

GEMINI

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Photo: FW AS/NTNU Info

REAL-TIME BEETHOVEN

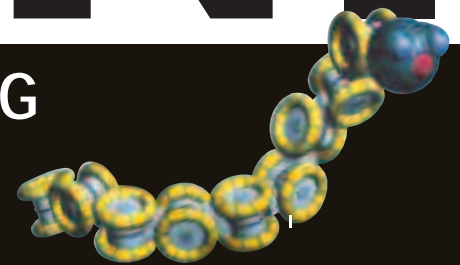
Compose and perform at once

MEMBRANE SNARES CO₂

Plastic membrane mimics human lungs

CLIMBING ROBOT

A gizmo on wheels inspects pipes



Smart textiles

Keep you cool when you're hot and warm when you're not.

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NTNU, SINTEF and the Norwegian petroleum industry have international expertise in offshore technology.

SINTEF and NTNU have primary responsibility for projects related to CO₂ capture and management – worth more than EUR 90 million.

SINTEF and NTNU are in charge of EU's largest bioenergy research project.

GEMINI

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Superconductors for industry

The world's first induction heater with superconductors is based on a Trondheim invention. This technology can bring large savings to the aluminium industry.

INDUCTION SUPERCONDUCTORS • ALUMINIUM INDUSTRY

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Photo: Thor Nielsen

BIG COILS: Magne Runde (left) and Frode Sætre working in the laboratory to make superconducting coils that are 1.5 m in diameter.

SUPERCONDUCTORS ARE MATERIALS that conduct current without resistance. For this reason, this field of research has always generated enormous interest, and considerable effort has been expended on techniques that can transform these materials into good energy conductors in technical components.

INCREASED EFFICIENCY • Magne Runde and Niklas Magnusson at SINTEF study superconductivity, and are testing superconductors in the huge induction heaters used by the aluminium industry.

Today the industry preheats large metre-long aluminium cylinders known as billets in induction heaters with copper conductors.

When the temperature reaches 500 °C, the billet is extruded into profiles.

"This heating process leads to large energy losses," says Runde. "Only half the energy supplied is used to heat the billet. The remaining 50 per cent is waste energy. This is something superconductors can improve."

WORLD'S LARGEST • The research scientists have now replaced the copper conductors in the induction coils with superconductors. As the conductivity is significantly improved, a

much higher proportion of the energy is transferred to the billet. The two research scientists have conducted laboratory tests that confirm the energy efficiency is increased to 80–90 per cent.

In their basement laboratory, Magnusson and Runde proudly show the two large superconducting coils with a 1.5m diameter. The superconducting material, magnesium diboride, is in thin, brittle filaments enclosed by a nickel matrix.

"These will be the world's largest supercon-

ducting coils made from this special material," says Runde.

GENERATING INTEREST • In 2007, the German company Zenergy Power licensed a patent based on SINTEF's basic idea. The company has acted quickly and produced two heaters, which it has sold. The concept of superconducting induction heaters was awarded a prize of € 100 000 at this year's Hannover trade fair.

Magnusson and Runde have continued with their research in a parallel and competing race with Zenergy Power. In an EU project with eight other partners, SINTEF now has a model under construction that is expected to be cheaper than the German one. The Trondheim research scientists designed and built the superconducting coils in their model.

"We have deliberately kept a low profile to see if Zenergy Power succeeded in building a complete model," says Magnusson. "We now believe the time is right to show that it is in fact a SINTEF invention behind the product."

With around 500 extrusion lines in Europe, the aluminium industry represents a niche market for the superconductors. However, given that the industry stands to gain energy savings of up to NOK 1 million for such induction heaters, the energy researchers believe there is a market for the product.

BY ÅSE DRAGLAND

Good news for pigs



Photo: Tim Graham / Image Bank

INSEMINATION: Moulding the sperm cells from pigs into an alginate gel provides for better storage capacity

Embedding sperm cells in a gel for artificial insemination increases the fertilization period for cattle and pigs and means more offspring.

2003 and with the assistance of funding from the Research Council of Norway, a research project was launched. Research scientists wanted to enable sperm cells to be able to fertilize eggs over a longer period. In 2008, the status is that the research scientists have developed a technique that moulds the sperm cells into an alginate gel. The cells can then be stored until the gel is inseminated into the animal.

"We have been trying to confirm a hypothesis that restricted tail movements of sperm cells, as is the case when they are in the animal's testicles, provides longer lasting qualities," says Geir Klinkenberg at SINTEF. "We achieve the restrictions by using the gel and the results to date are good. By achieving longer storage ability, it prolongs the lifespan of the sperm population in the uterus."

INSEMINATION REARING • ALGINATE

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THERE ARE CURRENTLY two methods for artificial insemination: bull semen that can be frozen to a temperature of -172 °C and stored indefinitely. However, pig semen must be diluted and stored as a liquid. Here the storage time is only a few days. The window of opportunity for insemination is also limited. Hitting the period when the sow is receptive is difficult and farmers need to inspect the animals regularly.

STORAGE • Achieving simpler insemination routines has therefore been an objective for Geno and Norsvin, two national artificial insemination companies for the breeding of cattle, horses and pigs.

"The time frame from when a sperm dose for pigs is extracted until it must be utilized is five days," says reproduction research scientist Ann Helen Gaustad at Norsvin. "Extending this by one to two days would be extremely significant."

The two organizations contacted SINTEF in

HIGH VALUES • Insemination sperm for pigs is currently sent all over Norway from a central plant in Hamar. Norsvin produces up to 3000 doses daily.

"This is production on an industrial scale where the sperm can be used in a large number of animals, and where each sperm and each piglet represents high value," says Klinkenberg. The next step will take place in the spring with insemination trials on larger animals. Around 1000 animals will be inseminated using the new method to see if better results are achieved than with today's conventional methods.

"This is a completely new and revolutionary approach where the focus has been on controlling the processes that occur both before and after the insemination," says Geno Research & Development Manager Elisabeth Kommisrud.

BY ÅSE DRAGLAND

The Scandinavian welfare model shows cracks

In Scandinavia, the State guarantees welfare and health services for all citizens. However, the actual disparities in health are greater than the rest of Europe.

HEALTH WELFARE • COMPARATIVE STUDIES

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THE FIGURES ARE CLEAR: It's not Scandinavia, but Germany, France, Switzerland and the Benelux countries that have the smallest disparities in

the health of their citizens. The reported figures are based on citizens' self-perceived health experiences and the comparisons have been made within each country.

Terje Andreas Eikemo at SINTEF Health Research has completed a doctoral thesis on this issue. Based on data from the European Social Survey, Eikemo has carried out the largest quantitative, comparative health investigation ever implemented.

STATE, FAMILY OR MARKET • He has assessed different welfare models from the point of view of the division of responsibility between the State, the family and the market.

"In Scandinavia, we contribute through relatively high taxes and fees and know that in return the State will take care of us if we get into difficulties," says Eikemo. "In Southern Europe, the family constitutes the security net; in Great Britain the market is important with private

health insurance options while in Central Europe benefits are based on previous earnings."

EXPLANATIONS • The fact that there are greater differences in citizen health in Scandinavia than Central Europe may be attributed to several factors. Eikemo believes that underlying social, historical and cultural factors create differences in the starting point. This makes it difficult for the welfare state to remedy matters afterwards.

Eikemo also points to recent immigration as an explanation for the discrepancy. These are people with few resources who do not use the health services to a major degree.

"Health is a good gauge of whether a welfare state is functioning," says Eikemo. "England has special focus on health for the lowest echelons of society. In Norway, we have an equality ideal where we are preoccupied with the outcome of good health care being equal for everyone. Since the principle of equality appeals most to Norwe-



Photo: Digital Vision

UNDERLYING FACTS: Social, historical and cultural factors can explain the Scandinavian health disparities. These are difficult for the welfare state to even out.

gian politicians, these figures should be of interest," says the SINTEF research scientist, who has published extracts of his thesis in several international journals.

BY ÅSE DRAGLAND