SPOTLIGHT ON DENMARK

Bringing business and academia together in Denmark

The private sector is helping drive innovation in Denmark and boosting its international research reputation

"Denmark is among the leaders globally in terms of overall investment in research."

Nikolaj Helm-Petersen, Innovation Center Denmark

PHYSICIST JEPPE Dyre has devoted his career to studying the molecular structure of viscous liquids — not an obvious route for research that could reduce Denmark's greenhouse gas emissions. But thanks to a collaboration involving Danish company NCC, a leading producer of asphalt and paving, Dyre's knowledge could help cut Denmark's total road-transport carbon output by at least 5 percent. The collaboration between NCC, the Danish Road Directorate, the Technical University of Denmark and Dyre's home institute Roskilde University aims to develop a material that reduces rolling resistance between tyres and the road. "It's highly satisfactory to use our knowledge from fundamental research to benefit society," says Dyre, based at Roskilde's Centre for Glass and Time. "It's not just applied research that produces real-world results."

The collaboration is not uncommon. Denmark is committed to bringing industry and academia together to boost innovation and productivity. Private sector companies and funds account for two-thirds of all investment in research and development (R&D) in the country, equivalent to 2.1 percent of the national gross domestic product (GDP), while the public sector contributes a further 1 percent of GDP. The Danish Agency for Science, Technology and Innovation (DASTI) has been running an industrial PhD programme since the 1970s, and in March 2011 the agency called for businesses to have a greater role in the EU's forthcoming Horizon 2020 research-funding framework programme. How is this integration being fostered, and what does it mean for researchers based in Denmark?

Matchmaking universities

For many years, it was Danish companies that reached out to universities or researchers with a particular project needing scientific expertise. Danish universities have long since recognised the benefits of developing these relationships and many have established meeting points for scientists and companies. Aalborg University, for example, operates a 'matchmaking' network comprising departmental representatives who liaise with companies and contacts in external business promotion offices. The University of Southern Denmark runs a similar network in collaboration with the Growth Forum of Southern Denmark; its current research areas include agricultural and assistive technologies and spinal rehabilitation.

"About half of our students' research projects are business-related," says Eskild Holm Nielsen, dean of the faculty of engineering and science at Aalborg University. He says a close relationship with industry helps scientists understand which areas of fundamental research will have the most impact on commercial and social needs. "Our PhD students work a lot with real-life issues," he says. "I would estimate that 75 percent of their projects are in collaboration with the private sector."

Building foundations

In addition to DASTI's work and the relationships between individual companies and universities, there are several independent foundations encouraging collaboration between the public and private sectors. One example is the Danish National Advanced Technology Foundation, which was established by the state in 2004 to increase the country's innovative output. »

NOVO NORDISK FOUNDATION LAUREATE RESEARCH GRANTS

ENABLING EXCEPTIONAL SCIENTISTS

International call for applications for two remarkable grants within the areas of biomedicine and biotechnology, each up to 40 million Danish Kroner (EUR ~5.5 million, USD ~7 million)

OBJECTIVES

The Novo Nordisk Foundation (NNF) announces a new grant program for leading scientists to come to Denmark to build their visionary research programs. The goal for these grants is to make substantial contributions to the funding needed for new scientific directions and breakthroughs.

GRANT FUNDING

- Up to DKK 40 million over a period of 7 years.
- NNF laureate grant holders can apply for continued funding, up to DKK 35 million over an additional 7 years.

APPLICANT

- Should be outstanding independent scientists within biomedical and/or biotechnology research, and have profiles as promising leaders in their field(s) of research.
- Should have a desire to conduct their research in Denmark. The Danish host institution can be a university, public research institution, or university hospital.
- Can have any nationality, but must be currently employed as scientists outside of Denmark.

SELECTION

Selection of NNF laureate research grantees will occur through international peer review and be based on the scientific excellence of both the investigator and the proposed research program.

APPLICATION PROCEDURE AND DEADLINE

The application process will consist of two stages; stage I applications must be submitted electronically via the NNF's web portal by May 31, 2012. Selected applicants will be invited to stage II.

FURTHER DETAILS

To learn more about these grants, applicant eligibility and the application procedure, please visit www.novonordiskfonden.dk/en.

novo nordisk fonden

ABOUT THE NOVO NORDISK FOUNDATION

The Novo Nordisk Foundation (NNF) is committed to supporting outstanding research within the biomedical sciences and biotechnology. The NNF is an independent and self-governing private foundation, supporting independent research as well as the publication freedom of researchers.

In addition to its research grant programs, the NNF provides significant funding to four research centers established since 2007: the Novo Nordisk Foundation Center for Protein Research, the Novo Nordisk Foundation Center for Basic Metabolic Research, the Danish Stem Cell Center (DanStem), and the Novo Nordisk Foundation Center for Biosustainability.

The NNF is also launching an international conference series in 2012, the Copenhagen Bioscience Conferences. More information about this unique program can be found at www.cph-bioscience.com.

Read more about the NNF and its activities at www.novonordiskfonden.dk/en.

"Many European countries are very good at doing fundamental research, but are challenged in transferring the research to the commercial sector," says Klaus Bock, deputy chairman of the foundation's board. Initial results from the foundation's projects showed a significant impact on businesses. Small companies that took part in a project grew by an average of 77% by the time the project was completed.

Danish companies have also established independent foundations that are funding research in the public sector. Since 2007 the Novo Nordisk Foundation (NNF) has donated more than 1.8 billion kroner (US$320 million) to the University of Copenhagen to fund three research centres: the NNF Center for Protein Research, the NNF Center for Basic Metabolic Research and the Danish Stem Cell Center (DanStem). In 2010 it granted 700 million kroner (US$120 million) to the Technical University of Denmark to fund the NNF Center for Biosustainability. "We grant money to larger-scale projects because this helps make Danish research competitive internationally and attract the best researchers worldwide," says NNF scientific officer John Wittschieben.

Scientists based at the centres say the investment is having the desired effect. "We have created vibrant academic environments," explains Oluf Borbye Pedersen, scientific director of the metabolic genetics division at the NNF Center for Basic Metabolic Research. "It is our ambition to have a centre at Harvard-level."

CF MØLLER

The University of Copenhagen's proposed science building, an extension to the Panum Institute, to be completed by 2015.

Matthias Mann, the research director at the NNF Center for Protein Research and a departmental director at the Max Planck Institute for Biochemistry in Munich, says that because of the integration between business and academia it's easier to link fundamental research with applied research in Denmark than it is in Germany: "The collaboration with industry works extremely well."

The University of Copenhagen has also received a funding boost from the A.P. Møller Foundation, owned by Danish shipping magnate Arnold Mærsk Mc-Kinney Møller, and the Nordea Foundation, associated with the Stockholm-based Nordea banking group. The Møller Foundation donation is contributing to the construction of a striking new science building at the university's Panum Institute. Ulla Wewer, dean of the faculty of health and medical sciences, says the developments are having a positive effect throughout the university. "It generates an atmosphere of enthusiasm," she says. "Initiatives such as the new Panum building create momentum, which could help establish Copenhagen as an international science metropolis."

Supporting the best researchers

As well as funding infrastructure, commercial foundations in Denmark are also investing in academia's human resources. The Lundbeck Foundation, principal shareholder of the Lundbeck pharmaceutical company, awards grants for visiting professorships to attract international talent to Denmark and junior group fellowships to support mid-career researchers. "The fellowships are intended for what we call 'post-postdocs' — people who are ready to apply for a full-time post at a university," explains Anne-Marie Engel, director of research at the Lundbeck Foundation. "We prioritise this group because we know there are more qualified people at this level than there are

Private sector investment in R&D

Biggest investors in R&D among private-sector employers in Denmark

Employer	R&D invested (2010, €m)
Novo Nordisk (Pharmaceuticals)	1,272
Lundbeck (Pharmaceuticals)	385
Vestas Wind Systems (Alternative energy)	358
Danske Bank (Banks)	332
Novozymes (Biotechnology)	156
Grundfos (Industrial machinery)	144
Danfoss (Industrial machinery)	141
DONG Energy (Oil and gas producers)	110
Danisco (Food producers)	110
William Demant (Healthcare equipment and services)	76

Source: 2011 EU Industrial R&D Investment Scoreboard

MIKLOS SZABO

available positions at universities."

Research supported by the Lundbeck Foundation does not have to be related to the business areas of its subsidiaries. While Lundbeck specialises in central nervous system (CNS) pharmaceuticals, for example, three of the fellows supported by the foundation are astrophysicists. "You don't see any CNS medicines coming from that," says the foundation's chief executive, Christian Dyvig. "Quality is the determining factor."

To further enhance Danish research, the Lundbeck Foundation has established the non-profit Grete Lundbeck European Brain Research Foundation, which will award a single major international prize every year. 'The Brain Prize', worth €1 million (US$1.3 million), is given to a scientist or a group of scientists who are distinguished by an outstanding contribution to European neuroscience. The only criteria are that the winner has several years of their research career remaining, and that they agree to take part in an outreach programme with Danish neuroscientists. In March 2012 the Lundbeck Foundation announced it would donate €18 million (US$24 million) to a collaboration between several Danish universities, including Aarhus University, and the public mental health services in Greater Copenhagen for research on serious mental disorders.

International appeal

The investment in academia by the private sector and foundations in Denmark is attracting international attention.

In 2010 the Chinese genomics powerhouse BGI (formerly Beijing Genomics Institute) announced it would establish its European headquarters in Copenhagen, following the largest-ever single grant from the Danish National Advanced Technology Foundation (84 million kroner; US$15 million) for a project to map the Danish genome. In February 2012 BGI opened its first European Genome Research Center at Copenhagen Bio Science Park (COBIS) and in March 2012 it announced a major global collaboration with Novo Nordisk. Since 2006, the total number of foreign applicants for university positions in Denmark has increased by around 8 percent. Half of all applicants are from outside Denmark, and one-third of all PhD students are foreign nationals.

The Danish government is striving to attract foreign researchers. One initiative, WorkinDenmark, is a website for international recruitment. The website has three associated regional centres offering advice on applying for jobs and moving to Denmark. Since 1992 a favourable tax scheme has been in place for foreign and Danish researchers who have worked abroad, which enables researchers employed by a Danish company or research institution to apply for tax reductions.

Nikolaj Helm-Petersen, technology and research attaché at the Innovation Center Denmark outpost in Munich, attributes part of the increase in foreign PhD students to the attractive working conditions in Denmark. "We probably have the world's highest PhD salaries," he says. PhD students are both formally enrolled and employed at a university, with corresponding benefits such as paid maternity leave. Job satisfaction is also evident across other career stages: in 2010 Denmark came first in a global *Nature* survey about salaries and general working conditions (see go.nature.com/w8ylYL for more).

Denmark scores well on other measures of research success. The country is recognised as an innovation leader by the European Commission, second only to Sweden on the European Innovation Scoreboard. Since 2007 researchers in Denmark have been awarded 49 European Research Council (ERC) grants, 18 of which have gone to Aarhus University. Rector Lauritz B. Holm-Nielsen says the university has a leading position because its researchers stand out on the international research scene: "Our chemists, for example, have the highest citation impact for researchers in the Nordic region across all academic fields. That is critical when they apply for funds."

Another encouraging sign for research in Denmark is the decision by the country's new government to cancel plans to make funding cuts to the 2012 national research budget. Denmark currently ranks third in the world after Finland and the United States in terms of investments in R&D in relation to GDP — excluding military-related costs, Denmark ranks second.

To consolidate Denmark's position in international research rankings — and continue to deliver real-world results — both the public and private sectors must continue their commitment to investing in science. "Denmark is among the global leaders in terms of overall investment in research," says Helm-Petersen. "Talented researchers always want to be where the research funds are." ■

Nature editorial staff have no responsibility for content

The Novo Nordisk Foundation, with its headquarters in Hellerup near Copenhagen, has donated more than 2.5 billion kroner (US$440 million) to public research in Denmark since 2007.

Public sector employers

Top universities by number of employed researchers

University	Approx. no. of employed researchers
Copenhagen University	4,300
Aarhus University	3,400
Technical University of Denmark	2,700
University of Southern Denmark	1,600
Aalborg University	1,400
Copenhagen Business School	600
Roskilde University	500
IT University of Copenhagen	100

Source: Danish Agency for Science, Technology and Innovation

AAU

AALBORG UNIVERSITY: FACULTY OF ENGINEERING AND SCIENCE

Work on global challenges in Denmark

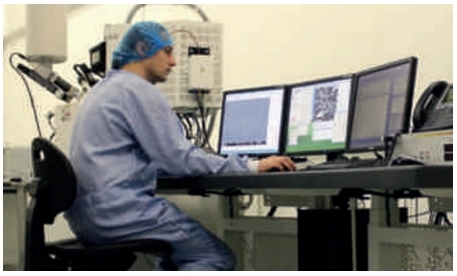
The world is facing significant challenges — global warming, an increased demand for energy, food and water and an ageing population are just a few of the issues we must tackle. Aalborg University (AAU), a young yet well-established research and teaching institution in Denmark, is committed to playing a leading role in the European research community's response to these 'Grand Challenges'. We're looking for scientists to join our Faculty of Engineering and Science — could you help us make a difference?

Cutting-edge research

At AAU one of our primary functions is to conduct research that meets societal needs. We regularly collaborate with the business community to solve real-life problems and we place a strong emphasis on interdisciplinary and interfaculty research. Many of the research areas at the Faculty of Engineering and Science have significant resonance with the Grand Challenges, in particular our work on power electronics and advanced materials.

Improving energy efficiency with power electronics

The proportion of energy consumed as electricity is expected to grow from 40% today to 60% in 2040, making improving energy efficiency a high priority. At AAU we believe that the key to using electricity more efficiently lies in power electronics: the systems and devices that control and convert electronic power. AAU's Department of Energy Technology, one of 12 departments in the Faculty of Engineering and Science, is developing innovative concepts, designs and prototypes that will optimise efficiency and reliability. The department's power electronics group, led by Professor Frede Blaabjerg, is also researching how the performance of power electronics is affected by stress factors such as temperature, overcurrent and overvoltage. "For example, we have developed a very efficient way to extract electrical power from photovoltaic panels in different operating conditions," explains Blaabjerg.



AAU

Researchers interested in the field need a fundamental understanding of electrical, mechanical, thermal and software engineering as well as material science. "Engineers should also be able to make prototypes to validate their theories," says Blaabjerg. "It's a very multidisciplinary field."

Developing advanced materials

AAU is internationally recognized as one of the world's leading universities for advanced materials research. The development of new materials is vital for a sustainable energy supply and is one of the most important areas of research for the Grand Challenges. "Materials research at AAU involves an integrated approach to materials, processes and applications and spans from physics and chemistry at the molecular level to the synthesis of macroscopic materials," says Professor Thomas G. Pedersen from the Department of Physics and Nanotechnology. Some of the specific areas of research at AAU include:

- Novel concepts and materials for solar cells, fuel cells and wind turbines
- Inorganic materials for energy-efficient materials
- Ultra-strong composite materials
- Carbon-based materials for nano-scale electronics

Facilities for advanced materials research at AAU include several world-class labs with state-of-the-art technical equipment as well as advanced tools for modelling and simulations. Our new Advanced Energy Materials Center (ADEMC), opening in the summer of 2012, will further consolidate our position in this cutting-edge field. "The ADEMC will support the development of advanced materials and structures with a broad range of applications in science and technology," says Professor Kjeld Pedersen, head of the Department of Physics and Nanotechnology.

"Researchers interested in the field of advanced materials science need both strong experimental skills and a solid theoretical foundation across several disciplines," says Professor Yuanzheng Yue from the Department of Biotechnology, Chemistry and Environmental Engineering. "You need the vision to do highly original research," Yue adds.

Working for AAU

AAU has a strong international identity and an increasing number of foreign researchers come to work at the university each year. Most AAU staff are based in Aalborg, the fourth largest city in Denmark, which offers a wealth of opportunities for recreation and leisure. The university itself is also an attractive workplace, with generous staff benefits including 25 days of annual leave, flexible working hours and a contributory pension scheme. Academic staff are paid according to the Danish national payscale for publicly employed university graduates. For example, postdocs with two to three years of research experience following their PhD are paid an annual salary in the region of 460,000 kroner (US$82,000), which includes a 17 percent pension. PhD students are paid in the region of 320,000 kroner (US$57,000) including pension.

AAU is committed to providing leadership and staff development opportunities by working closely with international institutions, with an emphasis on project work and peer learning. Our teaching structure is based on problem-based learning (PBL) and the Aalborg PBL Model is internationally recognised as an advanced and efficient learning model.

Current opportunities

We have regular openings for PhD students, postdocs, assistant professors and professors. "We're particularly looking for international scientists within the fields of computer science, mathematics, engineering and physics," says Eskild Holm Nielsen, dean of the Faculty of Engineering and Science. To see our latest vacancies, visit www.en.aau.dk and click on 'Vacant positions' in the right-hand menu. ■

Faculty of Engineering and Science

Departments: 12
Annual research budget:
Approx. 860 million kroner (US$150 million)
Research publications in 2011:
Approx. 2,000
Employees: Approx. 1,900
PhD students: Approx. 670
Undergraduates: Approx. 6,300

AALBORG UNIVERSITY

www.en.aau.dk

AARHUS UNIVERSITY

TALENT DEVELOPMENT AT AARHUS UNIVERSITY

Aarhus University is a competitive and visionary university placed in the top-100 on several world ranking lists. The university is host to four graduate schools covering the fields of Health, Arts, Science and Technology, and Business and Social Sciences with close to 2,000 PhD students enrolled.

Over the last decade, PhD education in Denmark has undergone significant development from being an apprenticeship exclusively centered on participation in a research project to becoming a structured educational program with courses rooted in high-quality research environments, where talent is nurtured and developed from graduate level to tenure track and beyond.

The graduate programs at Aarhus University are tailored to include significant international mobility, and the four graduate schools continually strive to strengthen their programs through international cooperation and strategic international alliances with selected partners. By promoting interdisciplinary research drawing on in-depth knowledge of core research disciplines as well as combining research-based education with research-based innovation, Aarhus University provides a springboard for graduates to build international careers and contribute to the dynamic development of Danish society and the world at large. With an international focus and a high quality of research, the university puts great effort into talent development and into ensuring that career paths are transparent and competitive, positioning its graduates among the international elite. Many of its graduates are placed at top universities across the world as they are considered valued faculty due to their high-caliber skills and research-based educational background attained during their training at Aarhus University.

The annual intake of PhD students at Aarhus University has increased significantly over the years, and in 2011, the total PhD student intake exceeded 500. The university recruits the most promising PhD students from Denmark and abroad at highly competitive salaries (more than $ 50,000 per year) and offers unique, groundbreaking research environments embedded in a friendly and supportive work atmosphere with numerous opportunities and freedom to pursue the unexpected. Learn more on: **talent.au.dk/phd**

Aarhus University offers an inspiring education and research environment for 40,000 students and 11,000 members of staff, ensuring results of a high international standard. The budgeted turnover for 2012 amounts to DKK 6.2 billion. The university's strategy and development contract are available at www.au.dk/en.

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Professor

In Systems Microbiology (60058)

Faculty of Engineering and Science, Department of Biotechnology, Chemistry and Environmental Engineering, Aalborg University. We seek an outstanding scientist with qualifications at professor level within systems microbiology with expertise in one or more aspects of -omics, single cell genomics or integrated modelling of microbial cell or community functions. The department is in the international forefront in studies of microbial communities in technical systems and wishes with the present position to expand this into fundamental research on microbial communities in technical and natural ecosystems. We seek a scientist with a proven research record in studies of microbial communities and with the potential in collaboration with the present researchers to develop a world-class laboratory for environmental biotechnology. The successful applicant will join an interdisciplinary research team with state of the art facilities in new buildings.

Department of Biotechnology, Chemistry and Environmental Engineering conducts research and teaching in biotechnology. Environmental Biotechnology is a focus area. On-going research topics include studies of microbial communities (biofilms and aggregates) and their function and dynamics in technical and natural systems with the use of single cell microbiology and genomics, metagenomics, transcriptomics, proteomics, metabolomics and modelling.

Apply online: **www.stillinger.aau.dk**

Deadline: **May 10th 2012**

Aalborg University (AAU) conducts teaching and research to the highest level in the fields of humanities, engineering, and natural, health, and social sciences.

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Interested in career opportunities in a challenging and progressive Danish Life Science environment?

Take a look at www.workindenmark.dk - the official Danish website for international recruitment and job search.

During the last few years several research centers have been created in Denmark and the Oresund Region. Among them are centers focused on Protein Research, Metabolism, Microbial Biotechnology, Cancer Research, Stem Cell etc.

Those centers, international research projects and Danish companies experience a lack of highly skilled specialists and the academic world in Denmark is continuously looking for researchers, PhD's, post docs etc.

In our job bank, you can see vacancies from Danish companies and academic institutions, looking specifically for international candidates.

You can create a profile, submit your CV to our CV bank and make your qualifications and competencies visible to Danish companies.

The website also contains useful information about permits, housing, language courses, relocation etc.

For more information visit www.workindenmark.dk and please notice the sub site for Highly Skilled Professionals.

WORK IN DENMARK

FASTHOLDELSE REKRUTTERING

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Technical University of Denmark DTU

THE H.C. ØRSTED POSTDOC PROGRAM

Technical University of Denmark (DTU)

DTU invites highly talented young researchers to apply for stipends under the H.C. Ørsted Postdoc Program. The program is named after the founder of the university, H.C. Ørsted, who discovered electromagnetism. We seek candidates who have obtained outstanding results during their PhD studies and who have demonstrated excellence and potential in their field of study.

In order to be considered, applications must include a confirmation letter signed by the relevant DTU department head, stating that the department and the candidate have agreed upon the research plan.

Applications must be based on the details of the full text announcement.

Application deadline: **10 May 2012**

DTU is a technical university providing internationally leading research, education, innovation and public service. Our staff of 5,000 advance science and technology to create innovative solutions that meet the demands of society; and our 7,000 students are educated to address the technological challenges of the future. DTU is an independent academic university collaborating globally with business, industry, government, and public agencies.

Further details: dtu.dk/career

SCIENCE AND TECHNOLOGY AT A GLOBAL SCALE – SET THE STANDARDS FOR THE FUTURE

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Technical University of Denmark DTU

HEAD OF DEPARTMENT

National Space Institute (DTU Space)

DTU Space. As Head of Department, your primary responsibility will be the department's quality and development within the fields of research, public sector consultancy, teaching and innovation. In addition, the Head of Department is responsible for the day-to-day management of the department and as such also for supporting employees and their competency development at an elite university. Lastly, the Head of Department has overall financial responsibility for the department.

Application deadline: **15 April 2012**

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Further details: dtu.dk/career

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