



UiO • **Faculty of Mathematics and Natural Sciences**
University of Oslo

Inno va tion

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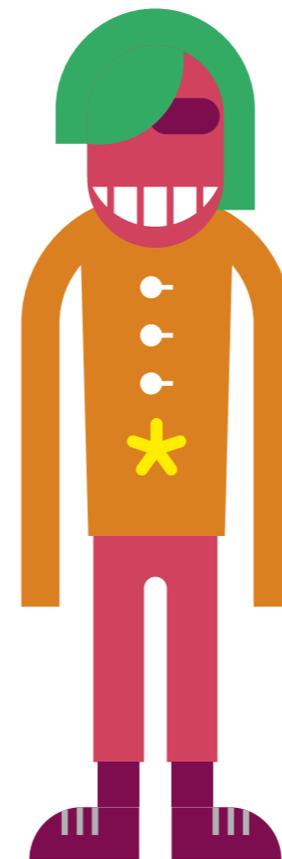
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The Faculty of Mathematics and Natural Sciences is the University of Oslo's entity for the study of mathematics, technology and natural sciences. The faculty was founded in 1811 as part of the Faculty of Philosophy. There were approximately 5000 students at the faculty in 2013. Morten Dæhlen is Dean of the Faculty, Svein Stølen is Vice-Dean of Research and Solveig Kristensen is Vice-Dean of Education. The faculty is one of the most important places in Norway for research-driven innovation, which you can read more about in this leaflet.

www.mn.uio.no/english/

We educate the creative people!

YOUNG PEOPLE ARE CONCERNED WITH SELF-REALIZATION. MANY OF THEM THINK THAT TO BE CREATIVE, THEY HAVE TO BE JOURNALISTS, ARTISTS OR DESIGNERS. BUT THEY ARE WRONG; A DEGREE FROM THE FACULTY OF MATHEMATICS AND NATURAL SCIENCES OPENS THE DOOR TO THE REALLY CREATIVE PROFESSIONS!



The three Deans of the Faculty of Mathematics and Natural Sciences are in no doubt. Most of those who graduate from their faculty embark on exciting, well-paid careers, and many start their own businesses.

In fact, the three Deans have always known that they have innovative people in their faculty. Mathematics and Natural Science subjects have always been at the junction of basic research and its applications, ever since Kristian Birkeland discovered how to bind nitrogen from the atmosphere to make artificial fertilizer, which formed the basis for the establishment of Norsk Hydro in 1905. However, they believe that there has recently been an increased awareness of this.

MORTEN DÆHLEN, DEAN: We have had a lot of innovation at the faculty for many, many years, but it is not well communicated. We have not, in fact, placed sufficient emphasis on this. Few people are aware that it was us who started the

Norwegian Internet revolution at the start of the 1990s. This began with the establishment of Oslonett, the parent of all Norwegian Internet companies. During the Winter Olympics in Lillehammer in 1994, the results of the competitions were published on the web by Oslonett – for the first time in history. We are a faculty that has research and education as its two major tasks, but communication and innovation are important additional ones.

SVEIN STØLEN, VICE-DEAN: Yes, we have a lot to boast about, but we have not been good at selling ourselves in this regard. Take the research being conducted by the Algeta company – one of Norway's new flagships in terms of research-based industry – which has its origins in the Department of Chemistry. Our faculty has had a great deal of contact with the business sector over a long period. The big difference is that now we are proud of this. Previously it was a bit vulgar to talk about industry and academia in the same breath.

SHOULD ALL INNOVATIVE RESEARCH END UP BEING COMMERCIALIZED BY COMPANIES?

SOLVEIG KRISTENSEN, VICE-DEAN: No, it is important to remember that not all innovation is about commercial products. The definition of innovation is that something new is brought into use to perform a task. We also have good examples of socially oriented innovation at the faculty. One example is Kristin Braa, Jørn Braa and Sundeep Sahay at the Department of Informatics, who were awarded the Innovation Prize for 2013. They have set up a system to handle health information in developing countries. This is not a commercial product, but an open source tool that is freely available on the Internet.

DÆHLEN: It is now three years since the University of Oslo began to award its own prize for innovation. We are happy and proud that the Faculty of Mathematics and Natural Sciences has been awarded three out of three possible prizes to date. Previously Inger Sandli at the Department of Biosciences and Truls Norby at the Department of Chemistry have received this prize.

STØLEN: The three people who have received the University of Oslo's Innovation Prize are very aware that it must be based on good research. Sandli and Norby have both published research results in Nature and the International Journal of Science that are related to their innovations. There is therefore no conflict between publishing in the world's most prestigious journals and commercializing their research.

WHAT IS NEEDED TO CREATE AN ENVIRONMENT OF INNOVATION AT A UNIVERSITY SUCH AS THE UNIVERSITY OF OSLO?

STØLEN: People have to think of the University of Oslo as a place where innovation happens. If we manage to demonstrate that this is an innovative university, then the students will have these expectations when they come here. We will therefore establish more systematic structures for schooling in innovation and entrepreneurship.

KRISTENSEN: Now we want to incorporate courses on innovation and entrepreneurship in our Bachelor degree programmes. We already have a very successful initiative where, through the systematic use of calculations and calculation tools, we expose students to research challenges and industry-related questions early in their studies. It is a way of putting the students in a position to think innovatively from day one of their course of study. We have been awarded the Learning Environment Prize by the Ministry of Education and Research for this initiative. It has currently been introduced into study programmes that include a lot of mathematics, and will now be introduced in all our Bachelor degree courses.

WHAT ELSE IS NEEDED TO SUCCEED IN TERMS OF INNOVATION?

STØLEN: Achieving an innovative environment at a university requires a good combination of brilliant ideas, committed people and a market. In addition we must have someone who assists in this, and especially someone who helps the students to play around with ideas. In this

regard we have helpful assistance from Startup Lab in the Research Park.

DÆHLEN: Traditionally academics with good ideas have seen potential, but they have not considered the market to a sufficient degree. We have to teach our students to think about the full picture in an entrepreneurial organization. You must have a genuine interest in the knowledge being developed – and you must see the opportunity for commercialization. And you must do both these things simultaneously.

KRISTENSEN: Therefore we are now underway with a restructuring of the programme portfolio for the Bachelor courses. You will learn the core subjects, but also something more. You will also know something about entrepreneurship, leadership, organization and learning, communication and dissemination.

DÆHLEN: Innovation at the Faculty of Mathematics and Natural Sciences is not just about the researchers' and the students' ideas. We also have a large portfolio of companies that we collaborate with on several projects, and this does not appear in our innovation statistics. GE Vingmed Ultrasound is such a company. They collaborate with us to develop their products, that is, to innovate. Going forward we want to work even more systematically and strategically with selected enterprises.



MORTEN DÆHLEN: Dean, Faculty of Mathematics and Natural Sciences

Follow Morten Dæhlen on his blog "Dærent's CORNER"



SVEIN STØLEN: Vice-Dean of Research, Faculty of Mathematics and Natural Sciences

Follow Svein Stølen on his blog "Sveins innkast"



SOLVEIG KRISTENSEN: Vice-Dean of Education, Faculty of Mathematics and Natural Sciences.

The desire to leave a footprint

RESEARCHERS ARE CONCERNED ABOUT THEIR FOOTPRINT, BUT MANY THINK THAT IF THEY START INVOLVING THEMSELVES WITH INNOVATION, THEY WILL GO OFF TRACK COMPLETELY. IT ISN'T LIKE THAT, SAYS JAN TERJE ANDERSEN.



“If I can leave a footprint that benefits society, it would be quite wonderful,” says Andersen. He is a postdoctoral student in Professor Inger Sandlie’s group at the Centre for Immune Regulation (CIR), one of the Research Council of Norway’s centres of excellence in research.

Andersen and Sandlie attempt to find explanations for why, in the case of immune-related diseases, the immune system attacks the body to which it belongs. The objective is to provide patients with better treatment and diagnostics.

“There is still an old notion lingering in many parts of the university that innovation and commercialization of basic research complicate and delay publication and shift the focus. However, we don’t agree. Innovation has become part of the culture of our group, and it is Inger who has created this culture,” says Andersen.

HAS BECOME A PART OF THE CULTURE Inger Sandlie, who is deputy group leader of CIR, was the first to be awarded the University of Oslo’s Innovation Prize. She received this for having obtained patents for a range of research results and for having contributed to the start-up of the two biotechnology companies, Vaccibody and Nextera.

Sandlie started at an early stage to collaborate with international research groups who had a quite different tradition with regard to the issue of innovation.

“I saw that it was completely possible to carry out both research and innovation. This has probably transmitted itself to my collaborators, and we see no conflict in this regard. Of course there may be challenges, but there are challenges everywhere in academia.”

Sandlie and her research group at CIR have published assiduously in several of the journals of the Nature group.

“All these publications have been associated with things that we have patented,” she tells us.

EVERYTHING HAS IMPROVED

Sandlie does not have an overview of how many patents she owns, but she remembers that she had a hard time with the first one.

“I literally had to go out on the town to get it sorted out. Over the years I have been doing this, the support system around us has improved remarkably.”

The University of Oslo has long been concerned with building organizations that assist us researchers with innovation. Firstly by participating in the establishment of the Research Park, and now recently with getting Inven2 up and running.

“Inven2 was a real step forward. With it we got a professional organization that is above a critical size, and with employees

who have special competence in commercialization,” she says.

Now Sandlie hopes that the University of Oslo and Inven2 will also manage to find solutions to how we can retain more of the innovations from Norwegian universities here in Norway.

“Today Inven2 is licensing patents that are based on our discoveries. I hope there will also be a financial opportunity in the future to invest in company start-ups. Both Sweden and Denmark are better at this than we are. Admittedly they have a different industry structure than us, but why can't the money for commercialization of pharmaceutical drugs, for example, come from oil extraction?” she asks.

Sandlie herself has been involved in establishing two companies. While Vaccibody develops vaccines based on specially designed antibodies, Nextera is targeted towards finding new medicines for diseases that cause the immune defence system to mistakenly attack the body.

“At the time when these companies were established, the strategy was different, and it couldn't be taken for granted that patents would be licensed. And that is fortunate for us, because now that the companies exist, it means that our new innovations can be licensed to them.”

STILL CURIOUS

In spite of many commercializations, Jan Terje Andersen believes that what drives the research in the group he is part of, is first and foremost the curiosity of the participants.

“We are curious about understanding life, how things are related, and what causes disease. Our research involves manipulating molecules to alter and improve their properties. Each time we map a new interaction or a new process, we think: might this have a practical application? If a completely new discovery that we make is to be developed, it must be protected,” he explains.

Sandlie believes that if a researcher comes across something that could be of great importance and benefit for society, it is quite simply a social responsibility to take the research further to its application.

In the last few years, she and her colleagues have collaborated with the Danish company Novozymes Biopharma A/S in developing a technology which will be used to prolong the half-life of drugs in the body. Thereby the patients can have a longer interval between each dose of the drug, and they can take it in lower doses. Lower doses also then mean fewer side-effects.

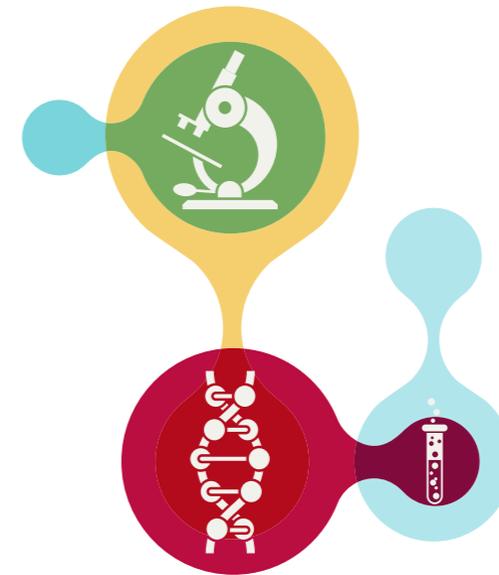
Some footprints have already been left.

PROFESSOR INGER SANDLIE,
post-doctoral researcher
Jan Terje Andersen and PhD
student Malin Bern all perform
basic research, but innovation
has become part of the culture
for their research group.



Beautifying CO₂

_____ GEOCHEMIST HELGE HELLEVANG IS FASCINATED BY CRYSTALS. NOT JUST BECAUSE THEY ARE BEAUTIFUL TO LOOK AT, BUT ALSO BECAUSE THEY CAN SOLVE ONE OF THE BIGGEST CHALLENGES WE FACE TODAY.



Through the microscope he sees more than the aesthetics. The experiments conducted by the researchers at the Department of Geosciences and the SUCCESS centre actually show that new crystals can help save our climate. “SUCCESS is one of the Research Council of Norway’s research centres for environmentally-friendly energy”, says Helge Hellevang.

DEVELOPS TOOLS

“When we pump CO₂ into the ground, we see that the minerals dissolve slowly and are replaced by beautiful new crystals. If we manage to convert CO₂ to a solid material, it would be a safer way of getting

rid of climate gas,” says Hellevang. “On the basis of the knowledge we possess today, we will soon be able to develop instruments that can predict what minerals are formed when CO₂ is injected into reservoirs. In this way we can maybe get rid of climate gas once and for all.”

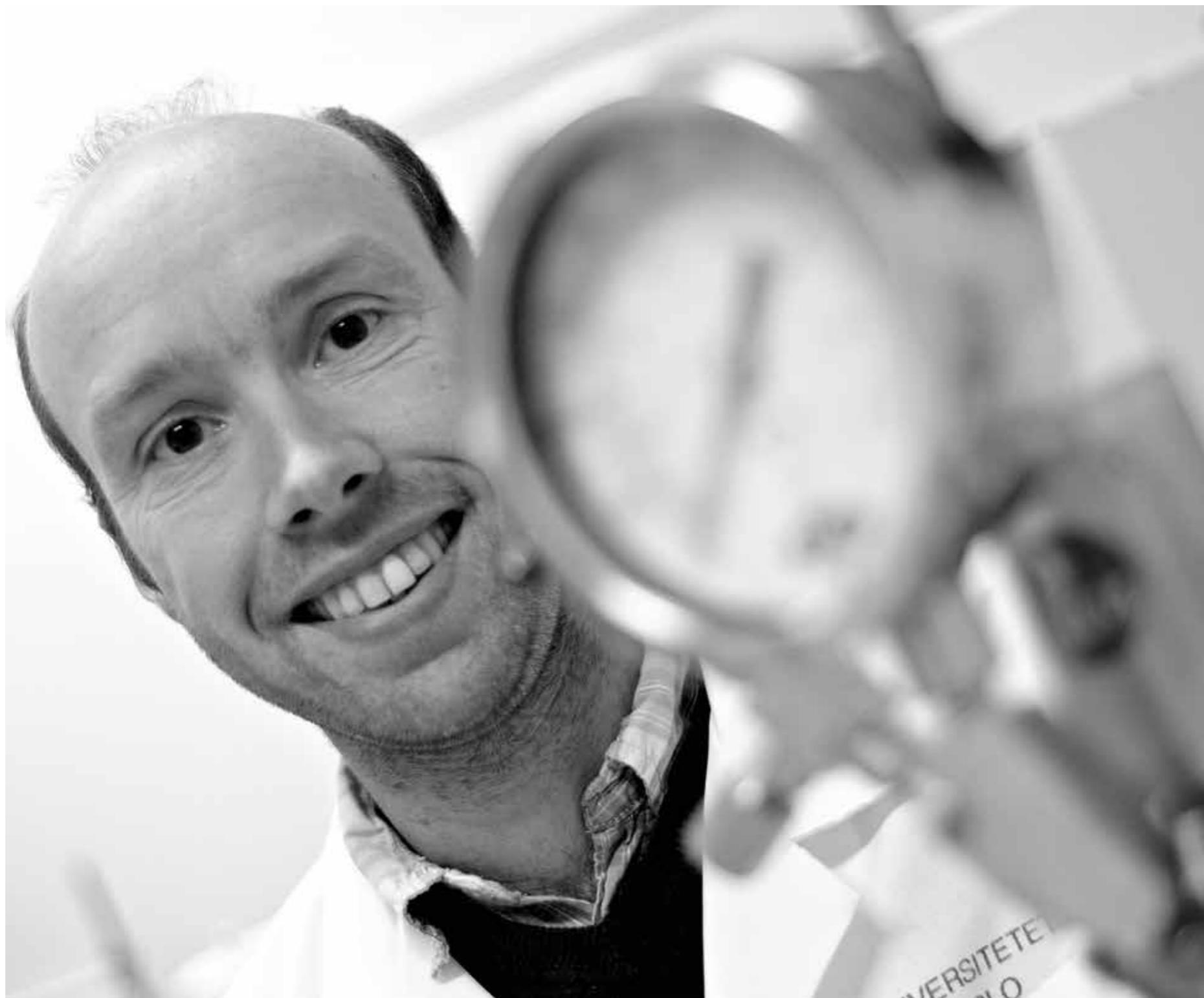
MORE RELEVANT THAN EVER

Geochemists at the Department of Geosciences work in close cooperation with a consortium of researchers from Oslo and Bergen. The researchers are from many different subject groups and together they will try to predict what happens with CO₂ when stored in the ground. After

the Stoltenberg government abandoned plans to build a full-scale capture and storage plant for CO₂ at Mongstad, the search is now on for alternatives. This makes the research done by SUCCESS more relevant than ever.

“This is still at the level of basic research but now we’ve developed new equations in order to predict more accurately when minerals are formed underground. We’ve also created new experimental equipment that can simulate these phases in the laboratory,” says Hellevang.

A lot of research on the storage of CO₂ is taking place at several places worldwide. Nevertheless, the researchers at



HELGE HELLEVANG develops methods that can give some indication of what will happen when we store CO₂ for thousands of years.

the University of Oslo and the University of Bergen are at the forefront of global research when it comes to developing equation tools. “The knowledge we have acquired would not be possible without a centre like SUCCESS with an eight-year funding programme,” Hellevang adds.

PROPERTIES CHANGE

Much of the research Hellevang and his colleagues carry out can also be used in other segments of the petroleum industry. They are also investigating what chemical reactions occur in the reservoirs, and developing new methods in order to predict detrimental reactions.

“When gas is transported in a pipeline, its properties will change in accordance with pressure and temperature. These are dynamic variables. Different pressures and temperatures arise at different points in the pipeline. Our instruments can be used to avoid problematic situations such as rust or ice-formation in the pipelines.

Particle formation can damage the equipment. At best these are problems that cost money. At worst ice particles can form that block the entire pipeline, and this can lead to a dangerous gas blowout.”

MUCH HIGHER SALARY

There is a strong demand for Hellevang’s expertise in the industry. He could get a job there with a much higher salary than he earns at the University of Oslo. But the methods he is working on can also give some indication of what will happen when we store CO₂ for thousands of years. This interests him more.

“I’m fascinated by sustainable energy and development. And that’s the reason why I work at the University. Here we can carry out projects that we know are useful for society, not just for the business sector. That’s satisfying. As a researcher I feel a responsibility for giving something back to society,” Hellevang concludes.

Hot on the trail of a drug for obesity

IT SOUNDS ALMOST LIKE A MIRACLE, BUT RESEARCHERS AT THE UNIVERSITY OF OSLO SCHOOL OF PHARMACY ARE ON THE TRAIL OF SOMETHING THAT MAY PERHAPS BE THE DRUG OF THE FUTURE FOR OBESITY.

Researchers throughout the world are seeking possible treatments for the greatest epidemic of our time, obesity. But Eili Tranheim Kase and her colleagues stumbled almost by chance upon an active ingredient, the effect of which is promising. It reduces the body's ability to store fat.

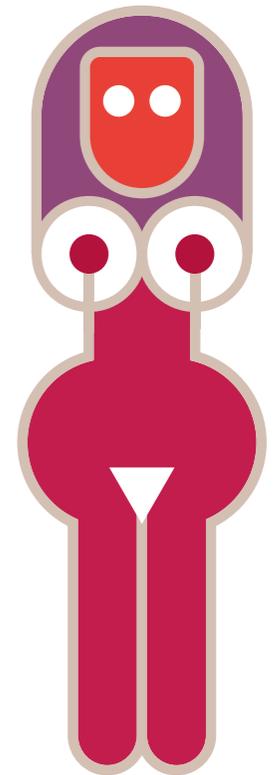
"The substance is known, but we didn't think it could be used for anything. It was actually documented as inactive. However, as a result of experiments on rats we have seen that it affects a regulator that controls lipid metabolism in the cells. All the cells in the body have this regulator," says Tranheim Kase.

NOT LIKE WAVING A MAGIC WAND
Unfortunately this active ingredient is already patented, and moreover it is very costly to produce. But the researchers have now designed a new substance that can be synthesized. They will test this on

animals to see whether it has the same effect as the parent compound. If the new substance acts in the same way, they can apply for a patent.

"Innovation takes time. Particularly in the development of pharmaceutical drugs, it is a long and costly journey from basic research to a product on the market. In the meantime we must do what we are best at, namely producing good research," says Tranheim Kase.

PATIENCE AND RESOURCES
Tranheim Kase finds it a challenge that many people involved in the research do not understand that this road is long and winding, and therefore lose patience when problems arise along the way. She makes it clear that a culture of innovation must entail patience, but that there needs to be more investment in the most promising projects.



EILI TRANHEIM KASE is hot on the trail of a drug for obesity.

“Today the university is very concerned with innovation, and this is good. But there are no additional resources when a research project moves on to become an innovation project as well. We have spent an unnecessary amount of time getting to where we are in our research group because for periods the resources have been too scant.”

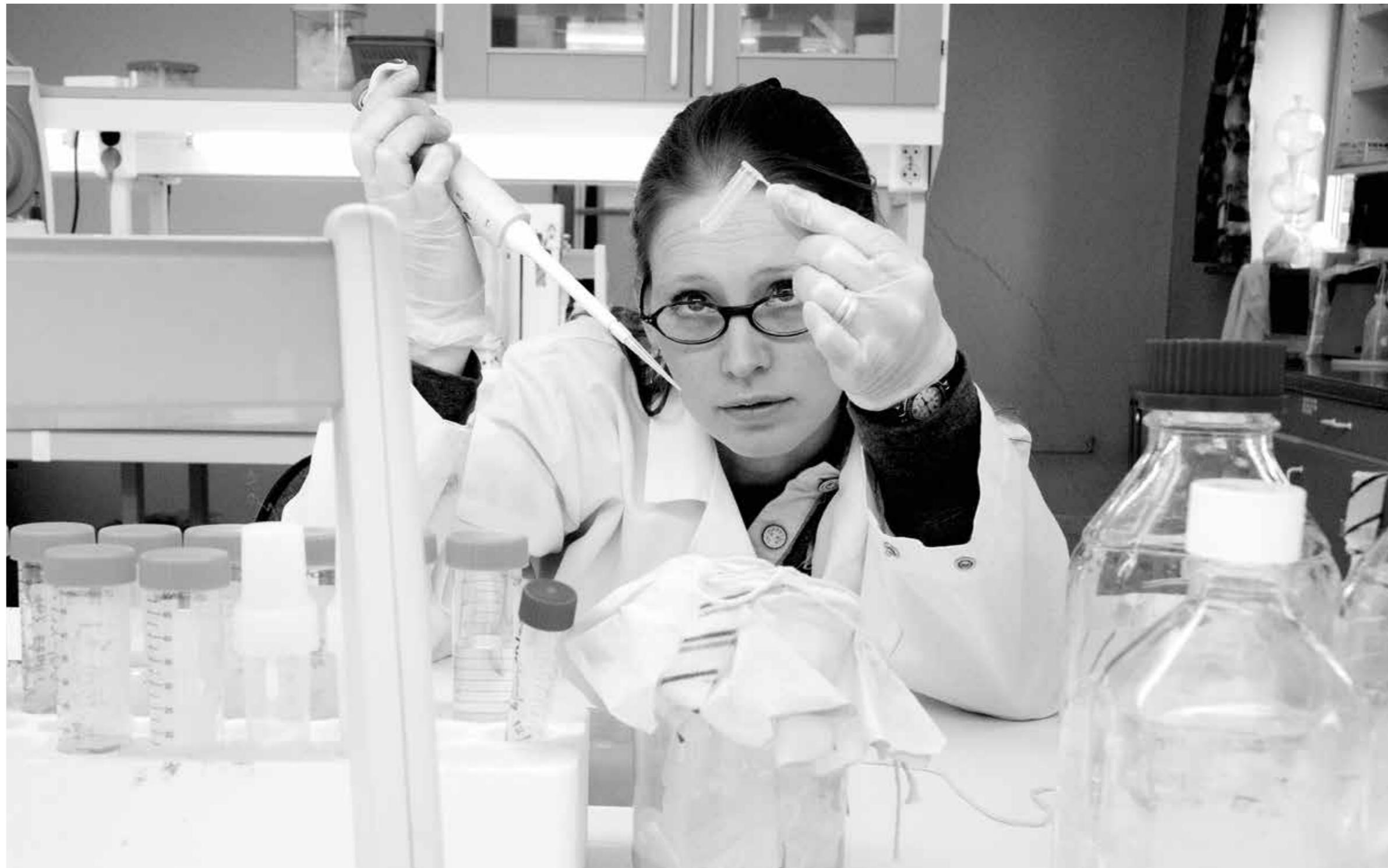
IMPORTANT FOR MANY

If the researchers succeed, it may lead to a patent that can be licensed for the pharmaceutical industry. There are no effective drugs for obesity today, and the existing drugs have many side-effects.

The market is large. Around one billion people today are overweight, and many of these will contract Type 2 diabetes.

The fact that this is important for many people in the world is a particular motivating factor for Eili Tranheim Kase.

“Nevertheless, I cannot simply focus on the main objective, namely that this could become a product that can help many people. As researchers we must constantly focus on sub-goals in order to understand the mechanisms at the level of basic research. If we only focus on the overall objective, there will be far too many disappointments along the way,” she says.



Passion for crazy ideas

AS POSTGRADUATE STUDENTS, THESE SPORTS-INTERESTED PHYSICISTS WANTED TO GIVE TV SPORTS A NEW DIMENSION. AND THAT WAS HOW THEY CREATED A COMPANY THAT HAS 15 EMPLOYEES TODAY.



Postgraduate students Morgan Kjølerbakken and Vibeke Jahr of the electronics research group at the University of Oslo's Department of Physics worked closely together from 2003 to 2004.

After completing their Master's degree, Kjølerbakken and Jahr began the work that led to the start-up of Squarehead Technology AS. In autumn 2004 they persuaded their fellow student Ines Hafizovic to join them.

"We wanted to lift sonar technology out of the water and into the air, and to apply it in an innovative way," Hafizovic relates. Sonar technology is used to chart the seabed underwater, and functions by sending and receiving sound echoes.

MARKET LEADERS

In due course they succeeded in combining principles from sonar technology

with advanced software and a self-developed advanced microphone. Unlike other microphones, this is able to calculate what kind of sound is to be recorded or heard.

Now the company that they started up as students is a market leader with an advanced direction-steered microphone that makes it possible to zoom sound in the same way as you zoom in on photographs.

FOOTBALL AND A GOOD SUPERVISOR

It all started with a great interest in sport and a good supervisor, says Hafizovic.

"Torfinn Lindem, who was our supervisor, had a lot of contacts in industry. Early in our postgraduate studies, he took us with him to conferences where the business sector was represented. Here we met companies and discovered entrepreneurship."

The entrepreneurs had a passionate interest in sport and regarded the broad-

casting industry as a good arena in which to apply the idea they wanted to pursue. They wanted to develop a microphone that would make it possible to hear a situation on a football pitch or ski track that was synchronized with the TV camera image, thus providing an improved viewing experience. What were the players actually saying to each other down there on the pitch? What did the laboured breathing of the biathletes actually sound like?

THE SECURITY SECTOR

After a period with a lot of attention from the broadcasting industry, it transpired that this sector was not really ready to spend money on their product.

But the creative ideas kept coming. Their microphone system was also well suited to the running of conferences and the company flourished for several years

VIBEKE JAHR AND INES HAFIZOVIC have taken sonar technology out of the water and into the air through Squarehead Technology. Now the company they started up as students at the Department of Physics is a market leader.

in this market. Today the marketing focus has changed to acoustic visualization and security.

The security market consists of intelligent security services, providing surveillance for towns, the health sector, preventive maintenance, critical infrastructure in towns, town centres and the like. And now the customers are starting to take notice.

“Broadly speaking the technology is well suited in many situations where it’s difficult for people to be present,” explains Hafizovic.

CRAZY IDEAS

Everyone who works in the company is either an engineer or has a PhD. Research is still a large part of their activities.

“For us it means that we can be well in the forefront when it comes to the development of new products. Companies that don’t invest in research have no chance of coming up to our level. We still spend a lot of time experimenting with crazy ideas,” says Hafizovic. “The market comes up with some far-out notions, many of them pure science fiction. But that stimulates

our creativity. We think: how much more can we actually manage?”

There has been a lot of hard work along the way, a lot of long nights with business plans, finances and other areas in which she has no training, but Hafizovic does not regret investing in Squarehead.

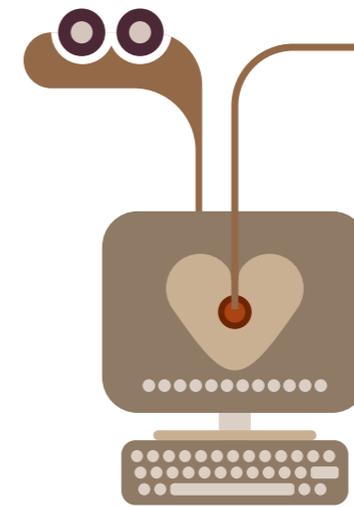
“This will never become a routine job. Never boring. If you like the kind of lifestyle where something new happens all the time, it’s perfect.” Recently she has supervised several master degree students who have come to the company via master degree programmes.

“My dream is for us to build up a research department here at Squarehead, a kind of mini-SINTEF in our field. There are few people in Norway who have the expertise we have. I hope we can help to bring about a change here.”



From Blindern to Silicon Valley

“I HAD AN EXCITING IDEA. IT WAS FAR TOO GOOD NOT TO DO ANYTHING ABOUT.”



This is how the entrepreneur Tobias Dahl, a former student of the Department of Informatics, explains the start-up of Elliptic Labs. And everything indicates that the idea he had was really good.

Today Elliptic Labs is a company with 20 employees divided between the offices at Nydalen in Oslo and Silicon Valley in California. They are now talking with the majority of the manufacturers of laptops, tablets and smartphones globally in order to have the company's technology integrated in such products. The international media are writing about them and they are winning prestigious technology awards all over the world.

Elliptic Labs develops technology that uses ultrasound to interpret people's movements almost in the same way as bats steer in the dark. A range of small loudspeakers and microphones, which emit ultrasonic waves, are built into the screen. Your hand gives out an 'echo' when it moves and this is sent back to the PC, the tablet or the smartphone. So you can communicate with such devices in this way.

STARTED AS A STUDENT

Dahl's PhD from the University of Oslo was the start of it all. The focus was on wireless technology. During his postdoctoral research the idea gradually matured

from getting screens to react to ultrasonic waves that arise from hand movements. Smart use of the echo was one of the criteria for success. At the same time Dahl and co. made use of the competence the Norwegian petroleum industry had built up in the field of sonar technology.

"Normally the echo is regarded as unwanted noise. But we played around with this and discovered we could use the echo to achieve something positive," says Dahl.

GAVE UP MEDICAL TECHNOLOGY

In the Department's research group for digital signal processing, ultrasound

TOBIAS DAHL is a former student of the Department of Informatics. Today he is the entrepreneur behind Elliptic Labs, a company with 20 employees in Oslo and Silicon Valley.

technology had long been the centre of research interest. Many interesting discoveries have been made by this group, including products used in petroleum exploration and medical technology. And it was precisely medical technological equipment that was the first area of application for Elliptic Labs.

The entrepreneur, Tobias Dahl, had an idea for how gestures could be used in medical technology in order to assist doctors to manipulate 3D pictures on a screen during operations without the surgeon having to leave the sterile zone. But the road from idea to marketing in the field of medical technology is long and winding.

Therefore in due course the company directed its efforts to the consumer market in electronics, where the road to the market is faster, the market is bigger and there is more money to be made. But here competition is also extremely tough. Products must be cheap, efficient and you must constantly dream up something new.

THINKING OUTSIDE THE BOX

“What’s good about doing research at a university is that you get the time and the opportunity to think outside the box and test out ideas, something which is not always as easy in a company,” says Dahl. He describes a research group character-

ized by generosity, a high level of tolerance and good relations with the business sector. This is what leads to innovation.

RECRUITS STUDENTS

Technology transfer is like moving house, according to Dahl. The potential lies in the actual move.

“Those who are talented should know that they don’t necessarily need to become academics, that there are other opportunities if you’re a risk-taker.” Dahl himself has kept in contact with the Department of Informatics long after completing his postdoctoral research, also for strategic reasons.

“I took the initiative to hold a course for students. In that way we were able to recruit fantastically gifted people from the university community to Elliptic Labs.”

Six of the company’s employees have a PhD. They have not abandoned research, even though a lot of their work involves negotiating with customers. The company has received funding from Innovation Norway as well as from the Research Council of Norway’s BIA-program (Programme for User-driven Research-based Innovation) together with SINTEF. Now they are engaged in further development of the company’s technology in Palo Alto, in the heartland of the IT-mecca Silicon Valley in California.



Doing the environment a favour

THE FACULTY OF MATHEMATICS AND NATURAL SCIENCES INCORPORATES THE ONLY CENTRE FOR RESEARCH-BASED INNOVATION AT THE UNIVERSITY OF OSLO. THE HEAD OF THE CENTRE BELIEVES THAT CLOSE COOPERATION WITH INDUSTRY HAS MADE THE RESEARCHERS MORE CREATIVE.



Unni Olsbye has headed inGAP (Innovative Natural Gas Processes and Products) since its start-up in 2007. In brief, research is conducted here into how to develop better catalysts that will result in more environmentally-friendly and more profitable gas processing. This is an important research field for Norway as a gas-producing country.

Olsbye and the other researchers at the centre work in close cooperation with industrial partners such as Statoil, Hydro and INEOS, the petrochemical company. The reason is namely that natural gas is used to produce a range of plastic products.

“Having close contacts with industry is a big advantage. We researchers can easily fall into a rut and remain there. When we have direct contact with those

who apply our research, we constantly get new ideas for things we can investigate,” the head of the centre maintains.

GREATER IMPETUS TO BASIC RESEARCH

Having close contact with industrial partners ensures that the research process is continually being improved so as to become more applicable, according to Olsbye. But the inventions that the researchers themselves come up with are just as important and exciting – inventions that are extremely important for basic research.

“The researchers at the centre have developed and patented a completely new material – UiO-66. This could become the new type of catalyst, thus a material that can increase the speed of desired

chemical reactions. The advantage of this material is that it is flexible and can be used under difficult conditions. It is stable up to 400 degrees and tolerates water.”

At present researchers must understand many factors at the basic research level before UiO-66 can be widely used. “But the potential is enormous. If we manage to make an optimal variant of the material, it could revolutionize catalysis completely,” says Olsbye.

NEEDING CREATIVE BRAINS

She and her colleagues at inGAP are now working on finding out how UiO-66 can be utilized to convert CO₂ into chemicals and fuel.

“To find out we need a lot of creative brains who together understand biology, physics and chemistry,” Olsbye asserts.

UNNI OLSBYE heads inGAP (Innovative Natural Gas Processes and Products) at the University of Oslo. She believes that researchers can easily fall into a rut and remain there. “When we have direct contact with those who apply our research, we constantly get new ideas for things we can investigate.

WORKING FOR A BETTER ENVIRONMENT

Young people who choose to study mathematics or natural sciences are like other young people concerned about realizing themselves and working with something that is important to society. Olsbye believes that she and her colleagues can offer young students both.

“Students have sometimes asked me how they can defend their choice of working with fossil fuels in front of their friends. I have no difficulty whatsoever in answering them.”

“Petroleum will be our most important source of energy in the foreseeable future whether we like it or not. When our work is devoted to finding the best catalysts to promote reactions that use less energy and have no polluting bi-products, this is extremely important for the environment,” she declares.

Olsbye describes a specific example of how inGAP has already had a positive effect on the environment:

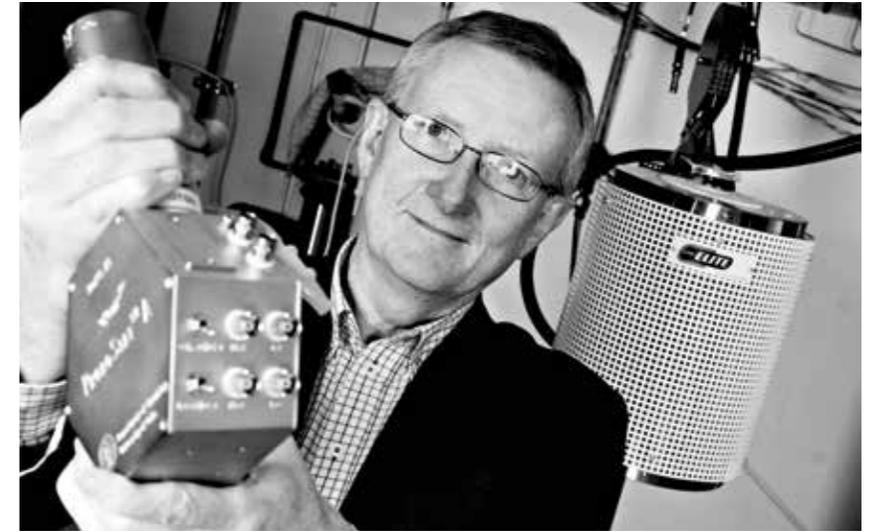
“Through cooperating with us researchers, the plastics producer INEOS has improved its processes thereby reducing costs and at the same time becoming more environmentally-friendly. By improving catalysts, you’re doing the environment a favour,” concludes Olsbye.



Can we make some kind of gadget from this?

EVERY TIME TRULS NORBY LISTENS TO A LECTURE, HE IS THINKING: HOW CAN THIS BE USED? CAN WE MAKE SOME KIND OF GADGET FROM THIS?

“**BASIC RESEARCH** is much improved when attempts are made to transpose it to actual products,” chemistry professor Truls Norby declares.



The chemistry professor actually owns the first approved patent in the University of Oslo’s history – and the first one to provide a financial return. Even Norby is in no doubt that his work on innovation has made him a better scholar.

“Basic research is much improved when attempts are made to transpose it to actual products,” the chemistry expert asserts.

He heads the Solid State Electrochemistry (FASE) research group at the Department of Chemistry – a group that includes over 30 researchers and students.

PATENT AFTER EIGHT YEARS

In 2004 Truls Norby and his co-workers submitted a patent application for a material they had discovered. Instead of following the traditional path via scientific publication, they first contacted Inven2, a Norwegian innovation company. Norby was first awarded the patent in 2012, eight years later.

However, in the meantime a company had been established based on the idea that you could use a material consisting of proton-conducting oxides to convert energy in an environmentally-friendly manner. The company, Protia AS, is working on

the development of a new method to convert natural gas to liquid fuel. Today this is a highly energy-intensive process. Production plants emit high concentrations of CO₂. Protia wants to make this simpler, cheaper and more environmentally-friendly. Protia’s idea won DnB Bank’s National Innovation Prize in 2010.

MAYBE A BIT NAIVE

“At that time back in 2004, both Inven2 and I were full of optimism, and maybe we were also a bit naive. Now we know how difficult it is to get a foothold in the energy market. Both fossil fuel and hydro-power are cheap, and in addition we have experienced a recession. At such a time most people invest in known, safe energy sources such as oil and gas. In 2012 our Norwegian investors said they wanted out, and as a result we were bought by a big American company.”

In the US there are enormous natural gas reservoirs that are almost worthless because transporting the gas is so expensive. But if this gas can be converted into liquid, it is of great interest in a country that otherwise imports a lot of oil.

THE BRAIN BEHIND SEVERAL COMPANIES

Truls Norby has commercialized research both before and after Protia. In 2001 the company NorECs Norwegian Electro Ceramics AS was founded. This company was based on 20 years experience and development targeted at the characterization of electrical properties of materials at high temperatures. NorECs now sells measurement control equipment all over the world. In 2009 the company was selected by the Norwegian business newspaper Dagens Næringsliv as the ‘gazelle company’ of the year.

In recent years Norby himself and entrepreneurial students at the University of Oslo have established several companies, such as Nano Rocks AS and InNano AS, which are targeted towards the use of nanostructured materials for the photochemical cleansing of water and air, and other processes related to environmentally-friendly energy conversion.

Truls Norby was awarded the University of Oslo’s Innovation Prize in 2012.

Put research to use

MORE AND MORE RESEARCHERS AND STUDENTS WANT TO PUT RESEARCH TO USE, STATES THE HEAD OF THE UNIVERSITY OF OSLO'S TECHNOLOGY TRANSFER OFFICE.

OLE HJELSTUEN heads Inven2.



“Innovation is one of the four pillars of the university. The researchers certainly still regard research and teaching as taking first place. However, the other two pillars – innovation and communication – are becoming ever-more important for many of us.”

Ole Kristian Hjelstuen is a professor and CEO of Inven2, the Technology Transfer Office (TTO) at the University of Oslo. Commercialization broker is another term used to describe TTOs.

“The most successful researchers are really those who can handle both research and innovation. Of course this is about time and resources, but it is also about how you build for the future,” believes Hjelstuen.

BIG HAIRY AUDACIOUS GOALS

Inven2 is ever on the lookout for University of Oslo people who are willing to, and dare to commit.

“There are many clever people at the university, but we want to get in contact with those who dare to set themselves the big hairy audacious goals.”

In Hjelstuen’s opinion, this is in fact completely possible to do at the University of Oslo. “A number of years ago it was less acceptable to want to commercialize ideas emanating from a university, but a positive change has rapidly come about,” states the head of the TTO.

BENEFIT TO SOCIETY

“The researchers who are closest to getting started with innovation are those who have given thought to what society needs. We also see that younger researchers are more concerned with

creating benefit to society and their own workplaces than older researchers. This is one of the most characteristic aspects with regard to innovation at a university like ours,” Hjelstuen recounts. He believes that the communities, researchers and students who will succeed best in the future are those who are strong in both research and innovation.

“More and more academics are focusing their minds on research that can be applied. It is a clear trend.”

STUDENTS AT THE FACULTY OF MATHEMATICS AND NATURAL SCIENCES

The Inven2 CEO predicts that the University of Oslo Technology Transfer Office will involve itself increasingly with the students at the university, and not least with those in the Faculty of Mathematics and Natural Sciences.

“The Faculty of Mathematics and Natural Sciences is the faculty that is most likely to produce innovations at the University of Oslo. At the same time we are seeing that some of the most innovative communities of all are across departments and faculties, they are cross-disciplinary. Take, for example, the excellent collaboration between the Department of Physics and Oslo University Hospital on the construction of surgical robots and diagnostic instruments.”

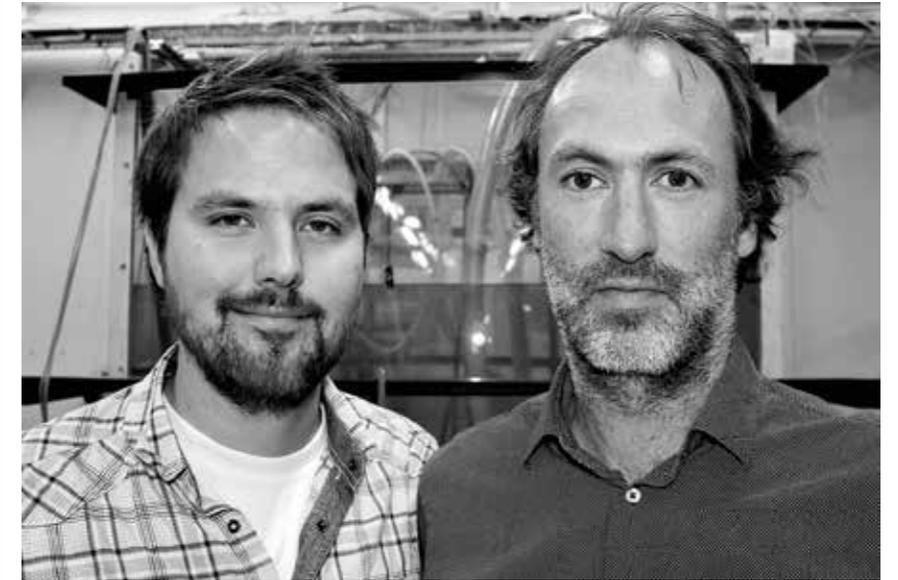
Does the head of the TTO at the University of Oslo have any tips to offer to someone wanting to drive innovation in an academic environment?

“Yes. Ensure that proper contracts are drawn up, preferably with our help here at the TTO. That way, you have little to fear if you institute a collaboration with industry.”

Mathe- matics on the ocean floor

AN INCREASING AMOUNT OF OIL AND GAS EXTRACTION IS CARRIED OUT USING SUBSEA EQUIPMENT ON THE OCEAN FLOOR. MATHEMATICIANS AT THE UNIVERSITY OF OSLO'S FACULTY OF MATHEMATICS AND NATURAL SCIENCES HAVE DEVELOPED A SOLUTION THAT RENDERS THE RECOVERY MORE EFFICIENT AND LESS COSTLY.

MATHEMATICIANS Stig Grafsrønningen and Atle Jensen tested their results in the laboratory tank behind them, at the University of Oslo.



The solution provided by the “Heat Exchanger” project can be used both in the North Sea and in other places where an ever-increasing share of the petroleum activity takes place on the ocean floor. In fact, nowadays parts of the processing – separating the oil and gas from water and sand – take place down on the ocean floor.

Subsea constructions that are currently installed on the seabed may weigh several thousand tonnes. This weight increases even more with the processing that takes place on the ocean floor. One reason for this is that the processing requires a cooling system to be placed there. This is because the oil and gas must be cooled down when they come up from the seabed.

MATHEMATICS FOR INNOVATION

In 2011 the researchers at the University of Oslo's Department of Mathematics came

up with a unique construction for a new cooling system, for which they won the “2011 Inven2 Prize”. Inven2 is the University's Technology Transfer Office (the broker in commercialization of research). That a group of mathematicians can win a prize for innovation in industrial development is no doubt surprising for some, but the mathematicians at the Faculty of Mathematics and Natural Sciences are a good example to show that it can be done.

This research may be able to help the recovery of more oil and gas resources in the North Sea and in other locations. The project also demonstrates how important theoretical disciplines like mathematics and physics often prove to be for advanced industrial activities.

ADVANCED RESEARCH

“The solution represents an exciting link between advanced research and an indus-

trial need,” said Ole Petter Ottersen, Rector of the University of Oslo, when the Heat Exchanger project won the Inven2 Prize.

The cooling system that will be installed on the ocean floor is designed to last for 30 years, which means it has to be durable, maintenance-free and without moving parts; but on the ocean floor, big means costly – and probably very costly.

In addition there are limits to the size of the constructions that marine cranes can lift, so it will be vital for future oil and gas extraction to make a bulky subsea module such as a cooling system as small and lightweight as possible.

OPTIMAL DESIGN

PhD research fellow Stig Grafsrønningen and Professor Atle Jensen together studied the physics of cooling down liquids at seabed level. This was how they discovered the new solution which can be

used by the oil industry, and which they concluded at the end of the project can increase the cooling effect by 15 per cent.

“We came up with the optimal design for the cooling system. We have also tested this in our own laboratory here at the Department of Mathematics,” says Atle Jensen.

FLUID MECHANICS

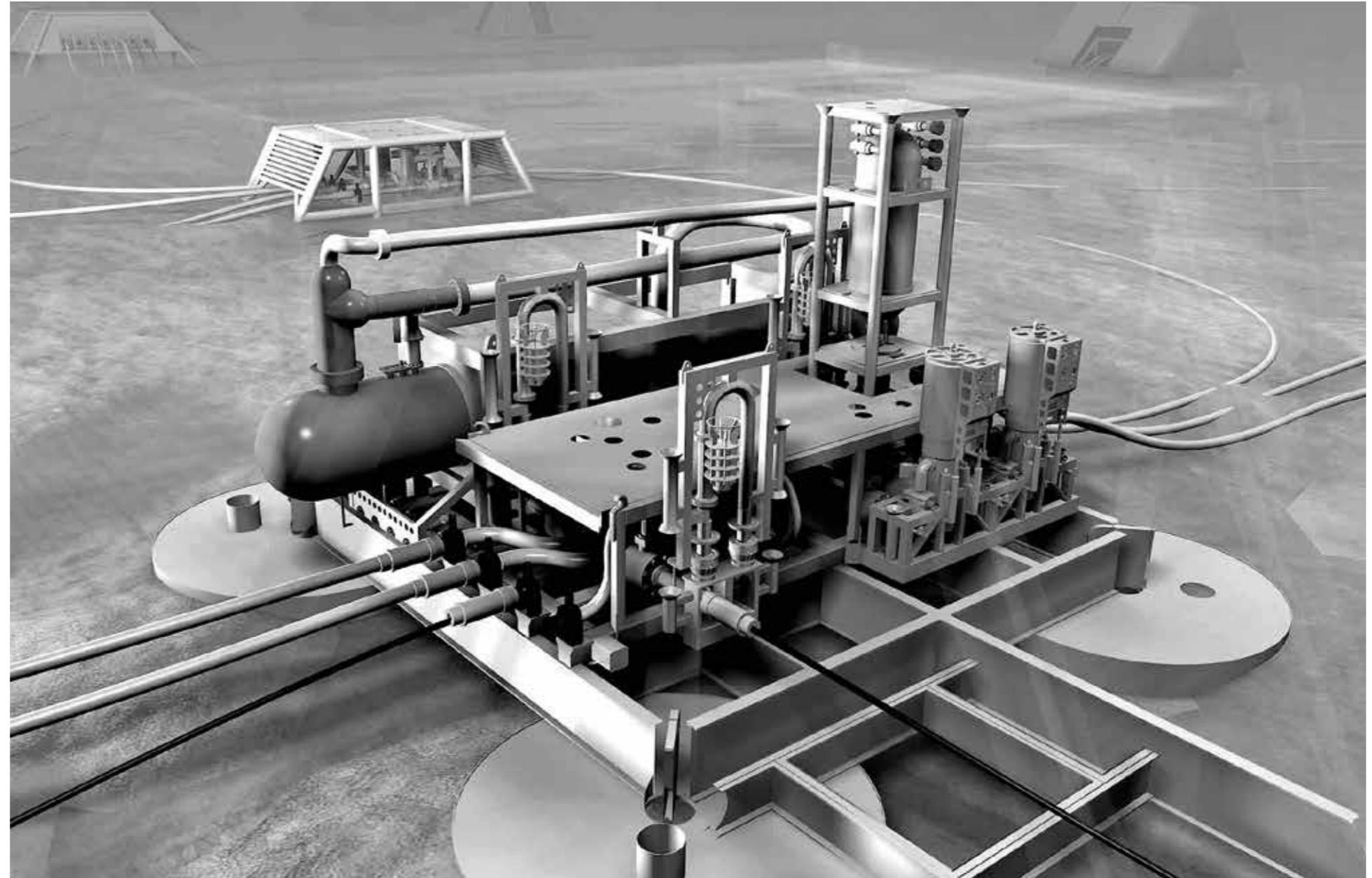
The two mathematicians are specialists in fluid mechanics, a branch of physics that uses mathematics as a tool to study the movements of fluids, in other words, liquids and gases. Norway has a long tradition of calculating fluid flow, particularly here at the University of Oslo. Without Vilhelm Bjerknes and his knowledge of the movements of liquids and gases almost one hundred years ago, Norwegian meteorology would not have the significance it has today.

The researchers believe that the process they have invented can also be used in connection with the export of Norwegian oil and gas to the Continent via subsea pipelines. The use of stainless steel for these long pipelines would be cost-prohibitive, and the alternative is to use less costly carbon steel.

The problem with carbon steel is that it rusts more quickly if the oil and gas being transported is too warm. This is where the optimized cooling system can prove useful.

The research project concluded in 2012, and a patent has been granted. However, the research is publicly available, which means that the results can be widely used.

MATHEMATICAL RESEARCH at the University of Oslo can make subsea equipment smaller, lighter and less costly.



Norway's largest incubator

THE UNIVERSITY OF OSLO'S STARTUPLAB IS NORWAY'S LARGEST INCUBATOR FOR START-UP COMPANIES. THE AIM IS TO GATHER THE BEST ENTREPRENEURS GRADUATING FROM THE UNIVERSITY AND CREATE AN ATTRACTIVE ENVIRONMENT FOR THEM.

TOR BÆKKELUND is one of the managing partners of StartupLab.



It is hardly surprising that the Faculty of Mathematics and Natural Sciences is the University of Oslo's main provider of young entrepreneurs to StartupLab. Nor is the fact that most of those who find their way to the incubator in the Research Park are from the Department of Informatics.

However, it is by no means obvious that students of the Faculty will become entrepreneurs; rather the opposite. For a young academic to become an entrepreneur may appear to many people akin to wandering in the desert.

When rookie entrepreneurs from the Faculty of Mathematics and Natural Sciences are faced with the choice of whether to take the path of committing to a permanent, safe and probably well-paid job in industry, or to take a leap into the uncertain existence of an entrepreneur – well, it is almost strange that anyone at all would want to do anything so painful.

However, some do. Not only that, they invest almost everything in their success.

GATHERING VARIOUS ENTREPRENEURS

StartupLab at the University of Oslo does not only consist of young entrepreneurs. One of the unique aspects of the approximately 60 start-up companies and 130 entrepreneurs who are housed in the university's incubator, is that they manage to attract both senior entrepreneurs (who have done it before) and rookie entrepreneurs. The idea is that the two groups should be able to derive benefit from one another.

"A lot of people think they have to have their entire business plan prepared before contacting an incubator like StartupLab. It isn't like that," emphasizes Tor Bækkelund, one of the managing partners of StartupLab.

He adds: "The only thing you can feel quite sure of here is that your journey will be different from the way you thought it would be".

STUDENT NIGHTS AND HACKATHONS

It should be as cheap as possible to get underway at the University of Oslo's StartupLab, and also as flexible as at all possible.

There is an awareness at the university incubator that many of those who apply to them are rejecting a secure and perhaps well-paid journey into the future. StartupLab must therefore make itself attractive in other ways. One of these is a high “cool factor”, and as far as this is concerned StartupLab definitely scores highly.

“We arrange our own student nights where we present ourselves to students at the Faculty of Mathematics and Natural Sciences. We tell them about starting your own business, about various funding schemes and how to get investors for a project. We also arrange hackathons, where students hack new ideas and solutions for a company and compete to be the best.”

Tor Bækkelund relates how StartupLab has also been successful in recruiting interns for enterprises at the Lab. “The company UX LAB here is an example of this. This is a company that offers interaction software development for companies, both within and outside of StartupLab.”

PEOPLE ARE THE MOST IMPORTANT FACTOR

Like other incubators, StartupLab has also become increasingly focused on the people behind the ideas. As many people have experienced over time, it is not necessarily the best ideas that win; it is the projects with the most committed and dedicated participants.

“The ability of people to navigate uncertain waters and bring ideas to realization has shown itself time and again to be the most important factor,” says Bækkelund.

REDUCING RISK

The risk is astronomically high for someone who invests in the implementation of an academic idea. However, it can be reduced by working systematically.

StartupLab collaborates with several actors to achieve this. One of the most important of these is Innovation House, Innovation Norway’s investment in Silicon Valley. Another important collaboration partner is of course Inven2, the University of Oslo’s Technology Transfer Office.

THE UX LAB COMPANY, was set up by students from the Faculty of Mathematics and Natural Sciences. Shown here are Asbjørn Lysne Voje, Karen Dolva, Halvard Eggen and Vilje Bech.



The biggest in the world on health data

RESEARCHERS AT THE UNIVERSITY OF OSLO HAVE DEVELOPED A SYSTEM FOR COLLECTING HEALTH DATA IN DEVELOPING COUNTRIES IN AFRICA AND ASIA. AMONG OTHER ATTRIBUTES THE SYSTEM CAN BE USED WHERE THERE ARE NO COMPUTERS OR INTERNET ACCESS.



At the core of the project is the District Health Information Software (DHIS) which has been developed at the University of Oslo. DHIS is an IT system that supports the collection, validation, and analysis of health data, and generates quality reports based on the data. Health workers and the authorities use the data to make speedy and better decisions on health measures.

According to *The Lancet*, a British medical journal, DHIS is now the world's most widely used open-source health information system. Altogether 44 countries have now implemented the system or are in the process of doing so.

INNOVATION AWARD

"We have achieved a lot for very little money. There are 1.3 billion people who could potentially be registered in our systems. The system helps to give several

hundred million people a better range of health initiatives," says Kristin Braa. She is a professor at the Department of Informatics and heads Global Infrastructure, a research group at the Department.

The University of Oslo's Innovation Prize for 2013 was awarded to DHIS and the researchers Kristin Braa, Jørn Braa and Sundeep Sahay.

DHIS is based on open-source software, user interface and standards.

ACTION RESEARCH

"This is a large-scale action research project. We build capacity locally through our research," Braa relates. "The innovation model is the result of PhD students from developing countries carrying out empirical studies in their home country or region, where they conduct research on relevant questions by actually implementing DHIS."

For every new functionality, a version specially adapted to the individual country is produced. But at the same time the participants keep in mind that the solutions must also be relevant elsewhere (generic). When a solution has been thoroughly tested, it is reabsorbed in the global software and made available to all the countries that use DHIS. DHIS is innovation based on real problems in real countries and on-site testing of new solutions.

"That's why this is successful. We're not just sitting here in our laboratory focusing on our programs. We always work on real implementation externally. We are focused on innovation all the time by working together with the users and looking for new solutions based on cutting-edge technology such as cloud computing resources, smartphones and new web technology."

KRISTIN BRAA is a professor at the Department of Informatics. “The definition of innovation in research is not commercialization, but that something is taken into use.



INNOVATION THROUGH DEVELOPMENT

When people talk about innovation in research, it is often in connection with the commercialization of research results.

“But the definition of innovation is that something is taken into use,” says Kristin Braa enthusiastically. “This research project is part of a very strong Scandinavian tradition: user participation, with a fundamental focus on the practice IT systems will form part of. We involve the grassroots as well as educating future health managers. Our PhD graduates return to their home countries and build capacity locally.”

So far 25 doctoral candidates have graduated and 25 more are currently participating in PhD programmes. Most PhD candidates in the project come from countries in the global South. The objective is that they return home and use their skills there, either as managers in ministries of health, in organizations or as university professors.

“Our aim is not to develop this commercially. The aim is to develop competence and to contribute to cooperation on education and research between universities and the authorities in each sepa-

rate country,” explains Kristin Braa. “This is innovation through development. Top Norwegian research builds national health information systems in developing countries through a programme of research.”

INNER IDEALISM

An increasing number are discovering DHIS 2.

The Norwegian Agency for Development Cooperation (NORAD) and the Research Council of Norway have been on board since the start 18 years ago, and the World Health Organization since 2007. Recently NORAD and the U.S. President’s Emergency Plan for AIDS Relief (Pepfar) and the Global Fund to Fight Aids, Tuberculosis and Malaria have combined forces to support the rollout in the 130 countries where the Fund works.

“There aren’t many people carrying out action research in the world of IT. Everyone working with this here at the Department is driven by an inner idealism. We won’t become rich as a result, but it generates a lot of jobs. On a global basis there are already a lot of people making a living from DHIS 2,” declares Braa.

Read more about DHIS2 at:

www.dhis2.org

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