterative set-up that includes four phases: planning, implementation, evaluation and correction. Results and evaluations based on these efforts will be submitted to the University Board in an annual Report on Educational Attainments.

Good exchange agreements

In line with the priority areas set out in the Bologna Declaration the University of Bergen is also attempting to increase student mobility and to promote the European dimension in its teaching. Interested students are offered a period of study at a foreign institution as part of their degree. The Bachelor's programmes have drawn up an international component of specific courses at a selected number of cooperating universities of high academic standing. These periods overseas are integrated practically and academically into the study programmes.

The University of Bergen has exchange agreements in place with well-regarded institutions on every continent and it is an active participant in the Erasmus and Nordplus programmes. We wish to strengthen our international profile in higher education in general, and in student mobility in particular, by offering a high level of service to visiting students and to our own students who go abroad to study.

Considerable activity in developing countries

For more than 30 years the University of Bergen has been running a wide range of cooperative academic projects with institutions in developing countries. A continuous line runs between the University's first major institutional collaboration with the University of Khartoum in the Sudan, which lasted from 1963 to 1969, and our frame agreement with Makerere University in Uganda, which will continue in effect until 2014. While cooperation with the University of Khartoum turned the University of Bergen into the world's leading institution in research and studies of the Sudan outside of that country itself, our collaboration with Makerere University is in the process of becoming the most binding, comprehensive and longest-lasting institutional cooperative effort that we have ever had, covering cooperation in research and education, student mobility, library development, and personnel and financial management. As the major Norwegian participant in the NUFU cooperation for fifteen years, we have been in a position to provide academic expertise in developing research competence and training large numbers of research staff at our partner institutions in the South.

Two-way transfer of knowledge

With fellowships from the NORAD Fellowship Programme or the Quota Programme, several hundred students from countries in Central and Eastern Europe, Africa, Asia and Latin America have taken their Master's or doctoral degrees at this university. In the first round of applications for Erasmus Mundus, the EU's major new programme for European educational cooperation, the University of Bergen was a member of two successful consortia that received approval to offer joint Master's programmes in international health and water studies/coastal zone management. The Erasmus Mundus programme enables us to accept students from third countries (all countries outwith the EU/EEZ) and offer them good fellowships that allow them to take their Master's degrees under the umbrella of the joint Master's programmes.

Our collaboration with institutions in developing countries has also been characterised by a two-way transfer of academic knowledge and competence. The University and its partner institutions in the South have been both providers and recipients of academic knowledge. The academic activities of a significant number of students and research staff from the University are solidly rooted in our research and educational cooperation programmes with institutions in the South.

prospective.uib.no

The University of Bergen plays the leading role in the NUFU cooperation.

The University of Bergen accepts about 100 students a year through NORAD and the Quota Programme.

The University of Bergen participates in the joint Master's programmes in international health and water-related studies via Erasmus Mundus.

The University of Bergen's grading and academic credit systems are adapted to the joint standard produced by the Bologna Process.

At the University of Bergen the recognition and incorporation of foreign educational qualifications take place in accordance with the Lisbon Convention and the Berlin Communiqué.

The University of Bergen has been awarded the EU's Diploma Supplement Label.

The University of Bergen offers 42 master's programmes and around 370 courses taught in English.

The University of Bergen participates in the efforts of the WUN Network and the Coimbra Group in the quality assurance of teaching.

One of the aims of the University of Bergen is that 20% of its Bachelor's degree students should have taken part of their course of studies abroad by 2008.

The University of Bergen participates in the Erasmus and Nordplus Programmes.

The degree system

The restructuring process has led to a degree structure, grading system and academic credit system that are adapted to the joint standard adopted in the wake of the Bologna Process. The University now offers three-year Bachelor's degrees, two-year Master's degrees and three-year doctorates. Students' academic performance is evaluated both on the basis of final exams and on oral and written tests taken in the course of their studies. Grades are given either on a scale of A to E (pass grades) and F (fail), or simply as pass/fail. Credits can be transferred via the European Credit Transfer System (ECTS), in which an academic year is equivalent to 60 credits. The recognition and incorporation of academic credits from other countries into the Norwegian degree system takes place according to the guidelines drawn up by the Lisbon Convention and the Berlin Communiqué. The University of Bergen supplies a Diploma Supplement with all official university degree diplomas. The Diploma Supplement is based on the European Commission's model, and it offers a detailed overview of the graduate's educational status and the Norwegian educational system. The University of Bergen has been awarded the Diploma Supplement Label, a mark of quality in the context of the labour market and further education.

Photo: Marius E Hauge

Centres of Excellence at the University of Bergen

Norwegian Centre of Excellence

In sharp competition with other Norwegian research groups for the status of Norwegian Centre of Excellence, the University of Bergen was awarded three of these 13 national centres in 2002. The Norwegian Centre of Excellence (CoE) scheme is designed to promote high-quality Norwegian research, and involves gathering first-class groups of researchers under a single leadership with a common set of research goals, with the aim of enabling them to perform leading-edge research at international level. The National Fund for Research and Innovation has made this effort possible, while the host institutions also commit themselves to share the costs out of their own funds. Besides academic quality, the selection process also took into account the social and commercial benefits of the individual proposals for centres. At the University of Bergen, the Bjerknes Centre for Climate Research, the Centre for Integrated Petroleum Research and the Centre for Medieval Studies have been awarded CoE status.

Centre for Medieval Studies (CMS)
CMS vision is to enhance our understanding of Europe as a whole, in the Middle Ages as well as today, from a peripheral point of view. The present transformation of Europe calls for new emphases on the continent's past, not least the period of European origin, the Middle Ages, when the tension between unity and diversity came into being.

www.uib.no/cms

Christianisation and State Formation in the European Periphery c. 900-1200

A new Europe emerged during the eleventh and twelfth centuries through the transition from an economy of plunder to an economy of exploitation and the development of a sharp distinction between a secular and a clerical elite.

Other important factors in this development were: the growth of royal and ecclesiastical government through a standardised education, the emergence of a class of people dependent on their superiors for their careers, and the formation of a common European intellectual culture claiming a monopoly and suppressing rivals by stamping them as heretical. These exciting changes are in the focus of the activities of the Center for Medieval Studies when it participates in an international research project concentrating on christianisation and state formation, including specialists on Scandinavia, East Central European countries (Poland, Hungary, and the Czech Republic) and Russia. The results from the first phase of the project are soon to be published as a book.

In tracing the development of this new Europe, scholars have mainly focused on what is usually regarded as the core areas of Latin Christendom, England, France, and Italy, only mentioning in passing the change on the borders through the inclusion of new areas which reduced the possibilities for plunder. If we regard a multiplicity of centres of political power as an essential feature of Europe, in contrast to e.g. China and the Islamic world, as is usually done, the expansion becomes equally important as the internal changes. Six new kingdoms came into existence during this period, i.e. the three Scandinavian kingdoms plus Poland, Bohemia, and Hungary, as well as a number of territorial principalities that later made themselves independent, e.g. Brandenburg, Mecklenburg, and Pomerania. Whereas most of Western Christendom had been united under one ruler in the Carolingian period and a substantial part of it under the Ottonian and Salian emperors, the expansion, combined with the weakening of the central power in Germany, made territorial principality the normal political organisation of Western Christendom. Thus the combination of cultural unity and political division was established and it has characterised Europe until the formation of the European Union in the second half of the twentieth century.

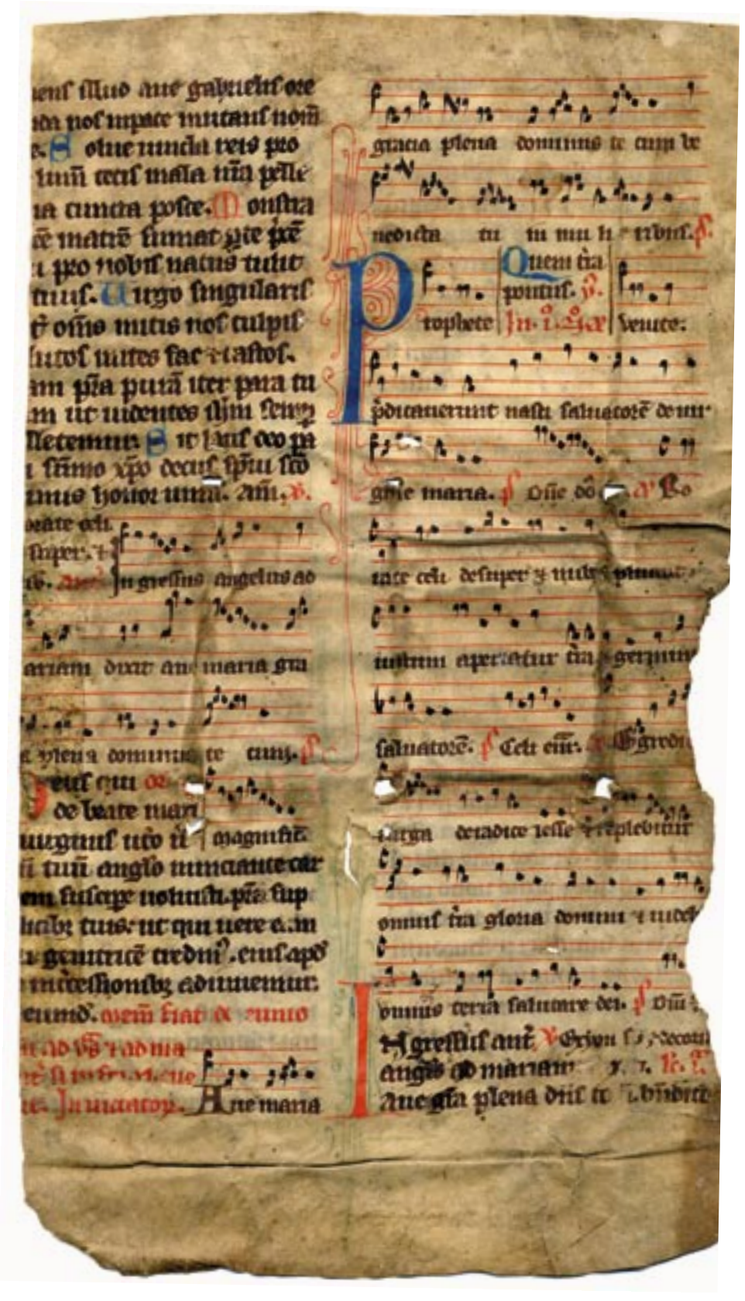
At the same time, the expansion from the tenth century onwards also marked the beginning of the European conquest of the rest of the world. Europe, i.e. Western Christendom, expanded in the Mediterranean, Scandinavia and Eastern Europe. Like the expansion following the Great Discoveries from the sixteenth century onwards, the conquests were conducted by a number of powers, often in mutual rivalry, rather than by one, great empire. Unlike the Early Modern expansion, however, the medieval one was not directed at completely unknown peoples and territories. Furthermore, colonies in the real sense played a subordinate part. The conquests that took place mostly consisted of the extension of existing European polities. Examples for that are the Spanish kingdoms and the formation of independent European principalities in the new areas, as in Southern Italy and Sicily, and the towns and principalities along the southern shore of Baltic Sea. As already mentioned, however, an important result of the conquest was the formation of new, indigenous principalities, notably in Scandinavia and Eastern Europe. Generally, the northern and eastern expansion was to a greater extent religious and cultural than the Mediterranean one. Its most characteristic feature was the spread of the Christian religion, with the book, the Latin language, and a learning and literature derived from Classical Antiquity. But the expansion also had military, economic, and political sides: e.g. the formation of the Hanseatic trade network, the export of military technology (heavy cavalry and castles) and ecclesiastical and royal bureaucracy.

Internet access to forgotten medieval manuscript fragments

The Centre for Medieval Studies (CMS) is currently working with the University Library of Bergen on a project to throw light upon the library's hitherto unused and poorly registered medieval manuscript fragments.

All 35 parchment fragments will be digitalized and presented on the Internet with images, transcriptions and full catalogue data. The collection contains material from the early twelfth to the fifteenth century with texts in both Latin and Old Norse. CMS is contributing with new research on the Latin texts which constitutes the largest share of the collection. The Latin fragments derive from English, German, and Norwegian liturgical books, and have entered the University Library through different routes. Now these important and unknown manuscript fragments are easily accessible to scholars all over the world.

www.ub.uib.no



The University Library of Bergen has a collection of about 35 medieval manuscript fragments, mainly from liturgical books. Here we have a leaf from an English thirteenth century breviary with musical notation. (Photo: UBB)

The Bjerknes Centre for Climate Research (BCCR)

BCCR is a joint climate research venture between the University of Bergen (UiB), the Institute of Marine Research (IMR) and the Nansen Environmental and Remote Sensing Center (NERSC). The BCCR integrates observationalists and modellers in a concerted interdisciplinary research effort with the ambition to be a world-class centre on studies of high-latitude climate change.

www.bjerknes.uib.no

Secret history of the climate

We know that the world climate has undergone a number of rapid changes in the past. But how did these occur, and are conditions such that they could occur again?

The Bjerknes Centre is responsible for the coordinated national Norwegian Ocean and Climate Project (NOClim), whose main aim is to offer us a better understanding of oceanic heat transport to the Nordic seas, and how this affects atmospheric heat transport. Scientists from a number of Norwegian institutions are participating in the project, in close collaboration with other international research groups.

"Among other things, we want to measure the inflow of warm highly saline water to the Nordic seas. We intend to make simultaneous measurements in our own waters and off Canada and Greenland, in order to find out what is happening in these different regions," says project manager Peter M. Haugan of the Bjerknes Centre.

At the same time, the project will map rapid climate changes in the past and try to identify their causes. The palaeoclimatologists are studying what happened to the inflow off the Faeroes and Shetland at the end of the last Ice Age. This region was marked by rapid changes, and there are ocean fronts where ice water from Greenland meets warmer water on its way north. By taking sediment samples, we can describe fairly accurately what happened, which in turn can tell us something about what could take place in the future.

Thawing and freezing processes in the Arctic are another element of the project.
"The ice has a great deal of influence on circulation, but many climate models are rather poor at dealing with sea ice. When seawater freezes, the layers of water that do not freeze become saltier and heavier, and sink towards the bottom. The relationship between surface water and the deep sea is determined by whether the water is heavy or light, and it is water from the polar region that fills up the oceans of the world. But will this process continue? Will the great volumes of deep water still be renewed? If the ice retreats as a result of continued global warming, how will the major current systems react"?

The scientists are trying to learn more about the forces that control the different types of ice, and how they behave, by means of field studies in areas where the ice freezes and melts every year. At the same time, they are studying the vertical mixing processes that take place between warm and cold water and salty and fresh water.

"We hope that when NOClim comes to an end in 2006, we will have made good progress in understanding how ice is formed. But we also hope that these key measurements will be able to continue after the end of the project. It is important to monitor the polar region in order to be able to detect any early signs of climate change. In any case, NOClim is unique in that it integrates climate models, palaeoclimatic studies and contemporary measurements. One obvious goal of the project is to improve our current climate models," says Haugan.

The NOClim project runs until the end of 2006.

Lead institution: The Bjerknes Centre

Partners: These include the Institute of Marine Research, the Norwegian Meteorological Institute, the Norwegian Polar Institute, the Nansen Center, the University of Cambridge, the Max Planck Institute for Meteorology.

Funding from the Research Council of Norway in 2005: NOK 4,474,000, plus NOK 6,388,000 to ProClim, which is a subproject within NOClim. The project has its focus on understanding climatic processes in the Arctic, with special emphasis on the western part of the Barents Sea, the Svalbard region and the Greenland Sea.

World's longest time series

Far-sighted scientists at the University of Bergen and the Institute of Marine Research ensured that the University currently possesses some of the longest and most important deep-sea time series in the world.

The weather ship "Polarfront," which is stationed at Station M, far out in the Norwegian Sea, has been making daily meteorological and oceanographic observations since as far back as 1948. After the Second World War, weather ships were stationed out in the Atlantic Ocean to help airlines work out how much fuel they would need to fly between Europe and the USA. In the course of time, aviation technology improved so much that the weather stations were no longer needed. However, Norway's Station M was left in position, and with its measurement series covering 65 years, the station is the most valuable resource we now have for deep-sea climate research. At the same time, the University of Bergen and the Institute of Marine Research have set up measurement stations to register how much of the life-giving warm Gulf Stream enters the Norwegian Sea and is transported onwards north to the Barents Sea and the Arctic Ocean. The University's Bjerknes Centre is coordinating a major European project (MOEN), which measures the water that enters all the branches of the Norwegian Sea between Scotland and Greenland, in addition to the cold, heavy water that flows south along the bottom of the sea towards the Equator.

Shedding new light on climate change

"Our long time series from the Norwegian Sea show the volume of deep water that flows over the underwater ridge near the Faeroes has fallen by 25 percent during the past 50 years. We have related these data to recent deep-water measurements from channels in this region and found that while the ocean current from the Norwegian Sea to the Equator has become weaker and less saline, the current in the other direction is both saltier and warmer. This process helps to maintain what is known as the thermohaline circulation," says Svein Østerhus, who is leading the MOEN project at the Bjerknes Centre. This means that the circulation of water in the Norwegian Sea will not cease completely, as has been predicted by some climate models. The coinage "thermohaline circulation" is used of the major ocean currents that carry warm surface water from the Equator to the poles, and cold deepwater back to the Equator. In the Norwegian Sea and the Arctic Ocean the water cools down again, and when it turns to ice the water that does not freeze becomes more salt. Both of these processes also make the water heavier, which means that it sinks and flows southwards through the North Atlantic and on to the Equator. This large-scale ocean circulation plays a major role in maintain the warm ocean current that flows north along the coast of Norway.

Better basis for climate prognoses

Together with colleagues from the Faeroes, Germany and Scotland, Østerhus has pointed out in a recent article in "Science" the importance of temperature and salinity variations when we are studying changes in ocean circulation systems.

In autumn 2004, the research vessels "G.O. Sars" took scientists to an area off the Faeroes to collect samples of sediment. Palaeo-oceanographic data can answer questions about the strength of the ocean currents during the past thousand years, and conjunction with the deep-sea data this could give us a better basis for making prognoses about the climate.

Since 1948, the weather ship "Polarfront" has been making daily meteorological and oceanographic measurements at station M, far out in the Norwegian Sea (Photo: Norwegian Meteorological Institute)

Studying CO_2 processes in the ocean

The five-year "Carboocean" project studies processes related to the uptake of CO_2 by the oceans.

This integrated EU project, which involves more than 40 research groups from all over Europe, and is also collaborating with a number of institutions in the USA, is coordinated by the Bjerknes Centre for Climate Research.

Anthropogenic carbon dioxide (CO_2) emissions are currently equivalent to more than 6 million tonnes of carbon a year. Since 1995, the University of Bergen has been measuring CO_2 pressure at the surface of the sea and in the atmosphere, mostly in the Greenland Sea, but also in the Norwegian Sea and around Iceland. One of the aims of "Carboocean" is to quantify the annual uptake of CO_2 by the sea on the basis of the results obtained by a number of measurement stations, as well as to study future variations.

The results of the modelling process suggest that we will see a increase in CO_2 uptake by the sea, and this will first be noticeable at great depths at high latitudes. However, these calculations are extremely complicated, because they deal with slow processes, and because we still do not know enough about how ocean biomass will react to the raised content of CO_2.

It is also difficult to distinguish between the signal caused by human influences and natural variations. If we wish to be able to say anything about the future climate, then, we will need a better understanding of CO_2 exchange between the atmosphere and the ocean, identify the most important processes and find out how these operate. As well as attempting to map the ocean carbon cycle for the past two hundred years, the scientists in the integrated project will also use models to study how the cycle is likely to change in the course of the next two hundred years. They also aim to study the consequences of a rise in ocean CO_2 levels.

Centre for Integrated Petroleum Research (CIPR)

The main focus for CIPR is to contribute to extended production by increasing recoverable reserves in existing oil and gas fields. The mission is to combine geology, chemistry, physics and mathematics to obtain improved understanding of multiphase flow phenomena in porous media.

CIPR develops reservoir models that provide faster and more reliable reservoir simulations, with emphasis on heterogeneous reservoirs.

The centre will contribute to increased oil recovery by improved understanding of oil recovery mechanisms.

www.cipr.uib.no

Maximizing oil production

Dynamic simulation of fluid flow in oil reservoirs is an important tool in reservoir management.

Such simulations are used for estimating reserves, generating production profiles, planning of new wells, evaluation of enhanced recovery measures and well interventions, etc. A main challenge for the oil companies is to maximize the information from all data, thus being able to build models with a minimum of uncertainty. Also, while the amount of data to be integrated in the models and the complexity increase, the companies put increasingly larger demands on efficiency, meaning that methods and tools for fast model updating will be more and more important for the industry.

The geometric complexity of the oil bearing formation models and the non-linear coupling in the flow models represent extremely challenging tasks. A main goal for Centre for Integrated Petroleum Research (CIPR) is to integrate the geological, physical and chemical modelling with the mathematical tool development, enabling us to handle and study such complex systems. Our information about the reservoir is typically very sparse. It is also to a large degree provided on scales which are not the same as the model scale. To reduce the uncertainty in the model predictions, it is important that the models are conditioned to all available data: seismic data, well logs, geological knowledge, pressure measurements, observed production, etc. Time dependent measurements are called dynamic data. Typical dynamic data are pressure development and observed production from wells. Recently, also repeated seismic surveys, also called 4D seismic indicating measurements both in space and time, have become an important source of dynamic information. Conditioning reservoir simulation models to dynamic data is called history matching, and since it typically requires a large number of simulation runs, this is a very complicated and time consuming process.

An important factor in flow modelling is the model resolution. On the one hand, high resolution gives good accuracy, but on the other hand, high resolution increases computational time. The degree of resolution, which is necessary, also to a large degree depends on what the models are to be used for. While high resolution is needed for detailed well planning, estimating uncertainty in oil reserves requires running a large number of predictions, but does not require very accurate results for individual wells. Multiscale modelling is currently an active area of research within computational science and applied mathematics, and at the Department of Mathematics, UiB, one has worked on methods where the model resolution varies continuously both in time and space.

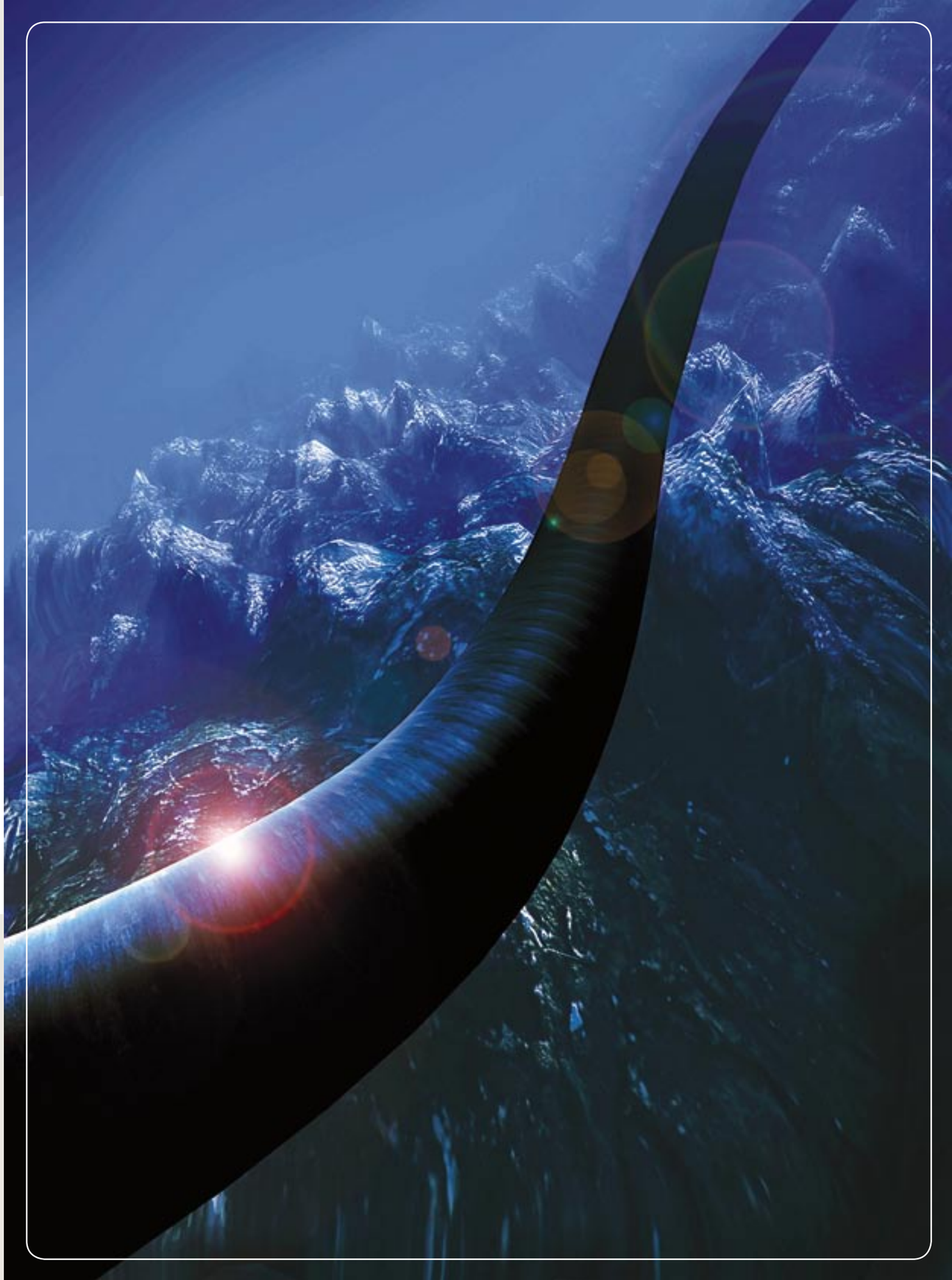
In one of the projects at CIPR we have developed techniques for multiscale history matching, and the results so far indicate that by using these techniques one may both speed up the process and at the same time generate models with different resolution, all being conditioned to the dynamic data. This means that not only do these techniques make the history-matching process more efficient, but one also obtains a suite of models suitable for different purposes. We also work with methods where the resolution in reservoir properties is gradually refined in a "clever" way, and the objective is to find the finest resolution warranted by the data (Adaptive Multiscale Estimation). Using these techniques also requires efficient methods for minimizing cost functions. As a part of a PhD project at CIPR, such a technique is implemented in an in-house reservoir simulator, and as far as we know, this is the first implementation of such methods in a compositional simulator, that is, a reservoir simulator where the oil and the gas may be split into their individual chemical components. In addition, new methods for the minimization of cost functions are developed in a separate CIPR project, which has direct support from the Research Council of Norway through the Petromaks programme.

UiB wins competition for petroleum projects

The University of Bergen is involved in more petroleum research projects than any other institution in Norway. The Research Council of Norway has gathered all petroleum research into a single major programme called Petromaks, whose overarching aim is to help keep Norwegian oil production going for another fifty years. The University of Bergen has been given funding for eight projects in the programme, and the University is also participating in five projects in which another institution is the lead partner with the Research Council.

"The projects will have a duration of three to four years, a time-scale which will enable us to engage a good number of new research fellows," says Arne Skauge, research director at the Centre for Integrated Petroleum Research (CIPR).

Photos: Hydro



Twenty-five years of development research

In the course of the past 25 years the University of Bergen has distinguished itself both nationally and internationally through its goal-oriented cooperation in research and education with universities in developing countries.

A number of academic and administrative positions have been earmarked for this purpose, and significant amounts of internal funding have been allocated to the field. Development research is one of the two main areas of emphasis in the University's Strategic Plan, and we have set up special centres for development research in which all of our faculties except the Faculty of Law are active. In the field of global health research, the University of Bergen has the largest research and education group in Scandinavia, comprising 14 academic positions, eight of which are chairs, while 130 MSc and PhD students are studying global health problems. More than 60 research projects are coordinated by the University.

These efforts have produced particularly good results within the NUFU programme, in which the University has been one of the main participants since it started in the early 90s. We have also put a great deal of effort into developing English-language programmes of study, which have been recruiting students from developing countries financed by the Quota Scheme and the NORAD Fellowship Programme since the mid-90s. The Masters programme in Gender Research and Development is Norway's most popular English-language MSc programme, attracting more than 400 applicants from developing countries for the ten places available.

The University of Bergen has long-term institutional cooperative agreements in place with Makerere University in Uganda, research centres in Tanzania and South Africa and institutions in Vietnam, Bangladesh and Malaysia.

In Tibet, the University has been involved in NORAD-supported projects in Lhasa since 1995, and has taught more than 20 members of staff of Lhasa University. One important feature of our work in development research is that we have managed to a great extent to combine these different elements in appropriate ways and integrated our efforts into the regular academic work of many of our own prestigious academic groups.

Photo: Scanpix

Ensuring that vaccines are distributed fairly

Photo: Francesco Zizola/Medecins Sans Frontieres

Thirty million children are still not getting the vaccines they need, and every year between two and three million children die of easily preventable diseases. Recent studies provide further confirmation that it is the poorest children who suffer most.

"Figures from countries in Africa indicate that only a third of the poorest children are given vaccines, while two-thirds of children from better-off families are vaccinated. This shows that it is not sufficient to simply increase the resources put into vaccination programmes; we also need to improve our knowledge and discuss strategies for developing vaccines and distributing them fairly all over the world," says Professor Ole Frithjof Norheim of the Department of Social Medicine and the Centre for International Health at the University of Bergen.

Outstanding young investigators

Ole Frithjof Norheim trained as a medical doctor, but took his Ph.D. in the theory of fair rationing. He has received considerable funds from the Research Council of Norway in order to study the ethical basis for prioritizing health resources in countries where these are extremely limited. This is part of the Research Council's new scheme for outstanding young investigators. Norheim has worked for some time in Tanzania, where the annual per capita public health sector budget is about $8.00, a figure which faces decision makers with extremely difficult choices. What are the most sensible measures to use the money on?

"When we consider which diseases ought to be prioritized, for example with vaccines, there are three main criteria involved: the number of people who are affected or who die of a given disease, the cost efficiency of treatment and our knowledge of the effects of treatment. We also need to evaluate how sure we can be of our knowledge. Since the vaccines have often been developed in western countries, we do not always know enough about how they will act when they are used in developing countries," says Norheim, who mentions that in terms of cost efficiency, the new hepatitis B. vaccine is a winner.

Pneumonia and diarrhoea

In addition to the usual vaccines that all Norwegian children are given, effective vaccines for certain types of pneumonia have also been developed. Their availability, however, varies a great deal from one country to another, and this is largely due to the lack of money. Researchers point out that there is a great need to develop vaccines against the most common forms of pneumonia and diarrhoea, diseases which together still kill more than four million children every year. The unfairness of this situation is not only obvious at international level, but within any given country there may be great differences. Even in developing countries where they have good vaccination programmes, it is by no means certain that the children who most need help are those who receive it. Norheim emphasizes that the situation is complex and that it may involve a number of different causes.

Nevertheless he points out that the lack of knowledge is one important cause.

"In addition to good information campaigns it is also important to improve access to medical care. Many people, for example, cannot afford to travel to the nearest doctor".

www.cih.uib.no

Analysing the World Bank's view on poverty

A new poverty research project is analysing the publications of the World Bank (WTO).

"We want to find out why poverty in third-world countries is not being reduced in spite of the existence of huge piles of action plans and political resolutions" says Vigdis Broch-Due, Professor of Poverty Research at the University of Bergen.

The three-year project entitled "Poverty politics: Current approaches to its production and reduction" is studying whether the World Bank is dominated by a market-oriented mind-set that is incompatible with the cultures to which it supplies development aid.

The Research Council of Norway has given the project NOK 3 million to support its theoretical and empirical studies of poverty and of strategies to reduce it. The researchers will therefore be analysing discourses, ideas and perceptions that concern poverty, primarily in the World Bank and other development aid organisations, but also within the tradition of the social sciences.

The project will also carry out field studies in India, Kenya, Morocco, Guatemala, Bolivia and Argentina.

Most of the researchers involved in the project are anthropologists, historians and political scientists. The project will also have partners in developing countries.

www.svf.uib.no

75,000-year-old jewellery discovered

A find of shell jewellery in Blombos Cave in South Africa provides new evidence that "modern man" came from Africa.

The discovery, which was made by Chris Henshilwood of the Centre for Development Studies, was announced in the journal "Science" in 2004.

Archaeologists found 41 shells that look like small beads pierced with holes. With the aid of a unique dating, they have come to the conclusion that the shells are about 75,000 years old, i.e. some 30,000 years earlier than any previously recognised personal adornments.

Using symbols

Blombos Cave lies in the De Hoop Nature Reserve on the east coast of South Africa, about four hours' drive from Cape Town, where Henshilwood has already made some remarkable discoveries. Bone implements and parts of abstract engravings presented in 2002 reinforced the theory that not only anatomically modern humans but "modern man" had their origins in Africa. Even though there is no longer any doubt that the anatomically modern Homo sapiens originated in Africa between 300,000 and 150,000 years ago, it has been widely assumed that modern behavioural traits developed for the first time in Europe about 40,000 years ago. The finding of these 75,000-year-old personal adornments provides yet more evidence to the contrary.

"This indicates that people were already using symbols in the same way as we do, as a communication strategy. We might say that the bead jewellery is the earliest evidence of storage of information outside the human brain," maintains Henshilwood.

New dating method

The shells, which were found in clusters of up to seventeen beads, are from a tiny mollusc known as Nassarius kraussanius which lives in river mouths and must have been brought from a nearby river 20 km either east or west of the cave where they were found. The shells seem to have been selected on the basis of size, and the holes that turned them into beads were probably made on the spot, before they were brought to the cave. Traces of red ochre suggest that the shells, or a surface that they had been in contact with, were coated in this widely used pigment.

Chris Henshilwood mentions the technique known as Optically Stimulated Luminescence (OSL), the new, highly accurate method used to date the shells.

"Put simply, we can say that we have stimulated the grains of sand that surrounded these objects by means of a special light source in the laboratory, causing them to release the energy that they absorbed when they were exposed to sunlight. Measuring this energy in thousands of individual grains has enabled us to establish with a fair degree of precision that the sand has been buried for 75,000 years".

www.svf.uib.no/sfu

Photo: National Science Foundation

Breastfeeding advisable in spite of risk of HIV

The Centre for International Health is coordinating an EU project that will document the benefits of breastfeeding, even in regions where many mothers are HIV-positive.

Fifteen million children could be saved in the next ten years if they were given only breast milk. However, many mothers are currently advised not to breastfeed because of the risk of HIV infection.

Powdered milk puts health at risk

"The seventies really showed us what could happen to many African children who were not breastfed. Even today the use of breast milk substitutes is highly risky for children, because conditions in large areas of Africa are such that they cannot be prepared properly. When health personnel stop recommending breastfeeding for fear of transmitting HIV from mothers to children we risk that many more children will die of severe malnutrition," says Thorkild Tylleskär, director of the project "Promoting infant health and nutrition in Sub-Saharan Africa," which has partners in seven countries and will build on already well-established relationships between researchers at institutions in the South and the North. Experts on the biology of HIV and specialists in child health are working in this area in order to ensure as well as they can that children will have a future.

Without treatment we can expect that around 30 percent of all HIV-positive pregnant women will be capable of transmitting the disease to their children in the course of pregnancy, birth or breastfeeding. However, in most places HIV-positive mothers will now be given medical treatment in the form of a single dose of Nevaripin at the onset of labour, and the baby will be given a little mouthful as soon as it is born. This has been shown to prevent infection in many cases, but there are few well-documented studies of what should be done next.

Counselling is essential

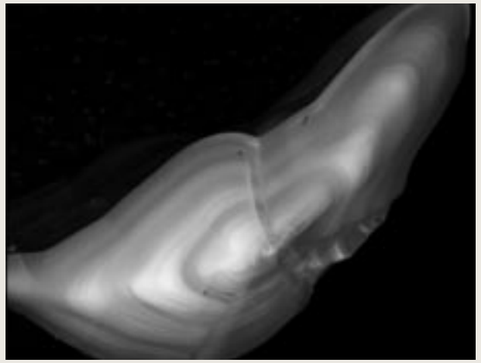
"If HIV-positive mothers breastfeed for about eighteen months, there is an estimated 15 percent risk of infection. In 1998, therefore, WHO, UNICEF and UNAIDS recommended that such mothers should use breast milk substitutes when these are reasonably priced, sustainable and safe in use, and the following year these UN organisations launched a pilot project that distributed free breast milk substitutes at a number of clinics in nine African countries, among other places. Unfortunately, the UN did not follow up the children who received the milk substitute, but in many places, they gained the impression that it did more harm than good. In Uganda, for example, there was a sharp rise in the number of malnourished children during that period, says Tylleskär.

In South Africa, HIV-positive mothers are still offered free breast milk substitute for six months. In addition to the problem of supplies that are often unreliable, in areas without electricity or a piped water supply it is difficult to prepare the milk properly.

This underlines the importance of counselling in order to persuade mothers that they should simply continue to breastfeed. In this EU project we will be studying the importance of using voluntary non-professional advisors, or "peer counsellors" as they are called, who are in a similar situation and live near the new mothers," says Tylleskär.

Photo: Silje Gripsrud

Secrets of the otoliths



A group of researchers from disciplines as diverse as climatology, fishery biology, geochemistry, palaeozoology, anthropology and archaeology are studying cod otoliths in the search for important historical data.

Scientists have long been using otoliths to determine the age of individual fish. The otolith has a crystalline structure of calcium carbonate, which grows very slightly every day in the life of a fish. It lies within a fluid-filled pocket, and acts as a stability organ. The number of layers that the otolith consists of tells us how old the fish is, in the same way as we can find the age of a tree by counting its annual rings. By combining different types of expertise and analytical methods, however, we can obtain a great deal more information from these tiny structures.

Revealing historical climate data

Because the otoliths grow with every new layer of material deposited, its chemical composition can tell us something about where the fish has lived, and for how long. Otoliths from fish from the Baltic, for example, contain more barium and less strontium than those of the ones from the coast of Norway. Findings of this sort tell us something of imports and trading patterns in the Middle Ages, and about how resources were exploited. They also enable us to read off the temperature: the ratio of two isotopes of oxygen in otoliths is temperature-dependent. In collaboration with the University's Bjerknes Centre, the temperature is measured on a monthly basis, and this provides an overview of summer and winter temperatures far back in time.

"The otoliths can also help to produce important data regarding climatic change at high latitudes. We can supply both raw data for climate models and data on human behaviour in historical time," says Professor Audrey Geffen of the Department of Biology.

While a good-quality sediment core can provide information on temperatures on a ten-year to fifty-year timescale, the otoliths are capable of providing information about variations in the course of a single year. Among other things, it is possible that some of the changes that had been observed in the production and availability of certain species of fish have been closely related to short-term alternations in climate and temperature.

International expertise gathers in Bergen

"What interested me was that this was a very "Norwegian" project, at the same time as it is of international calibre. It has basically grown by itself. We had no need to look for expertise elsewhere, because everyone was here already. This is where the internationally recognised research groups are, and we also have the high technology we need to perform the analyses," says Geffen, who herself comes from the USA. The investigators in the project belong to the Departments of Biology and Geosciences, as well as the Natural History Collections, the Bjerknes Climate Research Centre and the Institute of Marine Research.

Humanity influences evolution

Laboratory experiments on fish have shown that the age of sexual maturation can be altered in the course of only four generations. This is extremely rapid, in that evolution is something that usually takes place in a temporal perspective of millions of years.

Changes in the temperature of the ocean could have serious consequences for fish on the coast of Norway.

"Both fishing and pollution have turned human beings into one of the driving forces of evolution. Now we need to know which species we are in the process of modifying and whether they are robust enough to be able to deal with future climatic changes," says Christian Jørgensen of the Department of Biology, who is using advanced computer software to simulate evolutionary processes in fish and to study how their physiology and behaviour are altered when changes occur in their living conditions.

Rapid changes

Ecosystems have always been liable to undergo major dramatic changes, while many individual species are highly adaptable. Research has shown that the age of sexual maturation in the cod has changed in the course of the past 70 years. In the 1930s, cod became sexually mature at the age of ten or eleven years, while today they mature when they are eight years old. Although evolution is taking place rapidly, it is difficult for scientists to predict how fish will respond to the climate changes caused by human beings which we have witnessed during the past few years.

The living conditions of fish can be changed quite dramatically if the temperature of the sea rises. A typical consequence for marine species is that they alter their distribution range. If this happens, the species concerned may overlap with other species more than before, which may affect these species in turn. The consequences may include changes in the food available to the fish, or that they are faced with new predators. Such factors affect mortality and growth and may also have consequences for our own access to fish resources.

We fish too much

Jørgensen emphasises that it is difficult to predict changes of this sort.

"An ecosystem is a network in complex balance. There are so many mutual dependencies, that changing just one component may have serious consequences for the whole system, while other changes will have virtually no effect at all. This is why it is important to predict how fish species will evolve, so that we can suggest which of any set of scenarios is likely to occur. A report drawn up by the UN Food and Agriculture Organisation (FAO) shows that in a global perspective, fishing has reached the upper limit of sustainability.

"More than a quarter of fish stocks are in a critical situation, while half of them are being maximally exploited. This means that there is an enormous pressure to catch fish all over the world. In our models we can see that fishing changes the cod as a species. Modern fishing has "created" a small fish which may be very sensitive to changes in the length of its migrations," concludes Jørgensen.

Photo: Norwegian Seafood Export Council

Effects of muddy water

The ETHOFISH project is studying the effects of muddy water (turbidity) and reduced oxygen availability.

The size and scope of anthropogenic disturbances in coastal marine ecosystems in Europe has greatly increased in recent years. The EU's ETHOFISH project is looking at the effects of muddy water and oxygen insufficiency on three critical components of the interactions between a fish species and its environment: habitat selection, predator-prey interactions and schooling. Justin Meager and Anne C. Palm of the Department of Biology at the University of Bergen are responsible for the international project.

Laboratory studies have made it clear that turbidity and availability of oxygen are two powerful influences on fish behaviour, which means that they are important ecological variable in determining fish distribution patterns.

The effects of changes in oxygenation or turbidity conditions on coastal fish stocks have been little studied, in spite of the important role played by coastal waters on stocks of a number of important species of fish. Among other things, ETHOFISH will perform experiments to identify threshold values of oxygen and turbidity which, if they are breached, will result in changes in the physiology or behaviour of fish.

One of the aims of the project is to develop conceptual and situation-specific models capable of dealing with environmental problems; another is to support the development of the EU's environmental policies and regulations.

www.ifremer.fr/ethofish

Creating virtual fish

The Department of Biology is employing advanced computer technology to study how fish are being affected by climate change. Scientists are bringing together what is known about how fish function, and are attempting to create a "virtual fish" in the computer. An ordinary PC can simulate the behaviour of whole shoals of such artificial fish. More and more mechanisms are added to a model, until the simulated stock behaves more or less as it would in nature. A model allows us to simulate a change in climate, for example by increasing the temperature or changing the availability of food. We can also study the effects of combining two effects that have not yet occurred simultaneously under natural conditions, such as a rise in temperature and increased fishing pressure.

Surprising genetic finding

Scientists from the Sars International Centre for Marine Molecular Biology have presented completely new findings on the HOX genes - the "software" for animal design.

A few years ago, the scientists discovered the smallest genome among vertebrates in a tiny urochordate that goes by the name of Oikopleura dioica. The organism is about 5 mm long and its genome consists of only 70 million megabases (Mb). Although the human genome is forty times larger, Oikopleura is an excellent model organism. Studies of its compact genome may help to shed new light on the human genome, and scientists at the Sars Centre have already made a number of surprising discoveries.

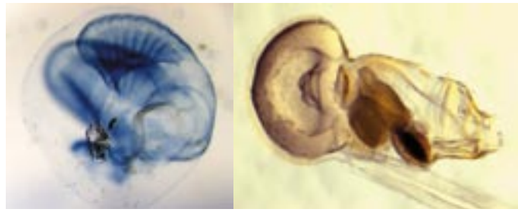
Their studies involved examining what are known as HOX genes. These important genes are common for all animals and they help to control development from the stage of the fertilised egg to the formation of the general body structure. In human beings, they make sure that our fingers and ribs, for example, grow to the right shape and length.

In every species from the insects to human beings, the HOX genes lie clustered together in the chromosomes like pearls on a string. Scientists also believe that this grouping and sequence of the genes was of importance for their ability to function in a proper and coordinated way, i.e. that the HOX gene that lies first on the chromosome, for example, controls the development of the posterior part of the brain, while number two affects the upper part of the neck, and so on along the main axis of the body. When the scientists at the Sars Centre found these genes in Oikopleura dioica, however, it turned out that this was by no means the case. In this species, the genes do not cluster, although it looks as though they function in the same way as in animals in which they do.

"This finding is interesting because it indicates that the generally accepted theory regarding the position and function of the HOX genes is over-simplified. This work is also of importance for our understanding of how body shapes develop in the animal world in general," says Rolf Brudvik Edvardsen, a research fellow who is co-author of the article "Hox cluster disintegration with persistent anteroposterior order of expression in Oikopleura dioica," which has been published in the journal "Nature".

The research is led by Professor Daniel Chourrout, director of the Sars Centre, which has also been cooperating with two other centres of genome research in Paris and Berlin.

The Sars Centre is Norway's representative in the European Molecular Biology (EMBL) network - a heavyweight in European research. This means that in the course of only a few years, the Centre has won recognition as the foremost European research institution in its field.



Oikopleura dioica

Point of focus for European cancer research

The University of Bergen will be the European point of focus of one of the most important areas of modern cancer research

Angiotargeting focuses on identifying and confirming hitherto unknown therapeutic targets in the blood-vessels of cancerous tumours.

The objective of the four-year research project "Angiotargeting," which has received funding of nearly NOK 50 million by the EU, is to identify hitherto unknown genes that regulate tumour angiogenesis, the formation of blood-vessels in tumours. Among the main objectives of the project is to offer patients better treatment by developing molecular treatment methods aimed directly at tumour blood vessels.

Best in Europe

In the past few years, research on communication between cancer cells and normal cells during the generation of new blood vessels has been arousing ever greater interest. Many scientists believe that improving our understanding of the mechanism that underlie the formation of new blood vessels is a promising strategy in the fight against cancer.

In tough competition with other institutes throughout Europe, the Neuro-oncology Research Group at the Department of Biomedicine, led by Professor Rolf Bjerkvig, has been given the role of coordinator of a wide-ranging project. Bjerkvig took the initiative in establishing a European research collaboration, and has selected a group of highly regarded research partners. Fourteen research institutions and 19 research groups are involved; partners include the University of Oxford and the Karolinska Institute.

Virtual institute

The angiogenesis project is being created as a virtual research institute, in which research is carried out in several countries, not to mention in various fields. The research has been organised into seven work-packages, the first two of which comprise clinical research.

"Angiogenesis research is a central aspect of modern cancer research. With traditional treatment with cytotoxins we often find that the cancerous cells develop resistance to the cytotoxin, which may prevent treatment from being successful. In this new type of treatment we want to attack the genetically stable vascular cells, which are less likely to develop resistance. By destroying the blood vessels in this way, we will be able to block the supply of nutrients to the tumour and thus kill the cells," says Frits Thorsen, a researcher at the Department of Biomedicine.

Testing molecular medicine

Professor Bjerkvig and his neuro-oncology research group at the Department of Biomedicine have been working for several years on the development of experimental models that describe how cancer cells grow. The group has been looking in particular at the biological mechanisms that control the ingrowth of blood vessels into tumours.

"Here at the University of Bergen we will continue to do basic research on angiogenesis. With the aid of advanced experimental models, for example, we will have the possibility of remove blood vessels from tumour tissue, which will let us test agents directly on vascular cells. Our results can then be evaluated for trials in clinical research" says Frits Thorsen.

Much of the clinical research will take place in the Netherlands and at Oxford, but it is hoped that some of this work will also come to be done in Bergen. The clinical centres involved in the project will test the effects of certain promising therapeutic agents that are already on the market. Samples will be taken from patients before and after treatment in order to find out whether particular treatments modify the expression of genes and proteins in cancerous cells.

www.uib.no/med/biomed

With NOK 50 million in EU funding the University of Bergen is bringing together European research expertise with the aim of identifying genes that control the formation of blood vessels in cancer tumours. (Illustration photo: Marius E. Hauge)

Interdisciplinary focus on mental health

At the Bergen Mental Health Research Center, psychologists, psychiatrists, geneticists and basic neuroscience researchers are working together to improve our understanding of mental problems.

Serious psychiatric problems such as schizophrenia and manic-depression are major causes of stress for sufferers and their families, and are also among the most expensive types of illness to treat. Although some scientific breakthroughs have been made in the fields of genetic material and treatment, there are still important gaps in our understanding of these illnesses that prevent us from providing better treatment for this group of patients.

Genetics and effects of treatment

"If we are to make any progress in this field, we will need to adopt an interdisciplinary perspective and take an integrated look at basic brain mechanisms, genetics, neuropsychology and clinical psychiatry. This is why we set up the Bergen Mental Health Research Center, a place where leading experts in these fields of research can work together," says Hugo Jørgensen, Professor of Psychiatry at the University of Bergen and leader of the centre's clinical psychiatry group.

In the course of the past few years, a good deal has been done to identify genetic explanations for why certain people become ill. Scientists have also been looking at genetic effects in terms of their ability to predict the effects of treatment and the risk of side effects.

"The problems that we are studying are extremely complex, which makes it difficult to start out from a basis of traditional diagnostic criteria. Patients with schizophrenia, for example, can be very different," says Jørgensen.

Mapping memory and language

The centre will not only study the classic symptoms of psychosis, but will also include cognitive functions such as memory and language in the mapping process. New ways of grouping patients will offer a better point of departure for research and treatment.

One aspect of the research involves the use of functional magnetic resonance imaging (fMRI), a method on which Kenneth Hugdahl, leader of the centre and professor of biological psychology, has done a great deal of work. An advanced MR instrument, jointly owned by Bergen Health Region and the University of Bergen, has recently been installed at Haukeland University Hospital. This has given the centre access to a more powerful advanced tool than it had before, increasing its ability to use fMRI to study both healthy people and patients with psychiatric problems. This is important in attempts to relate mental disease to genetics and cognitive functions.

"The new machine will enable us to study a larger number of people and will help us to obtain better results," says Hugdahl.

The instrument produces an image of brain activity without the use of radioactive irradiation (x-rays). This means, for example, that we can see where individual cognitive functions are located, or study how patients respond to therapy or medicines.

Strong international links

"Utilising the results of basic research and relating cognitive functions to genetic information will enable us to learn more about how genetic material determines the type of symptoms we suffer, mental functions and reactions to medical treatment," says Hugo Jørgensen.

The Bergen Mental Health Research Center consists of groups of people from four fields of research: functional genomics, basic neurosciences, clinical psychiatry and cognitive neuroscience, the last of which is led by Professor Hugdahl himself.

"We also have strong international links: four of our research fellows are financed by the German Krupp Foundation, which has also financed fellowships at the Universities of Greifswald and Trier. This means that these research fellows are part of the international research milieu from the very start," says Hugdahl.

fmri.uib.no

Photo: Magnus Vabø

Cultural values override principle of equality

Patriarchal values are being interpreted into the texts of the Koran and are preventing women from participating in discussions of the laws and their significance. Islam has become an instrument used to justify discrimination of women.

Henriette Sinding Aasen, Associate Professor at the Faculty of Law, is working on a research project on the legal rights of women in the Islamic Republic of Iran in the light of its history, religion and legal development. The point of departure for her project is "Democracy, Human Rights and Islam in Modern Iran: Psychological, Social and Cultural Perspectives," a book which she has written in collaboration with Nobel Peace Prize-winner Shirin Abadi, and other co-authors.

Challenging the legitimacy of current legislation

Women's rights are severely limited in contemporary Iran. The objective of Sinding Aasen's research is to investigate the legitimacy of Iranian laws that discriminate against women. Among other things, she aims to show that it is the patriarchal nature of Iranian culture rather than Islam that has played a decisive role in determining the content of Iranian family and criminal law. A married woman is regarded as the property of her husband and the legal system identifies the man as the head of the family, with the right to rule over women, for example with regard to their work. This is in spite of the fact that one of the basic principles of Islam concerns the equality of persons, irrespective of their colour, race or sex. Sinding Aasen believes that the patriarchal interpretation of the text of the Koran has its origins in a view of women that dates back to before the time when Islam became the official religion in Persia.

Culture from the past

Islam was born in Arabia at a time when women were regarded as the property of men, and new-born girls were often killed. The Prophet Mohammed, the messenger of Islam, rejected traditions that were hostile to women and introduced reforms in line with the message of the Koran. Important among these was the prohibition against killing girl children and the requirement that women should consent to their own marriage. In Persia, patriarchal traditions were well-established when Islam was introduced as a result of the Arabian invasion in 636. In its meeting with Persian civilisation, the radical message of Islam was modified. In Persia, as in other places where Islam was introduced, the early patriarchal traditions were gradually incorporated into Islam, a practice that also helped the new religion to gain acceptance.

The revolution a disappointment for women

It is true enough that in some of the Koran's texts, the man is identified as having authority over women. Sinding Aasen believes that these texts have been given too much significance and that they need to be seen in their historical context. It is the basic principle of equality that can claim to be the general rule.

An undemocratic society emerges when some individuals are given a monopoly on interpreting the authoritative texts while others are excluded, in the way that women in Iran have been prevented from interpreting the laws that play such a decisive role in their lives. The Islamic Revolution was a particular disappointment for the women of Iran. Many of them, including Shirin Ebadi, supported the revolutionaries' resistance to the Shah, but they did not anticipate that the legal position of women would come to be radically weakened by the Islamic Revolution. Few of them suspected that women would be made invisible in society, a condition that the requirement to go veiled and completely covered bears witness to.

"If men had interpreted the Koran with an open mind and had included the voice of women, the situation would have appeared very different," believes Sinding Aasen.

www.jur.uib.no

Photo: Scanpix

Terror changes the character of criminal justice

The UN "stretched" its mandate when the Security Council passed Resolution 1373. For the first time in the history of the world, the international organisation assumed the role of international legislator.

One consequence was that the character of criminal justice at national level was changed. Law professor Erling Johannes Husabø does research on how the internationalisation of criminal justice has contributed to a change in the character of this area of the law. His work include a comparative study of the implementation of Resolution 1373 in criminal legislation in Scandinavia, Germany and The Netherlands. Criminal justice in these countries is based on a common legal culture, although there are interesting legal and political differences between them.

"Stretching" the mandate

Husabø believes that the legislative role assumed by the Security Council in Resolution 1373 is problematic. This is because the Resolution is not related to a concrete situation that threatens world peace, as Article 39 of the Charter of the United Nations appears to require, but refers to a general problem currently facing the global community, that of international terrorism. Extending sanctions to individual persons, as was done via the Taliban black-list, is also an instrument of a different character than was intended for the Security Council when the UN Charter was adopted.

Black-listing means that all states are obliged to freeze all types of financial assets that belong to persons named on the Taliban list and to forbid any type of financial transaction with them. When such serious measures on individuals are adopted by an international organisation that can require nation-states to implement the resolution, the guarantees of due process usually extended by states to indvidual citizens are set aside. The European Union has assumed a leading role in the implementation of new anti-terror measures among its member states. The Security Council's requirement regarding criminalisation has been given concrete form via the EU's framework agreement on terrorism. This in turn has been implemented in the body of criminal law of individual countries. The EU has also introduced a system of black-listing terrorists.

When international bodies extend their own legislative mandates, national parliaments are weakened. People risk punishment for breaking laws that they themselves have not accepted (i.e. voted) to be punished for. Husabø's comparative study of changes in the criminal law in these five countries will shed light on the mechanisms that come into operation when international rules are implemented at national level.

Pro-active criminal justice

Resolution 1373 laid an obligation, which had the force of international law, on all UN member states to criminalise a number of different types of activity, to freeze the financial assets of terrorists and act to prevent recruitment to terrorist groups. This produced changes in international decision-making processes with respect to the design of criminal legislation. The world was given a new type of legislation that is contibuting to changes in the character of national criminal justice. Traditionally, criminal laws have been activated after a law has been broken (reactive criminal justice). Terrorism, on the other hand, makes it necessary to prevent serious activities from taking place (pro-active criminal justice).

The new laws aimed at combating terrorism have a tendency to subjectivise criminal responsibility to a greater extent that traditional criminal law. They focus on the underlying motivation of the individual rather than what he intends to do in terms of the specific action involved. Norwegian criminal law, for example, has already gone far in the direction of criminalising the financing of terrorism. In such cases it is the existence of the intention to sow terror, or awareness that the receiver has such an intention, that determines what is legal or illegal in raising funds. However, the terror motive is extremely difficult to demonstrate. When there are few indices that can be based on the external action, the person's social environment may well be used as evidence of his motives. This obviously brings in its wake the danger of doing suspects an injustice.

Attracted by philosophical writings

A lively international group of researchers meets every day to discuss the writings left behind by Ludwig Wittgenstein and their publication by the University of Bergen.

Wittgenstein was one of the most significant and influential philosophers of the twentieth century. He also influenced disciplines as diverse as linguistics, psychology, cybernetics, law, anthropology and aesthetics, but he published only a single work of philosophy during his lifetime; the Tractatus Logicus-Philosophicus. He had a close relationship with Norway, particularly Western Norway, and many of his most productive periods of activity were spent in this country. His thinking had a profound influence on post-war Norwegian philosophy. When he died in 1951 he left around 20,000 pages of unpublished manuscripts. Many of these writings, usually known as "Wittgeinstein's Nachlass," have subsequently been published in book form.

The Wittgenstein Archives was established in 1990 with the objective of producing a complete machine-readable version of the Nachlass. This task was completed in 1990, and in 2000 the complete Wittgeinstein Nachlass was published on CD-ROM by the Oxford University Press. The Wittgenstein Archives is currently concentrating on the maintenance and further processing of the machine-readable version and the publication, besides looking after its guests and visitors and performing its own research on Wittgeinstein's philosophy, his writings and digital edition philology.

When the Wittgenstein Archives was awarded the status of "European Research Infrastructure" in 2001, it was the first humanist discipline in Europe to gain this distinction. In the past three years, the funds that came with status as a Research Infrastructure have enabled a large number of young European academics to come to Bergen to study at the Wittgenstein Archives. Here they can go into his writings in depth, study the Wittgenstein Archives' publication methods and build up their networks of contacts.

www.aksis.uib.no.wab

Hunt for the oldest signs of life on Earth

Studies from 3.5 billion-year-old pillow lava in South Africa offer new evidence in the hunt for the oldest life on Earth.

Research on the origin of life has taken off during the past few years, and at the forefront of studies on this topic we find research groups at the Department of Geosciences at the University of Bergen. A great deal of international interest was aroused a few years ago when Harald Furnes, together with geologist Ingunn H. Thorseth and marine biologist Terje Torsvik, showed that micro-organisms and bacteria can be found several hundred metres below the seabed, without access to sunlight and fed by chemical substances in volcanic rocks.

International debate

Furnes has used these "biomarkers" to find out just how far back in time we can trace living organisms. Findings from the Barberton Greenstone Belt in South Africa indicate that they go back 3.5 billion years in time. The oldest traces of ancient life forms that are not in dispute today are "only" 2.7 billion years old.

An international debate is under way regarding whether ancient finds of biological material are capable of being confirmed. Australian fossils found in sedimentary rocks in the 80s suggested that life already existed on Earth 3.5 billion years ago. Towards the end of the 90s, geologists believed that they had found microscopic particles of carbon in a 3.87 million-year-old stone from the Isau Belt in Greenland - 700 million years after the formation of the Earth. However, doubt was cast on these sensational findings when other researchers managed to demonstrate identical processes without the help of bacteria, but by changing conditions such as pressure and temperature.

Little affected by geological conditions

The area in which the studies were carried out has not been particularly affected by subsequent geological processes, so that it is relatively unaltered. The researchers studied a number of parameters that provide good indications that their findings are of biological origin. All the studies done in the area point in the same direction: that there was organic life in these rocks 3.5 billion years ago, a short time after the formation of the primal sea. Furnes and his colleagues go back to the early history of the Earth and study the topmost layer of the ancient seabed crust, a 500-1000-metre thick layer of lava pillows. These pillows all display a rim of glass, because their outer layers have cooled so rapidly. The bacteria colonise the glass surfaces, which provide them with nutrients and energy, and etch their way down through the glass, gradually creating a network of microscopic tunnels only a couple of micrometres in diameter. The structure of these tunnels is very similar to others that have been found in pillow lava beds in "modern" ocean crust that is still covered by the sea.

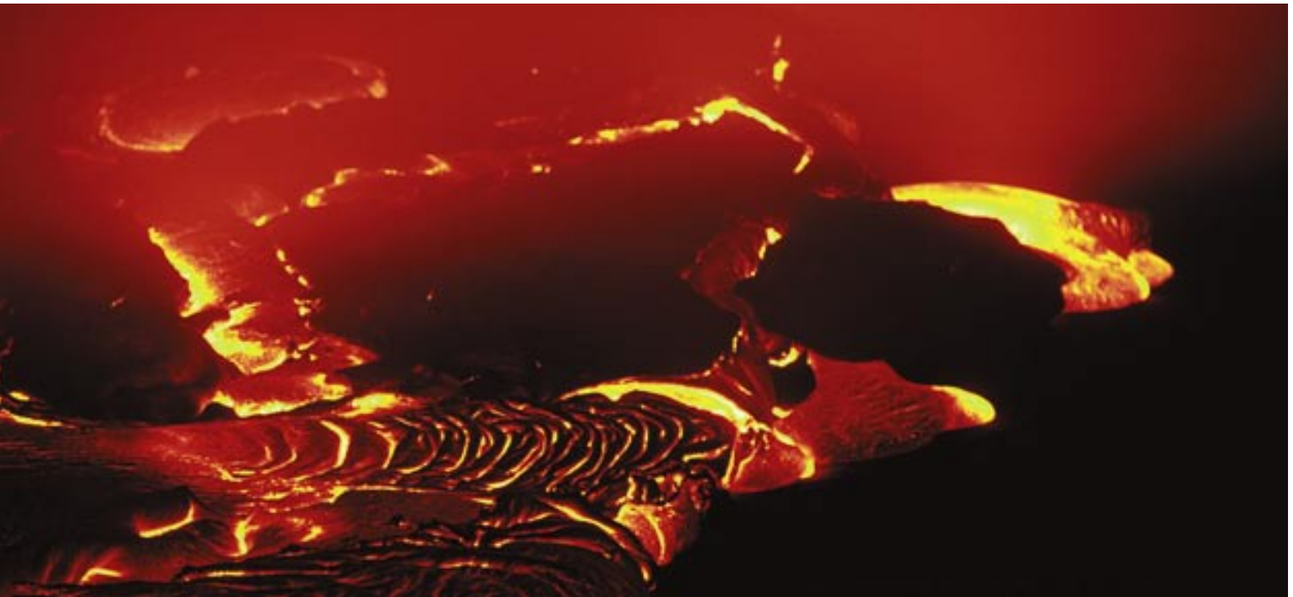
Everything suggests organic material

"Water originally brought the bacteria into tiny natural crevices in the glass, and it was here that they found a means of survival. One of the methods we used to demonstrate that these tunnels were created by bacteria was to study carbon levels in the material, which confirmed that it contained organic material. Comparisons of the isotopic composition of the cracks in the glass rim and in the centre of the pillows produced the same results," says Furnes.

Glass soon turns into minerals, and the glass rims of the lava pillows have been transformed into chlorite. Samples taken from the Barberton Greenstone Belt show that the chlorite has grown over the tiny tunnels formed by the bacteria, supporting the theory that they settled on the glass not long after the lava had cooled sufficiently to allow them to survive, at about 100 degrees Celsius.

"The rocks have been dated to 3.5 billion BP, so the traces of organic material would seem to be about the same age," says Furnes, whose work was presented in the journal "Science" in 2004. The article entitled "Gas or life" achieved 14th place in "The Year in Science: Top 100 Stories" in 2004.

www.geo.uib.no



Magnetic footprints in the heavens

Photo: Samfoto

The aurora borealis, also known as the northern lights, is the visible result of interactions between the Earth and the Sun. Among other things, the aurora can tell us how the Sun distorts the Earth's magnetic field.

"Ideally, we should have had two satellites with cameras that would be able to look down on both poles at the same time," says associate professor Nikolai Østgaard of the Space Physics Section of the Department of Physics and Technology.

Displaced northern lights oval

The scientists do not have two satellites, but in 2001 and 2002 the orbits of the Polar and IMAGE satellites occasionally made it possible to observe both polar regions simultaneously. Space research depends on satellites to be able to make proper measurements. And we still know so little about conditions in near-earth space that nearly all the knowledge we do have is basic knowledge.

"In our study we looked, among other things, at data from an aurora outbreak on September 13 2001. On that occasion we found a displaced northern lights oval, when the auroras in the northern and southern hemispheres took roughly the same form, but were distorted vis-à-vis one another," says Østgaard.

Charged particles produce the aurora

The aurora appears when charged particles are captured by the Earth's magnetic field and bombard the upper atmosphere, where they are braked and their energy is transformed into light, which we can observe as the northern and southern lights in two huge ovals that surround the magnetic poles. Before they are braked by the atmosphere, the particles are "bound" to the lines of a magnetic field and they spin round these field lines, back and forth from north to south. If we think of the Earth as a magnetic dipole, we should expect that when we have the northern lights in the northern hemisphere there ought to be a simultaneous appearance of southern lights at the other end of the Earth, and the aurora borealis and the aurora australis (the southern lights) should appear to be identical and be located at the same relative positions over the two hemispheres. In practice it has proved to be quite difficult to investigate this. There are few observation stations in the southern hemisphere, and we are dependent on clear skies and darkness to be able to observe the aurora borealis from the ground. Furthermore, the field of view from an observation point on the ground is too limited to enable a single observer to take in the whole extent of the aurora.

The Sun's magnetic field affects the field of the Earth

The data from September 2001 clearly showed that the Earth's magnetic field is not symmetrical. In this case, the southern lights were displaced in the direction of the morning side relative to the northern lights, by as much as one and a half time zones. The explanation lies in the Sun's magnetic field, which is projected into space by means of the solar wind, a current of charged particles that are continuously emitted by the Sun. The Earth's magnetic field protects us from most of the solar wind, but within a limited area the two magnetic fields may become connected. It is in such situations that charged particles are brought into the Earth's own magnetic field, where they generate the aurora borealis and aurora australis.

"The Sun's magnetic field can thus force its way through, and also influence, the Earth's magnetic field, distorting it in such a way that the end points of the field lines become asymmetrical. Our analyses show that the displacement of the northern lights can be predicted quite well by the angle of the magnetic field from the Sun," says Østgaard.

The northern and southern lights are thus the footprints of the magnetic field lines that connect the northern and southern hemispheres. Their asymmetry is the visible result of the distortion of the magnetic field.

There exist rough models of how the magnetosphere behaves under given conditions. Østgaard and his colleagues have compared a number of observations with the models and found that while they support one another, the displacements are much greater than the models predict. There are thus several factors that drive the differences between the northern and southern lights, and the researchers now intend to find out more about many of these factors.

Space physics studies processes in near-earth space, particularly interactions between the Sun and the Earth. The Space Physics section of the Department of Physics and Technology is participating in a number of satellite experiments, and has also developed detectors that are used in satellites.

www.ift.uib.no/Romfysikk

Functional genome research

Functional genome research will be of significance for a number of sectors of society and will become one of the most important driving forces of the industries of the future. In 2000, some key players took the initiative to draw up a national plan to give this field a boost. The result of their initiative is the programme known as "Functional Genomics in Norway" (FUGE), which has an annual budget for 2003 - 2007 of NOK 150 million, from which the University of Bergen has received funding for a number of projects.

The University of Bergen is responsible for four national technology platforms and is an active partner in the Norwegian Micro Array Consortium. Investments in infrastructure account for some 60% of the funding granted to the University by FUGE, with the largest allocations going to the Computational Biology Unit (CBU) and the establishment of a Proteomics Units in Bergen (PROBE), which have received a total of more than NOK 60 million in support between 2002 and 2006. The largest projects are "Hereditary diseases: An empirical approach to ethical and psychosocial challenges" og "Expression and function of disease related genes in Atlantic salmon". Several career fellowships have been awarded, including one to Dr. Bjørn Tore Giertsen for a project entitled "Proteome analysis of acute myelogenous leukaemia (AML) Molecular mechanisms of cell death regulation in AML related to cytogenetics and prognosis."

Functional genome research has expanded as a new international field of research since the genetic material of human beings and certain animals, plants and micro-organisms was mapped. New technology has made it possible to study thousands of genes and proteins simultaneously. Functional genome research makes use of these methods to identify the functions of individual genes and proteins, and how they influence one another. This knowledge will not only provide the basis of a new understanding of biological processes, but will also give rise to new products and manufacturing processes. The programme will be funded until 2011.

Centre for International Health

Research and training programmes at the Centre for International Health (CIH) focus on poverty-related health problems in low- and middle-income countries. The centre has adopted a broadly-based approach to dealing with international health issues that include the promotion of health, prevention and treatment of diseases, palliative care, rehabilitation and health policy and health services administration.

Topics targeted by students and researchers cover a wide range of disciplines, including public health, clinical and nursing sciences, nutrition, tropical medicine, medical anthropology, demography, epidemiology, and health economics.

www.cih.uib.no

The Selmer Centre

-a research centre in coding theory and cryptography

The Selmer Centre for reliable communication is a research centre in cryptology and coding theory at the University of Bergen. The centre is named in honour of Ernst S. Selmer, Professor Emeritus at the University of Bergen and a pioneer in this field of research.

International cooperation:
FASTSEC - Marie Curie Training Site

The University of Bergen offers European doctoral students research training in fast and secure communication.

www.selmer.uib.no

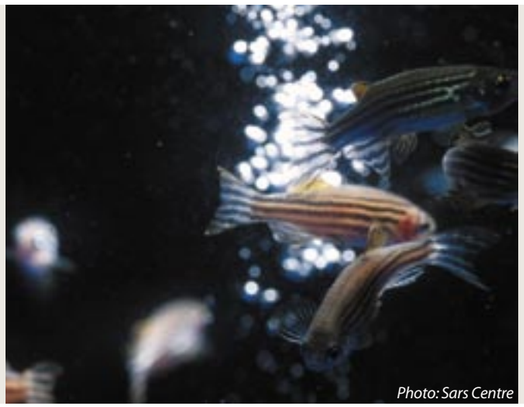


Photo: Sars Centre

Sars International Centre for Marine Molecular Biology

The Sars International Centre for Marine Molecular Biology comprises a number of independent research groups, each of which is subject to renewal after six years, and which perform basic research in the field of comparative molecular biology of marine animals. The programme has been defined in collaboration between the centre, its scientific advisory committee and the Research Council of Norway. Major model systems are the tunicate Oikopleura dioica, the zebrafish Brachydanio rerio, the sea anemone Nematostella vectensis and the freshwater polyp Hydra vulgaris.

The Sars Centre has been a partner of the European Molecular Biology Laboratory EMBL since June 19, 2003, and core funding has been awarded for a second ten-year period (2003-2012), with rapid expansion to eight research groups.

www.uib.no/fa/sars

Programme for health economics In Bergen

The Programme for Health Economics in Bergen, HEB, is a centre dedicated to economic research on health and health care. The principal objective of the centre is to generate knowledge about the organization and governance structures of the health care sector. Its main fields of research include economic analyses of resource use in health care institutions, and economic evaluation. The programme is based on economics and business administration but emphasises multidisciplinary research cooperation with medicine, health care institutions and other social science disciplines. The teaching and recruitment of young researchers to doctoral programmes are important aspects of the programme. HEB also participates actively in several international research networks in health economics.

heb.rokkan.uib.no

Programme for the study of Ancient Christianity (PROAC)

PROAC is an interdisciplinary group of scholars at the Institute of Classics, Russian, and the History of Religions, who study issues related to the emergence and development of Christianity, especially with regard to the complicated interactions between the new religion and its Greco-Roman environment. During 2004-2006 many of PROAC's activities will be financed via the "Highways and Byways" project.

PROAC also incorporates a graduate school. Important partners are the Centre for Medieval Studies (University of Bergen), and the PhD School of Religion/ Identity/Culture (Faculty of Theology, University of Aarhus).

PROAC is also a member of the Nag Hammadi and Gnosticism Network, in which scholars at the theological faculties in the Universities of Aarhus and Helsinki are PROAC's primary collaborators.

HOLBERG
PRIZE

The Ludvig Holberg Memorial Fund

The University of Bergen manages the Ludvig Holberg Memorial Fund, which was established by the Norwegian government in 2003. The main purpose of establishing the Fund is to award an international prize named Holberg International Memorial Prize for outstanding scientific work in the field of humanities, social sciences, law and theology. The prize shall be awarded annually and has a value of EUR 520,000. The aim of the prize is to contribute to raising the status of these disciplines in society and to stimulating children and young people to develop an interest in these fields. Professor Julia Kristeva was on 3 December 2004 awarded the first Holberg Prize.

The prize has been named after Ludvig Holberg (1684 - 1754) and is intended to honour his memory by focusing on the learned Holberg as an interdisciplinary scholar in the fields of social sciences, humanities and law. The Ludvig Holberg Memorial Fund also annually awards the Nils Klim Prize of EUR 29,000 to young Nordic researchers within the same academic fields as the Holberg Prize covers. Associate Professor Claes de Vreese is the first Nils Klim Prize laureate. *holberg.uib.no*

Research building of the future

The University of Bergen's Building for Basic Biological Research (BBR Building) houses some of the best-isolated test-rooms in the world, as well as state-of-the-art special rooms for research on infectious viruses.

The imposing building, which stands adjacent to Haukeland University Hospital, provides ideal conditions for carrying out advanced medical research.

An extremely advanced ventilation system ensures that air-flows do not become mixed, and in some rooms the atmosphere is kept below ambient pressure, in order that any air carrying infectious agents will not leak out through cracks in the walls and ceiling, in those premises, for example, where research is being done on antibiotic-resistant tuberculosis. The special rooms in the BBR Building are some of the most advanced of their kind anywhere in the world. They are screened against electromagnetic radiation by means of earthed steel plates, in order to allow electrical measurements to be made all the way down to cellular level without interference from external signals. There are also dedicated rooms for dissection practicals and studies of radioactive isotopes, and specially built rooms for making measurements of human brain activity, for example. The physiologists' experimental animals also live in the building, which is equipped with sluices where visitors and users have to shower and change their clothes in order to avoid spreading animal allergens. *www.uib.no/bbb*

Photo: Magnus Vabø

New research vessel

The hyper-modern research vessel G.O. Sars is operated by the Institute of Marine Research and is jointly used by ocean scientists, climate researchers and geologists from the Institute and the University of Bergen. The new vessel, which came into operation in 2003, represents the very latest in ocean-going research vessels, as it is capable of performing all types of tasks ranging from seismic measurements to trawling and routine sampling. The vessel replaces the two old ocean-going ships G.O. Sars and Michael Sars. This has brought about a significant improvement in efficiency, not least in terms of a reduction in the number of cruise days. G.O. Sars has been especially important for the performance of major integrated interdisciplinary projects in fisheries, geosciences and climate, such as MAR-ECO. *www.uib.no/gosars*

Photos: MAR-ECO

Global interest in subsea research cruise

The 2004 MAR-ECO Expedition returned with mysterious finds and hitherto unknown organisms brought up from the deep sea. The cruise along the Mid-Atlantic Ridge captured the imagination of a great number of people, and was covered by the press of 28 different countries.

The expedition, organised and run by the Institute of Marine Research and the University of Bergen, was discussed on the Internet, newspapers and TV all over the world. Its studies of the Mid-Atlantic Ridge and finds of exotic and unidentified species have evidently aroused a great deal of international interest.

Unknown mountain range

R/V G.O. Sars, the expedition vessel, operated between Iceland and the Azores over the northern part of the Mid-Atlantic Ridge, an enormous volcanic mountain range that stretches from north to south through the whole of the Atlantic Ocean. The catch that was brought back to Bergen contains enough material and observations to keep marine research groups occupied for several decades.

Now the task has begun of systematising and analysing more than 80,000 specimens of fish and octopus species, not to mention a large number of different types of plankton, all of them from areas of the planet that have never before been accessible to, or observed by, human beings.

Sixty scientists from 13 different countries took part in the research cruise. Bergen Museum will act as curator for the expedition's biological finds, which among other benefits will give it the most extensive collection of ocean cephalopods in the world.

Deep mystery

The cruise to the Atlantic Ocean also involved animals that were never seen. Underwater TV pictures of a seamount 2000 metres below the surface north of the Azores show a line of tracks or pits on the seabed disappearing into the darkness. The scientists waited in the hope that the animal would appear, and even tried to follow the tracks with the underwater vehicle, but without success.

"Working on an underwater mountain range is very demanding," says MAR-ECO project leader Odd Aksel Bergstad, who expects to see great progress being made in marine research thanks to the introduction of new technology. The brand-new G.O. Sars is a very silent-going research vessel, with stabilisers that make it easier to work in bad weather. And with the help of deepwater trawls and advanced acoustic equipment, remotely operated underwater vehicles (ROVs), video and still photography, the scientists have been able to gather information that will revolutionise our understanding of life in the ocean.

The scientists in the MAR-ECO Project, which started in 2001 and will continue until the end of 2008, are attached to the global Census of Marine Life Project.

www.mar-eco.no