

CENTRE FOR ADVANCED STUDY  
SENTER FOR GRUNNFORSKNING

**ANNUAL REPORT 2008**





## **Centre for Advanced Study** at the Norwegian Academy of Science and Letters

The Centre for Advanced Study (CAS) is a private foundation. It was established by the Norwegian Academy of Science and Letters in 1989, and its activities commenced in full from the autumn of 1992. Its purpose is to raise the calibre of Norwegian basic research and interdisciplinary theoretical work up to the highest international level in the humanities/theology, social sciences/law, natural sciences/medicine and mathematics. The Centre rents premises from the Norwegian Academy of Science and Letters at Drammensveien 78, NO-0271 Oslo.

Outstanding researchers from Norway and abroad are nominated for one-year stays in the Centre. The activities are organized in three groups – one in the humanities, one in the social sciences and one in the natural sciences – each with from six to ten members whose affiliation is long-term. In addition, numerous researchers spend shorter periods conducting research, altogether some 40–45 researchers of 10 to 15 nationalities a year. Each group is planned and organized around a unifying theme and headed by one or more outstanding researchers. The groups have no other obligations than their own research. They receive administrative and financial support from the Centre in formalized cooperation with seven Norwegian universities and two high-level research colleges, i.e. the University of Oslo, the University of Stavanger, the University of Bergen, the University of Tromsø, the Norwegian University of Science and Technology in Trondheim, the Norwegian University of Life Sciences in Ås, the University of Agder, the Norwegian School of Economics and Business Administration in Bergen and BI Norwegian School of Management.

The Centre has a Board appointed by the Norwegian Academy of Science and Letters, the Norwegian Association of Higher Education Institutions and the Research Council of Norway.



## Abbreviations used in the Annual Report

CAS	Centre for Advanced Study
NASL	Norwegian Academy of Science and Letters
NetIAS	European Network of Institutes of Advanced Study
NTNU	The Norwegian University of Science and Technology
RCN	The Research Council of Norway
UHR	The Norwegian Association of Higher Education Institutions
UiT	University of Tromsø
USIT	University of Oslo's Center for Information Technology
UiB	University of Bergen
UiO	University of Oslo

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## The Board



**Aanund Hylland**  
*Professor*  
University of Oslo  
(Chair) – NASL



**Gerd Bjørhovde**  
*Professor*  
University of Tromsø  
(Deputy Chair) –  
UHR



**Kenneth Hugdahl**  
*Professor*  
University of Bergen  
– NASL



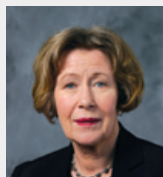
**Liv Bliksrud**  
*Professor*  
University of Oslo  
– NASL



**Ivar Langen**  
*Professor*  
University of  
Stavanger – UHR



**Leif Arne Heløe**  
*Professor*  
Norwegian Institute  
for Urban and Regional  
Research – RCN



**Reidun Sirevåg**  
*Professor*  
*Secretary General*  
The Norwegian  
Academy of Science  
and Letters (Observer  
for NASL)

## Alternates



**Ivar B. Ramberg**  
*Professor*  
Alternate (for  
Hylland), Ramberg  
Consulting AS – NASL



**Sigmund Grønmo**  
*Rector*  
Alternate (for  
Bjørhovde), Univer-  
sity of Bergen – UHR



**Egil Leer**  
*Professor*  
Alternate (for  
Hugdahl), University  
of Oslo – NASL



**Lars Walløe**  
*Professor*  
Alternate (for  
Bliksrud), University  
of Oslo – NASL

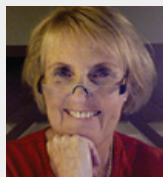


**Astrid Læg Reid**  
*Prorector*  
Alternate (for Langen),  
Norwegian University  
of Science and Tech-  
nology – UHR

Foto: Gunn Kallstad, Scampus/NTNU Info



**Anne Lise Ryel**  
*Secretary General*  
Alternate (for Heløe),  
The Cancer Society  
– RCN, until  
8 October 2008



**Marit Halvorsen**  
*Professor*  
Alternate (for Heløe),  
University of Oslo  
– RCN, from  
8 October 2008

## The administration



**Willy Østreng**  
*Professor*  
Scientific Director



**Unn Haaheim  
Hagen**  
*Office Manager,*  
until 1 August 2008



**Maria M. L. Sætre**  
*Adviser,*  
until 1 August 2008  
and *Office Manager,*  
from 1 August 2008



**Trude Gran Peters**  
*Higher Executive  
Officer,*  
from 4 August 2008



**Marit Finnemyhr  
Strøm**  
*Executive Officer*

## Research groups 2007/2008 - Participants spring 2008

### Nature-inspired Chemical Process Design



**Signe Kjelstrup**  
*(Group Leader)*  
Professor  
NTNU, Norway



**Henrik Koch**  
Professor  
NTNU, Norway



**Dick Bedeaux**  
Professor II  
NTNU, Norway



**Jean-Marc Simon**  
Associate Professor  
University of  
Bourgogne, France



**Alfredo Sánchez de Merás**  
Associate Professor  
University of  
Valencia, Spain



**Daniel Barragán**  
Associate Professor  
Universidad Nacional  
de Colombia



**Marc-Olivier Coppens**  
Professor  
Rensselaer Polytechnic  
Institute, USA



**Stefan Gheorghiu**  
Senior Researcher  
Center for Complexity  
Studies, Romania



**Peter Pfeifer**  
Professor  
University of Missouri  
Columbia,  
USA



**Jon G. Pharoah**  
Assistant Professor  
Queen's University,  
Canada



**Oodne Burheim**  
Research fellow,  
NTNU, Norway



**Linus Boman**  
Research fellow  
NTNU, Norway



**Miguel Rubí**  
Professor  
University of  
Barcelona, Spain



## Research groups 2007/2008 – Participants spring 2008

### The Power of the Ruler and the Ideology of Rulership in Nordic Culture 800-1200



Gro Steinsland  
(Group Leader)  
*Professor*  
UiO, Norway



Anders Hultgård  
*Professor emeritus*  
Uppsala University,  
Sweden



Jón Viðar Sigurðsson  
*Professor*  
UiO, Norway



Joanna Skorzevska  
*Researcher*  
UiO, Norway



Olof Sundqvist  
*Assistant Professor*  
University of Gävle  
and University of  
Uppsala, Sweden



Jan Erik Rekdal  
*Professor*  
UiO, Norway



Jens Peter Schjødt  
*Professor*  
University of Aarhus,  
Denmark



Ian Beuermann  
*Dr., Research fellow*  
Centre for Manx  
Studies, University  
of Liverpool, UK

## Research groups 2007/2008 – Participants spring 2008

### Understanding Innovation



**Jan Fagerberg**  
*(Group Leader)*  
Professor  
UiO, Norway



**Thomas Hoff**  
*Associate Professor*  
UiO, Norway



**Magnus Gulbrandsen**  
*Senior Researcher*  
NIFU STEP, Norway



**Sjur Kasa**  
*Senior Researcher*  
CICERO, Norway



**Cristina Chaminade**  
*Associate Professor*  
Lund University,  
Sweden



**Ben Martin**  
*Professor*  
University of Sussex,  
UK



**David C. Mowery**  
*Professor*  
University of California  
at Berkeley,  
USA



**Martin Srholec**  
*Senior Researcher*  
UiO, Norway



**Koson Sapprasert**  
*Research Fellow*  
UiO, Norway



**Susan Cozzens**  
*Professor*  
Georgia Institute of  
Technology, USA



**Charles Edquist**  
*Professor*  
Lund University,  
Sweden



**Maryann P. Feldman**  
*Professor*  
University of Georgia,  
USA



**Paul Nightingale**  
*Senior Fellow*  
University of Sussex,  
UK



**Bart Verspagen**  
*Professor*  
Eindhoven University  
of Technology,  
The Netherlands



**Anders Underthun**  
*Research Fellow*  
NTNU, Trondheim



**Stan Metcalfe**  
*Professor*  
University of  
Manchester, UK

## Research groups 2008/2009 – Participants autumn 2008

### Nonlinear Partial Differential Equations



**Helge Holden**  
*(Group Leader)*  
Professor  
NTNU, Norway



**Kenneth H. Karlsen**  
*(Group leader)*  
Professor  
UiO, Norway



**Nils Henrik Risebro**  
Professor  
UiO, Norway



**Alberto Bressan**  
Professor  
Penn State University,  
USA



**Boris Andreianov**  
Professor  
University of  
Franche-Comté,  
France



**Eduard Feireisl**  
Professor  
Mathematical Institute of the Academy of Sciences, Czech Republic



**Evgueni Panov,**  
Professor  
Novgorod State  
University, Russia



**Gui-Qiang Chen**  
Professor  
Northwestern  
University, USA



**Hailiang Liu**  
Professor  
Iowa State University,  
USA



**Henrik Kalisch**  
Associate Professor  
UiB, Norway



**José Antonio Carrillo de la Plata**  
Professor  
University Autònoma of Barcelona, Spain



**Konstantina Trivisa**  
Professor  
University of  
Maryland, USA



**Peter Lindqvist**  
Professor  
NTNU, Norway



**Sigmund Selberg**  
Associate professor  
NTNU, Norway



**Trygve Karper**  
Research Fellow  
UiO, Norway



**Wen Shen**  
Assistant Professor  
Penn State University,  
USA



**Xavier Raynaud**  
Postdoctoral Fellow  
NTNU, Norway



**Yann Brenier**  
Professor  
University of Nice  
- Sophia Antipolis,  
France



**Yin Zhaoyang**  
Professor  
Zhongshan  
University, China



**Young-Sam Kwon**  
Research Associate  
University of  
Maryland, USA

## Research groups 2008/2009 - Participants autumn 2008

### Early Networking in Northern Fennoscandia



Charlotte Damm  
(Group Leader)  
Professor  
UiT, Norway



Lars Forsberg  
Professor  
UiB, Norway



Lars Ivar Hansen  
Professor  
UiT, Norway



Lars-Gunnar Larsson  
Professor  
University of Uppsala,  
Sweden



Mika Lavento  
Professor  
University of  
Helsinki, Finland



Peter Jordan  
Senior lecturer  
University of  
Aberdeen, UK



Janne Saarikivi  
Researcher  
University of  
Helsinki, Finland

### Understanding the Role of Water in History and Development



Terje Tvedt  
(Group Leader)  
Professor  
UiB, Norway



Richard Coopey  
Senior Lecturer  
Aberystwyth Univer-  
sity, UK



Graham Chapman  
Professor  
Lancaster University,  
UK



Roar Hagen,  
Professor  
UiT, Norway



Armando J. Lamadrid  
Assistant Research  
Fellow  
UiB, Norway



Karen Syse  
Research Fellow  
UiO, Norway



Nina Witoszek  
Professor  
UiO, Norway



Terje Østigård  
Postdoctoral Fellow  
UiB, Norway

# CENTRE FOR ADVANCED STUDY

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The Centre for Advanced Study (CAS) is a private foundation. Established by the Norwegian Academy of Science and Letters in 1989, its activities commenced in full from autumn 1992. The purpose of CAS is to raise the calibre of Norwegian basic research, disciplinary as well as interdisciplinary, to the highest international standards in the humanities/theology, social sciences/law and science/medicine/mathematics. The Centre rents premises from the Norwegian Academy of Science and Letters at Drammensveien 78, NO-0271 Oslo. In 1993, in response to a request from the Ministry, an Operating Fund was established to ensure the operation of the Centre. The fund is administrated by the Board of the Centre.



## 1. Administrative affairs

The Board is the Centre's supreme governing body. Its composition is regulated by §4 of the Memorandum of Association, which reads as follows:

“The Board of the Norwegian Academy of Science and Letters (NASL) and the Norwegian Association of Higher Education Institutions (UHR) each appoint two members with alternates to the Board of the Centre. In agreement with the Norwegian Association of Higher Education Institutions, the Academy appoints yet another member to be Chair of the Board, as well as this member's alternate. ... The (Norwegian) State appoints the sixth member of the Board. In consultation with the Norwegian Association of Higher Education Institutions, the Academy appoints one of the other directors to be Deputy Chair of the Board. ... The Board of the Norwegian Academy of Science is entitled to appoint one of its members to serve as an observer of the Board of the Centre for Advanced Study.”  
The State's representative is appointed by the Research Council of Norway (RCN).

**In 2008, the Board was composed of the following members**

Professor Aanund Hylland, University of Oslo (Chair) – NASL

Professor Gerd Bjørhovde, University of Tromsø (Deputy Chair) – UHR

Professor Kenneth Hugdahl, University of Bergen – NASL

Professor Liv Blikrud, University of Oslo – NASL

Professor Ivar Langen, University of Stavanger – UHR,

Professor Leif Arne Heløe, Norwegian Institute for Urban and Regional Research – RCN

Secretary General Professor Reidun Sirevåg, observer for – NASL

### Alternates

Professor Ivar B. Ramberg, Ramberg Consulting AS – NASL (for Hylland)

Rector Sigmund Grønmo, University of Bergen – UHR (for Bjørhovde)

Professor Egil Leer, University of Oslo – NASL (for Hugdahl)

Professor Lars Walløe, University of Oslo – NASL (for Blikrud)

Prorector Astrid Lægread, Norwegian University of Science and Technology – UHR (for Langen)

Secretary General Anne Lise Ryel, The Cancer Society – RCN (for Heløe), until 8 October 2008

Professor Marit Halvorsen, University of Oslo – RCN (for Heløe), from 8 October 2008

The Board of Directors held four meetings in 2008. The following main issues were discussed and/or decided:

Selection of research groups for 2010/2011 - Financial Statements for 2007 - Budget for 2008 - Directors' Report for 2007 - application for funds from the Ministry of Education

and Research 2009 - mid-year accounts for 2008 - transfer of funds to the Operating Fund - distribution of funds between the research groups 2007/2008 - the process of identifying candidates for 2011/2012 - evaluation of the appointment process for the research groups 2010/2011 - the Centre's publications, including the reorganisation of and new design for the newsletter (*Glimt/Impressions*) and the *Annual report* - the Centre's evaluation process - bodies that can nominate applicants for places at the Centre - relevant partners for the Centre, including the formalisation and signing of a cooperation contract with the BI Norwegian School of Management - participation in the *European Network of Institutes of Advanced Study* (NetIAS) - discussion of the progress made by the research groups 2008/2009 - sundry refurbishment and maintenance projects - the Compensation Committee's work - wage adjustments - hiring of a new office manager from 1 August 2008 - hiring of a new higher executive officer from 4 August 2008 - hiring of new scientific director from 1 August 2009.

### **1.1 Management and administration**

The administration consisted of four employees and two part-time independent consultants. Willy Østreng served as scientific director on a fixed-term contract and was responsible for the Centre's routine operations and professional activities. Office Manager Unn Haaheim Hagen headed the day-to-day administrative activities up to 1 August 2008, when she took early retirement. As from the same date, Maria M. L. Sætre took over the position of office manager, heading day-to-day administrative work for the rest of the year. Trude Gran Peters was appointed higher executive officer, taking over Maria Sætre's earlier position on 4 August 2008, with responsibility for providing administrative assistance with the Centre's technical activities, running the archive and library services and the Centre's publications. Executive Officer Marit Finnemyhr Strøm was in charge of the switchboard, the registration of researchers, and postal and information services as well as general administrative assistance. In addition, Project Manager Bjarne Røsjo of *Bjarne Røsjo Media A/S* has been co-editor of and a writer for the CAS Newsletter, *Glimt/Impressions*. He was also involved in the production of the Centre's book project: *Confluence. Interdisciplinary Communications 2007/2008* and the *Annual Report for 2007*. Dag Christian Bjørnsen of the *University of Oslo's Center for Information Technology* (USIT) has been responsible for the operation of the computer systems and for providing IT support for the researchers two days a week, i.e. Tuesdays and Fridays. He worked at CAS full-time in August and the last week of July to ensure that the needs of the new research groups were attended to in a satisfactory manner. Temporary office help was hired on an hourly basis as needed to lighten the workload.

The regular administrative staff had weekly meetings to discuss matters of importance for day-to-day routines. Several meetings were also held between the administration and the heads of the research groups invited to work at the Centre. These meetings

were organised to help the groups plan the details of their stays. Experience indicates that the groups that invest effort in the planning stage get more out of their stays. Consequently, considerable importance is attached to these meetings.

Among its professional initiatives, the Centre continued arranging Wednesday seminars in 2008. These seminars are intended to encourage communication, dialogue and contact across fields of research, groups and disciplines. This initiative is one of several designed to contribute to the Centre's interdisciplinary objective and image.

The editorial board of the CAS newsletter held planning meetings prior to the publication of every issue, based on discussions at the administrative meetings. Every issue of the newsletter contains discussions of the research groups' work and an editorial that addresses relevant research policy topics of interest and significance to the Centre's activities. The editorial feature was well received in university circles. It was also decided to enhance the general scientific popularity of the CAS newsletter by publishing themed issues on the humanities, social sciences and natural sciences. An example of one such topic of general interest was printed in *Glimt/Impressions* 02/2008, in which Professor Ben Martin discussed specific examples of the research community's self-policing not always sufficient to unveil plagiarism and research falsification. *Glimt/Impressions* was also well-received by practitioners.

The scientific director had meetings with the Liaison Committee and administration of the University of Stavanger in connection with the call for applications for funding and the nomination of candidates to head projects during the 2011/2012 academic year (see below). There was also a meeting with the Minister of Research Tora Aasland about improving conditions for high-calibre Norwegian research by increasing the grant the Centre receives over the central government budget.

## 1.2 Other issues

Based on the feedback the administration has received from researchers, the working environment at the Centre is considered good. Absence due to illness totalled seven days in 2008. The organisation's activities do not pollute the outdoor environment.



## 2. The Centre's objectives and work

The Centre considers it important to continue its efforts to achieve the objectives enshrined in §2 of the Memorandum of Association:

- A. The academic activity at the Centre shall be known to satisfy the highest international standards and thereby contribute to raising the level of basic and interdisciplinary theoretical research in Norway within the fields of the humanities/theology, social science subjects/law and science/medicine/mathematics.
- B. The Centre shall provide opportunities for researchers to work without interruption on problems that need not provide short-term returns.
- C. The Centre's activities are to be long-term, independent and of a lasting nature.
- D. The Centre shall be a national institution, and contribute to widely publicising the results that are produced.
- E. The Centre aspires to provide a framework for close cooperation between Norwegian and foreign researchers.

One decisive element of the efforts to reach these goals is to recruit researchers who have achieved professional results of a high international standard. By the same token, the Centre encourages the broadest possible cooperation within the framework of the focus group scheme. This form of teamwork appears to work well, given the size, the professional gravitas and the youthful elements (at the post-doctoral level) of each group. The social and professional contact among the three focus groups strengthens the scholarly as well as the social atmosphere at the Centre. The weekly Wednesday seminars are one of several measures to promote contact across disciplinary and thematic divisions. A total of 27 joint seminars were organised in 2008, furnishing material for the publication of the book: *Confluence. Interdisciplinary Communications 2007/2008*. The contributions to this book, the fifth in a series of annual publications, were peer reviewed. The series, designated *CAS' Annual Book Series on Interdisciplinarity*, is edited by the scientific director, and has been well received at the national as well as the international level.

### 3. Research groups and academic activity

The three groups that started their work in autumn 2007 and continued in spring 2008 worked on the following topics:

- **The Power of the Ruler and the Ideology of Rulership in Nordic Culture 800-1200**  
headed by Professor Gro Steinsland, University of Oslo
- **Understanding Innovation**  
headed by Professor Jan Fagerberg, University of Oslo
- **Nature-inspired Chemical Process Design**  
headed by Professor Signe Kjelstrup, Norwegian University of Science and Technology

The project *The Power of the Ruler and the Ideology of Rulership in Nordic Culture 800-1200* focused on the power and the ideology of rulership as instrumental elements in the social, religious and cultural development in the Nordic communities in the transition from the Viking Age to the Middle Ages. The group focused on the Nordic communities, i.e. on the formation of communities in the Nordic countries and the Norse communities on the islands in the North Sea. The time perspective of the project (9th -13th centuries) straddled the change of religion in the late Viking Age, which implies that concepts such as change and transformation, continuity and breaches in terms of the power of the ruler were instrumental concepts in the research. Topics related to the ideology of rulership were intentionally chosen as the focus of a wide variety of analyses because it was in the ideas and practices associated with kings, earls and chieftains that the political, social and religious processes of change were visible in the transition from the Viking Age to the Middle Ages. While the medieval European, Christian ideology of rulership has received broad attention in both European and Nordic research, the way has only recently been opened for a vast field of research comprising the pre-Christian, Nordic expression of power and its transformation into the Christian Middle Ages. This complex, complicated subject area, which has far-reaching implications for the source-criticism and discussions of methods and theories, has not previously been subject to collective, interdisciplinary research efforts. The research group was made up of representatives of the following subjects: the history of religion, history, Norse and Anglo-Saxon philology, archaeology and Celtic studies.

For a more extensive presentation of the project and its preliminary results, see the group's report further back in this Annual Report.

The project *Understanding Innovation* aimed at further developing the theoretical, conceptual and terminological basis for systematic studies of innovation. Despite the assumed importance of innovation for promoting social targets such as economic growth, employment and quality of life, research on this phenomenon has been modest until recently. The challenge has been that no single discipline covers all aspects of innovation as a complicated, complex field. Research on innovation is, by nature, inter- and multidisciplinary.

Researchers in this field can be compared with a fragmented community consisting of different ‘tribes’ that lack a common ‘language’ (terminology) and which therefore have trouble communicating with each other. The project strived to develop an interdisciplinary language, conceptual structure and theory for the field of innovation, not least by building on and further developing the results from the so-called TEARI Project (2002-2004), which was intended to produce a comprehensive overview of the research done in this field.

For a more extensive presentation of the project and its preliminary results, see the group’s report further back in this Annual Report.

The project *Nature-inspired Chemical Process Design* was designed to shed light on the question of whether knowledge about nature’s structure and function can help us design more energy-efficient chemical processes. The Group studied biological systems such as lungs, kidneys and molecular engines, as well as chemical process equipment such as reactors, heat exchangers and separation equipment. To learn more about energy efficiency in natural and artificial systems, the Group worked with functions at the molecular level, and with structure and function at the macro level. The fundamental question was: What is accessible energy, how efficiently is it used, and what is efficiency dependent upon? The project group was interdisciplinary, and included expertise in non-equilibrium thermodynamics, statistical thermodynamics, biology, chemical engineering and calculator simulation.

For a more comprehensive presentation of the project and its provisional results, see the group’s report in this Annual Report.

The 2008/2009 research groups commenced working in August 2008. The research topics for these groups are:

- **Early Networking in Northern Fennoscandia**  
headed by Professor Charlotte Damm, University of Tromsø
- **Understanding the Role of Water in History and Development**  
headed by Professor Terje Tvedt, University of Bergen
- **Nonlinear Partial Differential Equations**  
headed by Professors Helge Holden, Norwegian University of Science and Technology, and Kenneth H. Karlsen, University of Oslo

CAS Newsletter No. 2, 2007 refers to the 2007/2008 groups’ activities, while *Glimt/Impressions* No. 1, 2008 discusses selected research topics for these projects.

*Glimt/Impressions* No. 2, 2008, describes the 2008/2009 groups’ activities.

The CAS newsletters are available in English and Norwegian versions and are posted on the Centre’s website at: [www.cas.uio.no](http://www.cas.uio.no).

In June 2008, the Board made its final decision on the nominations of the groups to be at the Centre in 2010/2011. The Centre had received 15 nominations, a decrease from the year before. After two rounds of discussions, the Board forwarded eight proposals for an international peer review in spring 2008. A total of 42 evaluation reports were submitted by prominent independent international researchers. Based on the evaluations, the Board decided to invite the following research groups to the Centre in 2010/2011:

- **Mantle Dynamics: Linking Surface and Deep Processes**  
headed by Professor Trond Helge Torsvik, Geological Survey of Norway (NGU) and Physics of Geological processes (PGP), University of Oslo
- **Meaning and Understanding across Languages,**  
headed by Professor Cathrine Fabricius-Hansen, University of Oslo
- **Personal Development and Socio-Cultural Change**  
headed by Professors Hanne Haavind and Harriet Bjerrum Nielsen, University of Oslo

The selection process for 2011/2012 was initiated in autumn 2008. The Centre received a total of 22 nominations, 16 of which went further to the next round.

## 4. Other academic activities

In 2008, the scientific director produced several publications and edited a peer-reviewed book for CAS. He also had a peer-reviewed book on interdisciplinary science accepted for publication by Temple University Press in Philadelphia. He has written a regular column in *Fiskeribladet Fiskaren* (The Fisheries Magazine “The Fisherman”) and was invited to speak at national and international conferences and meetings in his field of research.

## 5. Objectives and results

During the year, 80 researchers made professional contributions to the Centre's six projects. Of that number, 77 researchers had long-term stays (from one to eleven months) at the Centre. Of that number, 42 were non-Norwegians. There has been a significant international element: 51 researchers from 13 countries<sup>1</sup> and individuals from four continents participated in the research. Of this number, 12 were women, 10 of whom had longer stays. Eight post-doc fellows and PhD students were associated with the projects in 2008. This marked a decline from 2007, when there was an unusually large number of researchers at this level.

In spring 2008, 44 researchers worked at the Centre, 43 of whom were on long-term stays. Of that number, 24 were Norwegian and 20 were from other countries. The Centre was the place of work for eight post-doc fellows and PhD students. In addition, a large number of third-party seminar and conference participants provided contributions to the individual project groups, cf. the group reports further back in this Annual Report.

In autumn 2008, 36 researchers worked at the Centre. Of that number, 34 long-term stays were divided among 12 Norwegian and 22 foreign researchers. Besides the group members, there were numerous external seminar and conference participants.

Major seminars and workshops with broad national and international participation have now become a natural part of the academic activities of all the groups. In 2008, the Centre organised eight workshops/seminars of this type. In addition, one of the groups organised four smaller seminars with speakers from the outside. Several of the groups have also planned follow-up seminars after leaving CAS. Moreover, the groups have organised a series of internal working seminars (see the group reports further back in this Annual Report). One of the groups organised an average of one in-house academic seminar a week.

The interaction between the researchers from abroad and those from Norway and the many lectures delivered by the researchers from abroad at Norwegian universities and in other academic fora represent an important contribution to the internationalisation of Norwegian research in general and represent significant results in themselves, (see the group reports further back in this Annual Report).

The Centre is expecting numerous peer-reviewed publications in the form of books and articles in international journals as a result of its activities. Owing to the long lead time for the printing process, it is not possible at present to provide a complete survey of the results of the efforts made in 2008. Some works have already been published, but most of them are either being reviewed, are available in manuscript form or are still being compiled and evaluated. A complete survey of the results of the work carried out in 2008 will not be available for several years. The reports from the three research groups for 2007/2008 show that the provisional figure for published reports and/or reports in progress or that have been sent for publication has already reached a total of 196 works, including several books. To this may be added the 27 peer-reviewed articles published in the book: *Confluence. Interdisciplinary Communications 2007/2008*, CAS, Oslo 2009.

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<sup>1</sup> Brazil, Denmark, Finland, France, Greece, Japan, China, the Netherlands, Russia, Spain, Great Britain, Sweden and the US

The following goals were also reached in 2008:

- The selection procedure for new research groups maintains a high international standard and is subject to continual improvement. Selection spans an 8-month period before the nine best projects are subjected to independent international review. The 'finalists' for the 2010/2011 academic year were evaluated by an average of 5.4 peers from several countries.
- The CAS newsletter (*Glimt/Impressions*) maintains a high standard, and the feedback from readers, national as well as international, is exceptionally good. It is published twice a year in Norwegian (circulation: 12 500) and English (circulation: 700) versions. The CAS newsletter is distributed to all scientific staff employed by universities in Norway, and to foreign researchers who have previously been affiliated with the Centre. In addition, the CAS Newsletter is sent to the press, the Storting, relevant ministries, embassies and other interested parties.
- Contact with Norwegian researchers outside the Oslo area declined slightly in 2008 relative to previous years, but about 50 per cent of the nominations for group leaders still come from the research communities outside Oslo. For the academic year of 2011/2012, 14 of a total of 27 group leaders were nominated by partners other than the University of Oslo. The nominations were divided as follows: The University of Bergen nominated three group leaders; the Norwegian University of Science and Technology, three; the University of Life Sciences, three; the University of Tromsø, two; the University of Stavanger, three; and the University of Oslo, 13.
- Contact with the various disciplines is ensured through the Liaison Committees established at all the universities, the Norwegian School of Economics and Business Administration and the Norwegian School of Management BI (see below). The scheme works well, not least since the Liaison Committees were made identical with the central research bodies. In certain places, the deans' offices serve as the Liaison Committee, while other places appoint special research committees. Since this change, CAS has direct access to decision-makers among its partners. This has enhanced the value and importance of the annual meetings between the scientific director and the Liaison Committees.
- The reorganisation of the contact structure in recent years and the exchange of information between CAS and the universities/university colleges have led to major efficiency dividends. In 2008, it was only the administration and the Liaison Committee at the University of Stavanger that required a visit from the scientific director. The other partners felt they were sufficiently well informed and equipped after several years of meetings that the scientific director did not need to visit. This released funds that could be spent on research, at the same time as it shows that the cooperation works as intended.

- In 2008, CAS contracted formal cooperation with the Norwegian School of Management BI, which was granted the status of a specialised university institution the same year. The cooperation agreement between CAS and the Norwegian School of Management BI was signed on 21 October 2008 at a ceremony at BI. CAS now has eight external partners: The six oldest universities, the Norwegian School of Economics and Business Administration and the Norwegian School of Management BI. This is an important step to further consolidate CAS' role as a national arena for basic research communities in Norway.
- Contact has also been taken with a view to involving the University of Agder in this national cooperation. An agreement to that effect will most likely be signed in 2009.
- CAS' excellent, constructive and mutually binding cooperation with other academic and research administration institutions in Norway, e.g. the Norwegian Academy of Science and Letters (NASL), the Norwegian Association of Higher Education Institutions (UHR) and the Research Council of Norway (RCN) was carried further during the reporting period.
- Efforts to establish closer contact with international sister organisations were further strengthened in 2008. This was mainly achieved through work in NetIAS aimed at earning CAS and its European sister organisations a part in the formulation of the EU's Framework Programmes and at being defined as qualifying for EU research funding. Efforts to prepare a joint research project for the European NetIAS institutes were commenced following a meeting of the directors in Bologna in spring 2007 and were continued at a comparable meeting in Jerusalem in 2008. This programme, for which funding is being applied under the EU's 7th framework programme, has multiple objectives. First of all, it is intended to define which role the NetIAS institutes can play with a view to the EU's applied research portfolio. Secondly, it is intended to analyse the challenges facing researchers when the quality of interdisciplinary research is to be evaluated and, thirdly, there are plans to establish an IAS/EU fellowship programme.
- The interdisciplinary component of the Centre's work was strengthened by the continuation of weekly luncheon seminars and through the establishment of a separate budget item for this type of research. It is interesting to note that a growing number of the research projects conducted at CAS are inter- or multi-disciplinary by nature. Two of the programmes in the current reporting period are interdisciplinary, while the same was true of all the projects in the preceding period.
- In addition, the scientific director contributed actively to the establishment of the interdisciplinary Thor Heyerdahl Chair at the Norwegian University of Life Sciences in Ås,



which is one of CAS' partners. This Chair, established in autumn 2008, was set up in collaboration with the Thor Heyerdahl Institute in Larvik. The objective of this professorship is to further develop interdisciplinary methods and theories through empirical studies of the relationship between the environment, health and development. The Thor Heyerdahl Chair is the first of its kind in Norway, and it will undoubtedly help improve the quality of interdisciplinary research at CAS and in Norway in general.

- External mediation of research results takes place through peer-reviewed publication channels. Popularised articles are also published in *Glimt/Impressions* and the book series *Interdisciplinary Communications*. The book series was established in 2003 as a measure to stimulate the interdisciplinary component of the Centre's work and to reach readers outside the circles of experts. This year's book was published in a print-run of 850 copies and distributed free of charge to a number of research groups in Norway and abroad. It was also made available to interested institutions/individuals on request.

## 6. Financial affairs

### 6.1 The Centre for Advanced Study

CAS received a State grant of MNOK 15.4 in 2008. This marked an increase from the previous year of NOK 630 000, or 4.3 per cent. This increase compensated for inflation and wage adjustments, but is still below the level recommended by the Bjørgo Committee for CAS 10 years ago, which was about MNOK 16. In nominal terms, approximately MNOK 1.5 still remains before the State grant reaches the recommended level. The absence of any genuine increases in the past five years means the work of building up a satisfactory reference library and collection of books and journals in science and the humanities is coming to a standstill. The same applies to the need for better computer support services for the researchers. CAS' sister organisations in other Western countries have full-time in-house computer consultants and librarians. This is still beyond the reach of CAS, and will require grants that far exceed the Bjørgo Committee's recommendation and the NOK-adjusted gap of MNOK 1.5.

A reassignment of priorities in connection with the Centre's budget for 2008 made it possible to increase the groups' budgets for 2008/2009 to MNOK 3.3 per research group. This marked an increase from the previous year of NOK 100 000 per group. The funds that the Centre makes available to the three research groups are intended to cover general project costs as well as grants and the funds needed to buy foreign researchers out of their duties, including accommodation, travel, conference and seminar expenses. Until recently, the available resources were much too limited for a sufficiently large number of leading international researchers to be brought to Norway. To the extent that financial circumstances allow, the Centre will give this more priority in future. To enable the Centre to buy out the services of the best researchers from abroad for long-term research stays, each project group would require about NOK 700 000 more than the current allocation. In other words, the goal should be for each group eventually to have a budget of about MNOK 4.

As in previous years, the university agreements represent considerable additional funding, since visiting researchers from the Norwegian universities, the Norwegian School of Economics and Business Administration and the Norwegian School of Management BI are generally paid by their respective home institutions while at CAS. This supplementary funding represented about 6.4 full-time equivalents in 2008. That marked a decline of 1.2 full-time equivalents from the year before.

The Centre's Income Statement for 2008 shows an operating deficit of NOK 1 916 379. The budget for 2008 was set up with a budget deficit of NOK 800 000.

The Balance Sheet shows a balance of NOK 2 188 824. Of this amount, NOK 1 671 318 are current liabilities.

The accounts for 2008 were prepared on the going concern assumption. In the view of the Board, the annual financial statements presented give a fair indication of the development and results of the activities at the Centre for Advanced Study as at 31 December 2008. The accounts have been audited by the company Nitschke A/S.

## 6.2 The Operating Fund at the Centre for Advanced Study

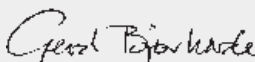
The Centre enters into binding agreements for up to three years in advance. The Operating Fund was established as a kind of collateral for these long-term commitments. The Operating Fund consists of basic capital, which is inviolable, and disposable funds. No funds were drawn from the Operating Fund in 2008. Net interest income came to NOK 1 031 679, which was added to the fund, bringing the Operating Fund's aggregate capital to NOK 17 634 631 at year-end 2008.

The internal accounts for 2008 were drawn up on the basis of the going concern assumption. In the view of the Board, the annual financial statements submitted give a fair indication of the development and results of the activities of the Operating Fund at the Centre for Advanced Study as at 31 December 2008. The accounts have been audited by the company Nitschke A/S.

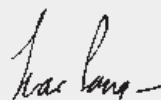
Oslo, 23 February 2009  
Centre for Advanced Study



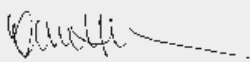
Aanund Hylland,  
Chair of the Board




Gerd Bjørhovde,  
Deputy Chair



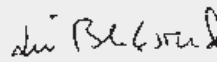
Ivar Langen



Kenneth Hugdahl



Leif Arne Heløe



Liv Bliksrud

To the Board of the Foundation  
Centre for Advanced Study

### AUDITORS' REPORT FOR 2008

We have audited the Annual Accounts of the Centre for Advanced Study for 2008, which show a deficit of NOK 1,699,909,-. We have also audited the information in the Annual Report concerning the Annual Accounts, and the assumption of continued operation. The Annual Accounts comprise the profit and loss account, balance sheet and notes. The Accounts have been done in conformity with the Accounting Act and good auditing practice. The Annual Account and the Annual Report have been submitted by the Board of the Foundation. Our responsibility is to express an opinion on the annual accounts and other matters in accordance with the requirements of the Auditors Act.

We have performed our audit in conformity with the law, regulations and good auditing practice in Norway and auditing standards adopted by the Norwegian Institute of Public Accountants. The auditing standards require that we plan and conduct the audit in order to achieve a satisfactory level of certainty that the annual accounts do not contain any significantly incorrect information. The audit comprises an examination of selected parts of the evidence in support of the information in the annual accounts, an assessment of the accounting principles applied and of important accounting estimates, and an evaluation of the content and presentation of the annual accounts. To the extent required by generally accepted standards of good auditing, the audit also includes an examination of the Foundation's asset management and of its accounting and internal control systems.

We believe that our audit provides a satisfactory basis for our statement.

We are of the opinion that

- the annual accounts have been presented in conformity with statute law and regulations and reflect the Foundation's financial situation on 31 December 2008 and its result for the financial year in accordance with good auditing practice in Norway.
- the management has fulfilled its duty to ensure orderly and clear registration and documentation of information relating to the accounts in conformity with statute law and good accounting practice in Norway.
- the information in the Annual Report concerning the assumption that operations would continue is consistent with the annual accounts and is in conformity with statute law and regulations.

Stabekk, 23 February 2009

NITSCHKE AS

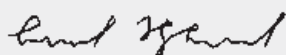
Morten Hurum  
State-authorized auditor

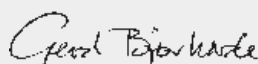
## 7. Accounts

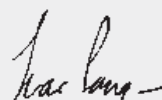
### 7.1 Centre for Advanced Study


Balance at 31 december	Notes	2008	2007
<b>ASSETS</b>			
<b>Cash</b>			
Cash, bank deposits etc.	4	2 188 824	3 846 790
Total cash		2 188 824	3 846 790
<b>Total assets</b>		<b>2 188 824</b>	<b>3 846 790</b>
<b>LIABILITIES AND CAPITAL AND RESERVES</b>			
<b>Capital and reserves</b>			
Basic capital	5	119 600	118 400
Capital account		397 906	2 099 015
Total capital and reserves		517 506	2 217 415
<b>Short-term liabilities</b>			
Payable to the Norwegian Academy of Science and Letters		100 000	100 000
Payable tax deductions, National Insurance contributions, holiday pay etc.		446 785	432 811
Other short-term liabilities	6	1 124 533	1 096 564
Total short-term liabilities		1 671 318	1 629 375
<b>Total liabilities and capital and reserves</b>		<b>2 188 824</b>	<b>3 846 790</b>


Oslo, 23 February 2009  
Board of the Centre for Advanced Study

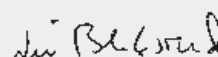
  
Aanund Hylland,  
Chair of the Board

  
Gerd Bjørhovde,  
Deputy Chair

  
Ivar Langen

  
Kenneth Hugdahl

  
Leif Arne Heløe

  
Liv Bliksrud

## 7.1 Centre for Advanced Study

PROFIT AND LOSS ACCOUNT	Notes	2008	2007
<b>Income from operations</b>			
State grant from Ministry of Education and Research		15 400 000	14 770 000
<b>Total income from operations</b>		<b>15 400 000</b>	<b>14 770 000</b>
<b>Operating expenses</b>			
Expenses relating to research fellows	1	10 244 654	9 035 036
Salaries, fees etc.	2	2 959 122	2 537 935
Office furniture, furnishings, computer equipment		348 747	294 340
Other operating expenses	3	3 763 856	3 371 195
<b>Total operating expenses</b>		<b>17 316 379</b>	<b>15 238 506</b>
<b>Operating result</b>		<b>-1 916 379</b>	<b>-468 506</b>
<b>FINANCIAL INCOME AND FINANCIAL EXPENDITURE</b>			
		2008	2007
Income from interest		240 658	215 885
Bank charges		24 188	19 453
<b>Net financial income</b>		<b>216 470</b>	<b>196 432</b>
Annual balance		-1 699 909	-272 074
which is to be allocated as follows			
To the Basic capital		1 200	1 200
To/(from) the Capital account		-1 701 109	-273 274

## 7.1 Centre for Advanced Study

### Accounting principles

The Accounts have been set out in conformity with the Accounting Act and good accounting practice. Cash and short-term liabilities normally include items falling due within one year. Pension premiums are linked to the employer's share of the premium payable to the Public Service Pension Fund. The enterprise is required to have a service pension scheme under the Act relating to Obligatory Company Pensions; the enterprise has a pension plan that meets the requirements of this Act.

### Notes on the Accounts

<b>Note 1 Expenses relating to research fellows</b>	<b>2008</b>	<b>2007</b>
Fellowships etc., researchers	5 041 122	4 501 625
Rent for researchers' flats	2 210 564	2 000 749
Travel expenses	666 681	622 660
Publications, printing, equipment	495 510	22 544
Seminars/Workshops	1 673 187	1 587 090
Miscellaneous expenses research groups	157 590	300 368
<b>Total</b>	<b>10 244 654</b>	<b>9 035 036</b>

<b>Note 2 Salaries/fees</b>	<b>2008</b>	<b>2007</b>
Salaries/holiday pay	2 136 011	1 961 799
Pension premiums	242 853	223 731
National Insurance Contributions	335 773	310 530
Manpower services	191 911	0
Auditors' fees	38 125	36 250
Social expenditure	14 450	5 625
<b>Total</b>	<b>2 959 122</b>	<b>2 537 935</b>

The Centre's administration constitutes four full-time equivalents

The Centre for Advanced Study has a pension scheme that satisfies the requirements for mandatory service pension insurance

The director was paid a salary of NOK 686.078

The sum of NOK 40.000 was paid out as remuneration to members of the Board

Auditing expenses cover in their entirety auditing services

## 7.1 Centre for Advanced Study

### Notes on the Accounts cont.

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<b>Note 3 Other operating expenses</b>	<b>2008</b>	<b>2007</b>
Lighting, heating, cleaning, rent, insurance, security	989 533	957 474
Telephone, fax, postage	216 660	133 136
Equipment, copying, computing	603 161	653 823
Books, library service, printing	904 613	514 359
Operating equipment, maintenance	94 822	393 547
Running the canteen, social measures and representation	529 893	422 375
Travel expenses	75 093	66 589
Miscellaneous expenditure	350 082	229 892
<b>Total</b>	<b>3 763 856</b>	<b>3 371 195</b>

### Note 4 Bank deposits

---

Of the bank deposits entered in the books, the sum of NOK 246,529 represents withheld tax deductions

<b>Specification of bank deposits on 31.12.</b>		<b>2008</b>	<b>2007</b>
DnB NOR, account 8200.01.17044	NOK	246 529	233 147
DnB NOR, account 1607.83.68385	NOK	1 917 401	3 586 419
DnB NOR, account 1644.14.60264	NOK	4 968	4 717
DnB NOR, account 8210.04.35809	NOK	1 676	1 298
<b>Total bank deposits</b>	<b>NOK</b>	<b>2 170 574</b>	<b>3 825 581</b>
Cash balance 31.12.	NOK	18 250	21 209
<b>Total cash, bank etc.</b>	<b>NOK</b>	<b>2 188 824</b>	<b>3 846 790</b>

### Note 5 Basic Capital

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10% of a calculated yield on the Basic capital throughout the year is allocated to the Basic capital.

### Note 6 Other short-term liabilities

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This entry consists of items with a time limit at the end of the year.

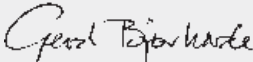


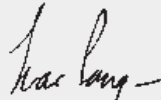
## 7.2 Operating Fund at the Centre for Advanced Study

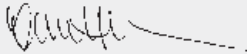
Balance at 31 December	Notes	2008	2007
<b>ASSETS</b>			
<b>Cash</b>			
Short-term claim		279 595	
Bank deposit	1	17 355 036	16 602 952
<b>Total cash</b>		<b>17 634 631</b>	<b>16 602 952</b>
<b>Total assets</b>		<b>17 634 631</b>	<b>16 602 952</b>
<b>LIABILITIES AND CAPITAL AND RESERVES</b>			
<b>Capital and reserves</b>			
Basic capital	2	1 474 810	1 371 610
Disposable funds		16 159 821	15 231 342
<b>Total capital and reserves</b>		<b>17 634 631</b>	<b>16 602 952</b>
<b>Total liabilities and capital and reserves</b>		<b>17 634 631</b>	<b>16 602 952</b>

Oslo, 23 February 2009  
Board of the Centre for Advanced Study

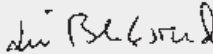
  
Aanund Hylland,  
Chair of the Board

  
Gerd Bjørhovde,  
Deputy Chair

  
Ivar Langen

  
Kenneth Hugdahl

  
Leif Arne Heløe

  
Liv Bliksrud

## 7.2 Operating Fund at the Centre for Advanced Study

<b>Profit and loss account</b>	<b>2008</b>	<b>2007</b>
<b>Income</b>		
Income from interest	1 031 679	648 379
<b>Annual balance</b>	<b>1 031 679</b>	<b>648 379</b>

which it is proposed to allocate as follows:

To the basic capital	103 200	64 900
To Disposable funds	928 479	583 479
	<b>1 031 679</b>	<b>648 379</b>

### Notes on the Accounts for the period ending 31 December 2008

The accounts have been prepared in compliance with the Norwegian Accounting Act and generally accepted Norwegian accounting practices for small businesses.

The enterprise is not required to have a service pension scheme under the Act relating to Obligatory Company Pensions since it has no employees.

#### Note 1 Bank deposit

Specification of bank deposit for the period ending 31 December 2008

DnBNOR, account 5076.09.13577	17 123 751	
DnBNOR, account 8200.06.22903, balance	231 285	16 602 952
<b>Total</b>	<b>17 355 036</b>	<b>16 602 952</b>

#### Note 2 Basic capital

The Basic capital has increased by 10 per cent of the annual yield.

To the Board of the Operating Fund  
Centre for Advanced Study

### AUDITORS' REPORT FOR 2008

We have audited the Annual Accounts of The Operating Fund of Centre for Advanced Study for 2008, which show a surplus of NOK 1,031,679,-. We have also audited the information in the Annual Report concerning the Annual Accounts, and the assumption of continued operation. The Annual Accounts comprise the profit and loss account, balance sheet and notes. The Accounts have been done in conformity with the Accounting Act and good auditing practice. The Annual Account and the Annual Report have been submitted by the Board of Operating Fund. Our responsibility is to express an opinion on the annual accounts and other matters in accordance with the requirements of the Auditors Act.

We have performed our audit in conformity with the law, regulations and good auditing practice in Norway and auditing standards adopted by the Norwegian Institute of Public Accountants. The auditing standards require that we plan and conduct the audit in order to achieve a satisfactory level of certainty that the annual accounts do not contain any significantly incorrect information. The audit comprises an examination of selected parts of the evidence in support of the information in the annual accounts, an assessment of the accounting principles applied and of important accounting estimates, and an evaluation of the content and presentation of the annual accounts. To the extent required by generally accepted standards of good auditing, the audit also includes an examination of the Operating Fund's asset management and of its accounting and internal control systems. We believe that our audit provides a satisfactory basis for our statement.

We are of the opinion that

- the annual accounts have been presented in conformity with statute law and regulations and reflect the Operating Fund's financial situation on 31 December 2008 and its result for the financial year in accordance with good auditing practice in Norway.
- the management has fulfilled its duty to ensure orderly and clear registration and documentation of information relating to the accounts in conformity with statute law and good accounting practice in Norway.
- the information in the Annual Report concerning the assumption that operations would continue is consistent with the annual accounts and is in conformity with statute law and regulations.

Stabekk, 23 February 2009

NITSCHKE AS

Morten Hurum  
State-authorized auditor

## Opening Ceremony 2008

September 3rd the opening of the 17th academic year of the Centre for Advanced Study took place on the premises of the Norwegian Academy of Science and Letters, Drammensveien 78. The same evening the Centre hosted a welcoming dinner for this year's fellows at CAS



1

1. Professor Terje Tvedt, University of Bergen held the lecture:  
"The way the rivers run: A 'water system' perspective on global history with a special focus on the Industrial Revolution"





2. Reception in the Academy's Tapestry Room

3

3. Group leaders 2008/2009:

From left: Professors Kenneth H. Karlsen, Terje Tvedt, Helge Holden and Charlotte Damm

2

Day trip to Kongsberg and Heddal Stave Church, September 2008



Lunch at Knutehytta, at the foot of mount Jonsknuten



A walk in the mining district around Kongsberg

Day trip to the Modum and Ringerike area, May 2008



1

2



1. Guided tour into the cobalt mines at Blaafarveværket
2. Coffee break at Blaafarveværket



## 8. The Power of the Ruler and the Ideology of Rulership in Nordic Culture 800-1200

Report by Gro Steinsland  
Group leader 2007/2008  
September 1, 2008

### 8.1 General description

The focus of the project is the power of the ruler and the ideology of rulership in the Nordic countries from 800 AD until 1200 AD. An interdisciplinary research group representing the disciplines of History of Religion, History, Philology, Archaeology and Celtic studies has examined the ideological, symbolical and empirical traces of power and how this changed within the Nordic culture and societies from the Viking to the Medieval Age.

With 'Nordic societies' is meant the formation of societies within the geographical area of modern Norway, Sweden, Denmark as well as Ireland and the North Atlantic islands. The period studied encompasses the change of religion in the late Viking Age and this has, in turn, made terms such as change, transformation and continuity in the expression of power important.

A few examples of the problems that has been encountered and the analyses which are carried out are: the ideas, the myths and the ritual apparatus surrounding the ruler; the genealogical traditions of the ruling families; halls and grave mounds as institutional elements in the cultural landscape; symbols of dignity manifested in artefacts and iconography; gender aspects tied to the sphere of power; connections between the formation of society and rulership in the Nordic mainland kingdoms and in Ireland and the islands of the North Atlantic. Questions regarding the construction of identity among the different peoples through the ideology of rulership have been posed.

The ideology of rulership is deliberately chosen as the focal point for a broad spectre of analyses. In the ideas and practices linked to the kings, earls and chieftains, the political, social and religious changes become visible in the period of transition from the Viking Age to the Middle Ages. The ideology of rulership and power are central elements in the development of society, religion and culture in the Nordic societies in the period of transition from the Viking Age to the Middle Ages. The introduction of Christianity in the Nordic countries from the mid 10th century brought a new world picture, a new faith, new rituals and extensive changes in ideology. All of this contributed to a change of the Nordic mentality.

One could say that the change of religion altered the Norse world, the mental as well as the physical landscape. These radical changes created a conflict between old and new which the Nordic culture had to overcome. It is the process of transformation between domestic tradition and foreign impulse that lies at the core of our interest. The point of

departure for this project is that the ideology of rulership (the ideas and practice linked to royal power and the power of earls and chieftains) was the focus of events in the transformation of the Nordic culture from 800 AD to 1200 AD.

Studying changes, the period 800-1200 is very important since the Nordic countries, for the first time, established firm ties with Europe. The ties between the Norse (West-Nordic) areas and England, Scotland and Ireland have been strong. Traditions and impulses were reciprocally exchanged in the areas where the Norse, Anglo-Saxon, British and Irish peoples met. In the eastern parts of Scandinavia (Sweden and Denmark), the influences on and from the Nordic culture seem to have moved along other routes, to the south and east. Thus the Nordic countries became cultural melting pots in late Viking Age. Despite the cultural complexity, the Nordic countries have often been seen as one uniform culture, without considering local and regional variations.

Through intensive interdisciplinary work, analysis of sources, debates of methods and theories, and discussions about the relationships between religion, society and power, the members of the group have been able to deepen their understanding of important cultural developments and changes in the North culture from Viking to Medieval Age.

## 8.2 Participants and research activities

The following researchers participated in the project:

Professor Gro Steinsland, University of Oslo

Professor Jón Viðar Sigurðsson, University of Oslo

Professor Jan Erik Rekdal, University of Oslo

Professor emeritus Anders Hultgård, University of Uppsala, Sweden

Associate Professor Olof Sundqvist, University of Uppsala/Gävle, Sweden

Professor Jens Peter Schjødt, University of Aarhus, Denmark

Post. doc. Joanna Skórzewska, Polen

Dr. Ian Beuermann, the Netherlands

Mag. art. Per Hernæs, Østfold

In addition several guests contributed to the discussions within the project.

**Gro Steinsland** (group leader) was at CAS for the entire academic year. In collaboration with the other team members, she organized the theme's activities during the year, including weekly seminars, guest seminars, excursions and an international workshop. As a historian of religion, her scholarly focus has been on texts and mythology as doorways to ideology and power. She is a co-editor of the book being generated by the project during 2009/2010.

**Jón Viðar Sigurðsson** worked at CAS the whole year. As an expert on medieval Nordic history, he contributed significantly to the group's orientation in historical matters, concerning the development of the different Norse societies. His own contribution has focus on the description of the rulers in the sagas as doorways to the ideology of rulership from the pre-Christian into the Christian Norse culture. He is a co-editor of the book generated by the project.

**Jan Erik Rekdal** was at CAS for half a year, joining the group in the spring term 2008. He has contributed profoundly to the project by his research in Celtic and Irish culture. He had the main responsibility for the excursion to Ireland and Dublin in March, preparing an interesting academic journey for the group. His contribution had focused on clerical admonition of rulership in Irish prose narratives from the ninth and the eleventh centuries. He is a co-editor of the book generated by the project.

**Anders Hultgård** from Uppsala spent a whole year at CAS. As an emeritus in the field of History of Religion, he contributed with a comparative view on different literary sources. His project has focused on eschatology and means of rulership ideology in late Viking Age and early Christian Middle Ages, focusing on the remarkable use of pagan afterlife-ideology even for Christian rulers.

**Olof Sundqvist** from Uppsala worked at CAS a whole year, contributing eagerly to the project and the community of the fellows. His concentration on archaeological source material opened up for new methodological and theoretical discussions in the field of History of Religion. His contribution has a regional character, concentrated on pre-Christian and Christian cultic sites in Mälardalen, Sweden.

**Jens Peter Schjødt** from the University of Århus, in the field History of Religion, spent four months at CAS. As a comparative oriented scholar, with especially interest in theory and methods, he has contributed a lot to the methodological and theoretical discussions connected to the project.

**Joanna Skórzewska** spent a whole year at CAS, after having fulfilled her doctoral thesis at the University of Oslo in spring 2007. She worked with a project on the kingly martyrs of the Nordic countries in early medieval age, a theme important for the project as a whole.

**Ian Beuermann**, the Netherlands, a doctor from the University of Oslo, spent three months at CAS in the spring. Though a short stay, he contributed a lot to the project and the milieu of fellows, especially with his knowledge of the history of Orkney, Man and Ireland. We all profited of the skill and working capability of Ian, who is a co-editor of the forthcoming book generated by the project as well.

**Per Hernæs** was connected to the group for the last three months as consultative archaeologist, preparing two excursions for us in the spring term. As a specialist in the archaeology of the Viking Age, with a special knowledge of the areas chosen for our excavations, he was a door-opener for the group towards archaeological sites.

### **8.3 Colloquia, workshops, seminars and excursions**

#### **8.3.1 Weekly seminars**

The group's chosen way of working has been structured as an intense, interdisciplinary co-work, the participants spending much time together around a big table, arranging seminars three times a week during the whole academic year.

For the weekly seminars Mondays and Wednesdays we concentrated on basic source studies, opening up for new considerations about old literary sources, discussing texts, translations and interpretations, relating old textual sources to newly archaeological discoveries. This basic activity gave a lot of new insights and generated questions and problems to all of us.

For the weekly Tuesday-seminars the common interdisciplinary project as such was held in focus.

The group members participated in the common CAS-seminars on Wednesdays, occasionally giving lectures there as well.

Several weeks specific guests were invited to our seminars to present the newest research on specific topics. The guest seminars became rather fruitful to our work, as all of the invited scholars were positive to visit CAS, contributing to the aim of our project.

#### **Lectures given by the group members**

##### **8.3.2 Luncheon seminars, CAS**

**Olof Sundqvist.** Aspects of Rulership Ideology in Early Scandinavia – with a particular reference to the scaldic poem *Ynglingtal*, 12. *September 2007*.

**Jón Viðar Sigurðsson.** Ideology and chieftains, earls and kings in the North in the Viking Age, 24. *October 2007*.

**Joanna Skórzewska.** The King is dead, Long Live the King. 7. *November 2007*.

**Anders Hultgård.** How to deal with religious concepts and dangers, 21. *November 2007*.

**Jan Erik Rekdal.** Transmissions of texts and kings. 13. *February 2008*

**Gro Steinsland.** Reflections on Power and Religion, 22. February 2008.

**Jens Peter Schjødt.** 'Mythology and Rulership – with a View to the Pagan Religion of Scandinavia', 16. April 2008.

**Ian Beuermann.** Sveinn Ásleifarson and the Message behind Orkneyinga Saga, 7. May 2008.

**Per Hernæs.** Innovation and Grand Scale Politics at the Beginning of Iron Age, 14. May 2008.

### 8.3.3 Guest-seminars for the group

October 2007: **Dr. Jonas Wellendorf**, University of Bergen: The Visionary Literature of Norse Medieval Age.

October 2007: **Professor Kjartan Ottósson**, University of Oslo: The Etymology to different terms of rulership.

November 2007: **Ph. Student Anette Glørstad**, University of Oslo: On Ideology and material Culture.

November 2007: Sophus Bugge-seminar by **Professor Magnus Rindal**, NOVA/University of Oslo.

January 2008: **Kulturminnesjef Terje Gansum**, Vestfold fylkeskommune, presenting results from recent archaeological excavations at Borre, Vestfold

February 2008: **Professor Else Mundal**, University of Bergen, presenting new research on Orkneyingasaga.

March 2008: Lecture and guiding at the Vikingship Museum, Bygdøy, by **Professor emeritus Arne Emil Christensen**.

April and May 2008: **Dr. Fiona Edwards**, Cambridge, gave four lectures at CAS:

1. The cultural contact between Celtic and Old Norse Culture c. 900-1200.
2. Ideology and rulership in Ireland and Norway c. 900-1200.
3. Slaves as cultural actors?
4. Cult of saints in Ireland, Norway and Iceland.

May 2008: **Professor Leidulv Melve**, University of Bergen: European Kingship Ideology.

### 8.3.4 Lectures given on conferences and seminars

**Anders Hultgård.** How to deal with ancient Iranian eschatology, The European Conference on Iranian Studies, Vienna. 18.-22. *September 2007.*

**Anders Hultgård.** Folkreligion - vad är det? Föredrag vid Kungl Gustav Adolfs Akademiens 75 års jubileum. 5. *November 2007.*

**Jón Viðar Sigurðsson.** Conducted a session on Det Nordiske historikermøtet Reykjavík, Venner, patroner og klienter i Norden ca. 900-1800, 09. *August 2007.*

**Jan Erik Rekdal.** Tuán mac Cairill – a Hero of Faith, The 10th Symposium of Societas Celtologica Nordica Gothenburg 17.-19. *June 2008.*

**Jens Peter Schjødt.** A Discussion of the Religio-Phenomenological Notion of Sacrifice, Applied to the pre-Christian Scandinavian Religion', Bonn, Germany 23.- 24. May, 'Opfer. Praktiken und Vorstellungen in Nord-, West- und Mitteleuropa bis zum Mittelalter.

**Jens Peter Schjødt.** Planlægning og deltagelse i 27. Tværfaglige Vikingsymposium: Kommunikation i Vikingetiden, University of Aarhus, *May 2008.*

**Joanna Skórzewska.** Icelandic Annals as a Source, Project Hólarannsóknin and The Nordic Network of Cultural and Environmental History in Nordic Viking Age and Medieval Time 6.-8. *March 2008.*

**Steinsland, Gro.** Opening lecture of the CAS academic year 2007/2008: Myth and Power in the Cultural transformation of the Nordic Countries from Viking to Medieval Age, The Norwegian Academy of Science and Letters, 4. *September 2007.*

**Steinsland, Gro.** Konstruksjonen av hedendom – konsensus og konflikt, Collegium Mediale, UiO, 20. *November 2007.*

**Steinsland, Gro.** Voluspá and the Sibylline Oracles – with focus on the Myth of Future, Nordic Apocalypse, The Hólar Judgement Day and Voluspá, University of Iceland, Reykjavík, 1.- 4. *May, 2008.*

**Sundqvist, Olle.** Urnordiska erilaR – en tidig kultledare i sydvästra Skandinavien, Järnålderns rituella platser. Tvådagarskonferens i Halmstad, 4.-5. *October 2007.*

**Sundqvist, Olof.** Hov – specifik kultbyggnad eller multifunktionell hövdingahall? Borreseminariet, Midgård, Borre, 9. *June 2008.*

### 8.3.5 Excursions

25.-30. *March 2008*: Excursion to Dublin, conducted by **Jan Erik Rekdal**.

25.-26. *April 2008*: Field-excursion to Oppland, Hadeland, visiting archaeological and historical sites important to the project, conducted by **Per Hernæs**.

9.-10. *June 2008*: Field-excursion to Vestfold, visiting archaeological and historical sites, as Borre, Oseberg, Gokstad, Mølen etc., conducted by **Per Hernæs**.  
The group members from CAS presented lectures at Vestfold Fylkeskommune.

### 8.3.6 The Final Workshop 24.-25. June 2008 in The Norwegian Academy of Science and Letters

*The Power of the Ruler and the ideology of Rulership in Nordic Culture c. 800-1200.*

Invited scholars from France, Germany, Ireland, Iceland, Scotland, Sweden, and Norway participated as opponents to the preliminary results of the project:

Professor Kolbrún Haraldsdóttir, Erlangen, Germany

Professor Anne-Sofie Gräslund, Uppsala

Professor Stefan Brink, Aberdeen

Fylkeskultursjef dr. Terje Gansum, Vestfold

Professor François-Xavier Dillmann, Paris

Professor Michael Stausberg, Bergen

Professor Anders Frøjmark, Kalmar

Professor Máirín Ní Dhonnchadha, Galway, Ireland

## 8.4 Achievements and evaluation

The opportunity to work at CAS for a whole year gave us the greatest possibility to concentrate on research ever given to any member of the group, an experience highly appreciated. As a year invited to CAS ought to be something different from the individual sabbatical year, the research was organized as real co-work, with preferred long-term stay at CAS for the persons invited to the group. Thus the scholarly discussions could go on from day to day over a long period.

The continuity of the co-work was utterly made possible by the material structures at CAS: the members having offices next door to each-other and the possibility to meet around a big table several times a week.

Not least it was the excellent staff at CAS that made the daily work so easy for us, solving any problem in such a smooth and friendly way that everybody felt comfortable. The staff made whatever they could to let us spend all our energy on the scholarly work.

As the leader of the group I underlined that the members were supposed to concentrate on the actual project and rather spend minimum of participation in other activities. As a result, the group really succeeded in doing co-work. Evaluating ourselves at the end of the academic year spent at CAS, it was just this concentrated co-work going on from day to day and the stability of the stay of the members, that everybody had appreciated most and found most fruitful for their own research.

We agreed that the way CAS is structured and the practical support given the members by the excellent staff during the stay, is the most fruitful occasion offered to scholars who are ready to go into a challenging co-work.

One year is a short time to finish a project. When we in June had to end our activity at CAS, we invited a number of internationally well-known scholars to a workshop at the Academy of Letters and Science, asking for feedback on our preliminary results. We did get a lot of inputs during these days, positive as well as critical ones, and not least we got a lot of incentives to continue and fulfil the project.

The three members of the group employed at the University of Oslo, Steinsland, Sigurðsson and Rekdal, will, together with Beuermann from the Netherlands, take the project further on, inviting scholars to workshops and publish the main results of the project as a common book by an international publisher.

The project started at CAS will thus continue in the form of a research group at the University of Oslo. Another result of the CAS-project concerns the teaching: a new entity for study in Norse and Irish culture with focus on society, religion and rulership will be offered at UiO from the spring-term 2009.

It is not easy to summon up the results of the whole year spent at CAS as we have got so many inputs and new thoughts on basic sources, methods and theories during the time spent together as an interdisciplinary group.

For the historians of religion, the daily co-work with historians resulted in new insights of the relationship between religion and society. The literary fields were deeply challenged by historical and archaeological methods, and vice versa.

We all seemed to develop a new understanding of important relations between power, ideology, myths and rituals in a common north-European warrior culture of the late Viking Age.



The hypothesis that important element of the pre-Christian ruler-ideology continued into the early Middle Ages, transformed or transferred, have been strengthened through the project.

It was not until the middle of the 13th century that the European rulership ideology really got hold on the Nordic culture.

Though the change of religion was a crucial event in the development of the Nordic cultures in late Viking Age, there seems to have been more of ideological continuity than realized by earlier scholarship.

These results are interesting in the broader scholarly debate about centre and periphery in the European Middle Ages and the discussion whether the Nordic countries did contribute with something of their own in the development of a new European culture in the Medieval Age.

## 8.5 Publications

### 8.5.1 Published books and articles

**Ian Beuermann.** King John's Attack on Man in 1210; published in *Northern Studies* vol. 40 (2008), 23-50.

**Anders Hultgård.** The mythic theme of the great winter in ancient Iranian traditions, In: F. Vahman & C. Pedersen (eds.) *Religious Texts in Iranian Languages*, Copenhagen 2007:101-120.

**Jón Viðar Sigurðsson.** Kinship and Friendship in the Icelandic Free State Society, *Revue D'histoire Nordique* 2007, 4, 122-140.

**Jón Viðar Sigurðsson.** Becoming 'Old', Ageism and Taking Care of the Elderly in Iceland c. 900-1300. In: *Youth and Age in the Medieval North*. Shannon Lewis-Simpson (ed.) The Northern World 42, Brill, 124-137.

**Jón Viðar Sigurðsson et al.** (red), Vänner, patroner och klienter i Norden, Rapport till 26:e Nordiska historikermötet i Reykjavík den 8-12 augusti 2007. Ritsafn Sagnfræðistofnunar 39.

**Jón Viðar Sigurðsson.** De vennlige Islendingene og den uvennlige kongen, *Vänner, patroner och klienter i Norden*, Rapport till 26:e Nordiska historikermötet i Reykjavík den 8-12 augusti 2007. Red. Lars Hermanson et al., Ritsafn Sagnfræðistofnunar 39, 2007, 81-100.

**Jan Erik Rekdal and Ailbhe Ó Corráin** (eds.) *Proceedings of the Eight Symposium of Societas Celtologica Nordica*, Uppsala Universitet, 2007.

**Jan Erik Rekdal.** Carl Marstrander's Encounter with the great Basket, in Jan Erik Rekdal and Ailbhe Ó Corráin (eds.) *Proceedings of the Eight Symposium of Societas Celtologica Nordica*, Uppsala Universitet, 2007, 15-21.

**Gro Steinsland.** *Fornnordisk religion*, Natur och Kultur, Sth. 2007, 569 s.

**Gro Steinsland.** Snorre-Edda som kilde til norrøn religion, *Snorre Sturlason: Edda*, utg. ved Asbjørn Aarnes, Oslo 2008, 138-159.

**Olof Sundqvist.** *Kultledare i fornkandinavisk religion*. OPIA 41. Institutionen för arkeologi och antik historia. Uppsala universitet. Uppsala 2007. 272 s.

### 8.5.2 Forthcoming publications

**Ian Beuermann.** "R. Andrew McDonald *Manx Kingship in its Irish Sea Setting*, 1187-1229. Dublin: Four Courts Press, 2007"; Reviewed for H-Albion, Canada, submitted July 2008.

**Ian Beuermann.** *Dynasty, Túath, and God's Grace. Manx Kingship in the Twelfth and Thirteenth Centuries. Paper submitted for the conference Between the Islands: Interaction with Vikings in Britain and Ireland in the Early Medieval Period*, Department of Anglo-Saxon, Norse and Celtic, University of Cambridge, 13-15 March 2009.

**Ian Beuermann.** Scandinavian Ideology of Rulership in the West: Earls in or of Orkney, Kings in or of the Isles c. 850-c. 1260? ed. Gro Steinsland et al., forthcoming 2009/2010.

**Ian Beuermann.** A Chieftain in an Old Norse Text: Sveinn Ásleifarson and the Message behind *Orkneyinga saga*, *Confluence*, Interdisciplinary Communications 2007/08, ed. Willy Østreng, CAS 2009.

**Anders Hultgård.** Folkreligion - vad är det?, In: M. Reinhammar (ed), 75 år med Svensk Folkkultur. Uppsala 2008.

**Anders Hultgård.** The Religion of the Vikings, In: S. Brink & N. Price (eds.), *The Viking World*, Routledge: Oxford 2008.

**Anders Hultgård.** Le "jour de Dieu" et les "millénaires de Dieu" - deux types d'eschatologie iranienne, In: A.Hultgård & S. Norin (eds., *Le Jour de Dieu/ Der Tag Gottes*. Tübingen: Mohr Siebeck.

**Anders Hultgård.** Persian Religion and Early Judaism, in J. J. Collins & D. C. Harlow (eds., *The Dictionary of Early Judaism*. Eerdmans Publishing Co: Grand Rapids, Michigan.

**Anders Hultgård.** Studying Religion – Concepts, Methods and Dilemmas, *Confluence*, Interdisciplinary Communications 2007/08, ed. Willy Østreng, CAS 2009.

**Anders Hultgård.** Afterlife ideologies for rulers in a period of religious change, ed. Gro Steinsland et al., forthcoming 2009/2010.

**Jón Viðar Sigurðsson.** *Det norrøne samfunnet: vikingen, kongen, erkebiskopen og bonden.* Pax forlag, Oslo, 350 sider.

**Jón Viðar Sigurðsson.** *Making, Using and Resisting the Law in European History.* Günther Lottes, Eero Medijainen and Jón Viðar Sigurðsson (ed.), Pisa University Press, Pisa, 2008, c. 280 sider.

**Jón Viðar Sigurðsson.** Rulers, personal abilities and religion in Iceland, Norway and Orkneys, ed. Gro Steinsland et al., forthcoming 2009/2010.

**Jón Viðar Sigurðsson.** Politics and Personal Abilities in Iceland, Norway and Orkneys, *Confluence*, Interdisciplinary Communications 2007/08, ed. Willy Østreng, CAS 2009.

**Jan Erik Rekdal.** Murder in the Hostel. Clerical admonition of kingship in Irish prose narratives of the ninth and the eleventh-twelfth centuries, ed. Gro Steinsland et al., forthcoming 2009/2010.

**Jan Erik Rekdal.** Transmissions of Kings and texts in Medieval Irish Literature, *Confluence*, Interdisciplinary Communications 2007/08, ed. Willy Østreng, CAS 2009.

**Jens Peter Schjødt.** *Initiation between two Worlds. Structure and Symbolism in pre-Christian Scandinavian Religion.* Vol. 17, 'The Viking Collection', forthcoming October 2008.

**Jens Peter Schjødt.** Freyr and Fróði and some Reflections on Euhemerism', Festschrift til Professor Kurt Schier, February 2009.

**Jens Peter Schjødt.** Diversity and its Consequences for the Study of Old Norse Religion – What are we Trying to Reconstruct?, Rzeszow, Polen, forthcoming 2009.

**Jens Peter Schjødt.** Basic Traits in Religious World Views, *Confluence*, Interdisciplinary Communications 2007/08, ed. Willy Østreng, CAS 2009.

**Jens Peter Schjødt.** The Ideology of the Ruler: Mythic and Ritual Relations, ed. Gro Steinsland et al., forthcoming 2009/2010,

**Joanna Skórzewska.** *Sveinn einn ungr fell í sýruker*: medieval Icelandic children in vernacular miracle stories, in *Youth and Age in the Medieval North*, Brill, The northern World Series, ed. Shannon Lewis-Simpson, forthcoming.

**Joanna Skórzewska.** Family matters? The relics of Scandinavian royal martyrs and the ideology of power, ed. Gro Steinsland et al., forthcoming 2009/2010.

**Gro Steinsland.** *Voluspá* and the Sibylline Oracles – with focus on the Myth of Future, Reykjavík, 2009.

**Gro Steinsland.** Rulers as Offsprings of Gods and Giantesses: On the Mythology of pagan Norse Rulership, in: S. Brink & N. Price (eds.), *The Viking World*, Routledge, Oxford 2008.

**Gro Steinsland.** Foundation myths as Ideology of Rulership – From the Viking Age Ruler to the King of Medieval Historiography. Continuity, Transformations and Innovations, ed. Gro Steinsland et al., forthcoming 2009/2010.

**Gro Steinsland.** *Voluspá* – a Source to Norse Pagan Mythology or a Christian revelation in Disguise of a Classical Sibylline Oracle?, *Confluence*, Interdisciplinary Communications 2007/08, ed. Willy Østreng, CAS 2009.

**Olof Sundqvist.** Cult leaders, rulers and religion. I: *The Viking World*. Red. S. Brink & N. Price. Routledge, London 2008.

**Olof Sundqvist.** Cosmic Aspects of Sanctuaries in Viking Age Scandinavia with Comparisons to West-Slavic Area. I: *Proceedings from XVth Viking Congress in Cork*, 2008.

**Olof Sundqvist.** Urnordiska erilaR – en tidig kultledare i sydvästra Skandinavien. I: *Järnålderns rituella platser*. Red. Anne Carlie, 2008.

**Olof Sundqvist.** The Hanging, the Nine Nights and the “Precious Knowledge” in *Hávamál* 138–145: The Cultic Context. I: *Festschrift für Kurt Schier*. Hgg. A. Van Nahl & W. Heizmann. Berlin-New York. 2008.

**Olof Sundqvist.** The problem of ancient Scandinavian cultic buildings – with particular reference to Old Norse *hof*. I: *Temenos*. Red V. Anttonen. 2008.

**Olof Sundqvist.** Aspects of rulership ideology in Early Scandinavia – with particular reference to the skaldic poem *Ynglingatal*, *Confluence*, Interdisciplinary Communications 2007/08, ed. Willy Østreng, CAS 2009. 2008.

**Olof Sundqvist.** Francois-Xavier Dillmann. Les magiciens dans l'Islande ancienne. Études sur la représentation de la magie islandaise et de ses agents dans les sources littéraires norroises. Acta academiae regiae Gustavi Adolphi. XCII. Uppsala. 2006. / Andreas Nordberg. Jul, disting och förkyrklig tideräkning. Kalendrar och kalendariska riter i det förkristna Norden. Acta Academiae Regiae Gustavi Adolphi. XCI. Uppsala. 2006. & I: *Svensk religionshistorisk årsskrift* 16. Red. M.-L. Keinänen. Stockholm 2007, s. 205–210.

**Olof Sundqvist.** An Arena for higher Powers. Cultic Buildings and Rulers in the Late Iron Age and the Early Medieval Mälaren region, ed. Gro Steinsland et al., forthcoming 2009/2010.

## 9. Understanding Innovation

Report by Jan Fagerberg  
Group leader 2007/2008  
August 27, 2008

### 9.1 General description

During the last two decades innovation has increasingly become a central focus for policy makers. The reason for this is the central role innovation is assumed to play for income and employment growth (and quality of life more generally). However, in spite of this, innovation has not always received the scholarly attention it arguably deserves. For instance, students examining the causes of long-run economic change used to focus on other factors, such as capital accumulation or the working of markets, rather than innovation. This is now changing. Research on the role of innovation for economic and social change has proliferated in recent years, particularly within the social sciences, and with a bent towards cross-disciplinarity.

Although a few scholars were active in this area in the early years of the previous century (Joseph Schumpeter is the most obvious example) innovation studies did not really emerge as an academic field before the 1960s. When it did, it did so mostly outside (or in the fringes of) the dominant disciplines in the social sciences and the most prestigious universities. Technical universities also became host to many new research centres in this area, as did business/management schools, especially in the United States. Many of these adopted a cross-disciplinary orientation.

The cross- and/or multi-disciplinarity that characterize much scholarly work in this area reflect the fact that no single discipline deals with all aspects of innovation. Arguably, developing a comprehensive understanding of the phenomenon requires a combination of insights from several disciplines. However, this diversity in backgrounds and orientations may also create problems. For example, different parts of the research community use the same concept (such as “innovation” for instance) in different senses, and, similarly, different concepts are used to explain the same phenomenon. Such “conceptual fuzziness” may be an important obstacle for meaningful interaction between researchers in the field.

This does not mean that attempts to have constructive interaction between scholars with different backgrounds in this field are doomed to failure. Instead, it suggests that effort and leadership are needed to create and support such interaction. One such attempt in which several of the potential participants in this project were involved, was the TEARI-project (2002-2004) which led to publication of the Oxford Handbook of Innovation (Oxford University Press, October 2004), edited by Jan Fagerberg, David Mowery and Richard Nelson. The current project builds on the results obtained there. However, while the TEARI project attempted to create a broad overview of our current knowledge on the

subject, the current project aimed at exploring a small set of strongly interrelated issues in greater depth. During the lifetime of the project three thematic conferences were organized with participation from the researchers in the project and a group of invited leading international scholars in the field (drawn among other places from the TEARI network). In this way a large number of researchers working at the frontier of innovation research were invited to give a contribution to the project. These conferences contributed to enhance the quality of the work undertaken during the project and disseminate it to a wider audience.

## **9.2 Participants and research activities**

The following researchers participated in the project and spent a month or more at CAS:

Jan Fagerberg, Professor, University of Oslo  
Cristina Chaminade, Associate Professor, Lund University  
Tommy Clausen, Research Fellow, Nordland Research Institute, Bodø  
Susan Cozzens, Professor, Georgia Institute of Technology  
Charles Edquist, Professor, Lund University  
Maryann Feldman, Professor, University of North Carolina  
Magnus Gulbrandsen, Senior Research Fellow, NIFU STEP, Oslo  
Bronwyn Hall, Professor, University of California – Berkeley  
Thomas Hoff, Associate Professor, University of Oslo  
Sjur Kasa, Senior Research Fellow, University of Oslo  
Ben Martin, Professor, University of Sussex  
Stan Metcalfe, Professor, University of Manchester  
David C. Mowery, Professor, University of California – Berkeley  
Paul Nightingale, Senior Research Fellow, University of Sussex  
Koson Sappasert, Research Fellow, University of Oslo  
Martin Srholec, Senior Research Fellow, University of Oslo  
Bart Verspagen, Professor, Maastricht University  
Anders Underthun, Research Fellow, Norwegian University of Science and Technology (NTNU), Trondheim

In addition, there were four international researchers who visited for up to a week.

The participating researchers came from a range of different disciplines and specializations including – in addition to innovation studies proper – economics, management, political science, sociology, psychology and science studies.

While all the participating researchers contributed significantly to the progress of the work, some had longer stays and carried more organizational responsibility. Jan Fagerberg

(group leader) worked at CAS for the entire academic year. Together with Koson Sapprasert, he coordinated the activities of the group. Martin Srholec, who was at CAS the whole year, had the primary responsibility for the first workshop (innovation in firms). Magnus Gulbrandsen and Sjur Kasa, who also worked at CAS the whole year, were responsible for the second (public sector research) and third (policy) workshop, respectively. They furthermore organized one conference each in cooperation with the Norwegian Research Council aiming at disseminating the discussions at the workshops to a broader public. Kasa also organized the internal (Tuesday) seminars. Among the foreign visitors David Mowery, Ben Martin and Paul Nightingale all stayed at CAS three to four months and did, among other things, contribute to the organization of all three workshops.

### **9.3 Workshops and seminars**

#### **9.3.1 Workshop I: Innovation in Firms**

The key role of firms for innovation was emphasized by Schumpeter nearly a hundred years ago and, more recently, by Nelson & Winter. In their account firms are described as heterogeneous actors that perceive the world differently, make different strategic choices and act accordingly. Firms are producers as well as users of knowledge, hence innovation does not stop at the front door, but depends on a complex interplay between firms and their environments (including users). Since Nelson and Winter first outlined this perspective a few decades ago a good deal of new research has emerged, mainly in business & management studies, on firms as knowledge-based organizations and the implications of this for innovation.

In parallel with this outpouring of research the saliency of innovation as a concern for policymakers and citizens alike has grown. One result of this increased interest in innovation is a much more extensive effort to collect data on innovation activities within firms. Although such data were rare a few decades ago, most if not all European countries now conduct extensive surveys of innovation activities and similar activities are taking part in other parts of the globe, including some developing countries. There is also an increasing amount of case-study evidence on this topic.

How does the current state-of-the-art in evolutionary analysis, as pioneered by Schumpeter, Nelson & Winter, and others, help us to understand the role of firms in innovation processes, and innovation processes in firms? And what light does the new empirical evidence throw on this body of evolutionary thinking about firms and innovation? These are some of the questions that we wanted to address in this workshop.

The workshop was arranged at SEM Gjestegård, Asker, from 30. October to 1. November 2007. The program may be summarized under four central headings:



### (1) The knowledge-based firm

The workshop started by taking stock of existing interpretations & theories about knowledge, capabilities, innovation and firms with a focus on the central insights, controversies and challenges that have emerged since Nelson and Winter presented their approach a quarter of a century ago. Five papers were presented followed by a joint discussion led by Ben Martin.

**Bengt Åke Lundvall** (University of Aalborg). On the complementarity between science-based and experience-based learning in Danish firms (with E. Lorenz and M.B. Jensen)

**Paul Nightingale**. Knowledge & capabilities – identical or overlapping?

**Thomas Hoff**. On psychology and product innovation

**Patrick Cohendet** (University Louis Pasteur, Strasbourg). Innovation, Knowledge Intensive Firms and Creative Environments (with L. Simon)

**Tommy Clausen**. Perception and Innovation – A firm level analysis

### (2) How (and why) do firms differ in their approaches to innovation?

A central argument in the evolutionary literature is that firms are cognitively different, develop different firm-specific capabilities and make different strategic choices with respect to innovation. What can the empirical evidence available tell us about the existence, sources, character and consequences of such heterogeneity? Is there a limited number of “strategic types” and how are these related to the (economic, industrial, social & institutional) context in which firms operate? To what extent can we still generalize about firm behaviour in the presence of heterogeneity? As attempts at answering these questions, six papers were presented followed by a joint discussion led by Bart Verspagen.

**Stan Metcalfe**. Strategy formation & firm diversity – The driving force of economic evolution

**Keld Laursen** (Copenhagen Business School). Keep searching and you’ll find – What do we know about variety creation through firms’ search activities for innovation?

**Martin Srholec**. How much do innovation strategies differ across firms, industries and countries? (with B. Verspagen)

**Aija Leiponen** (Cornell University). Service innovation – a totally different ballgame?

**Michael S. Dahl** (University of Aalborg). The Influence of Human and Social Capital on Entrepreneurial Survival

**Edward Lorenz** (University of Nice-Sophia Antipolis). Systems of social protection, labour market structure and innovative performance: a comparison of the EU-15 (with B.-Å. Lundvall)

### (3) Blurred boundaries: Firms & environments

Innovation consists of combining and recombining knowledge. The richer the knowledge base the larger the scope for innovation. It follows logically that firms that wish to continue to excel in innovation has to focus not only on internal knowledge but also on the vast amount of knowledge that resides in its environment. Cohen & Levinthal in a justly famous contribution fifteen years ago, for instance, coined the concept “absorptive capacity” for the ability of a firm to identify, access and exploit external knowledge. Since then there has been a burgeoning literature on the subject and many new concepts have been suggested such as “innovation system”, “open innovation” & “democratic innovation”. The following papers presented some new empirical evidence emerged in recent years. David Mowery led a joint discussion of the papers.

**John Cantwell** (Rutgers Business School, New Jersey). Blurred boundaries within and between firms

**Wim Vanhaverbeke** (Eindhoven University of Technology). How to balance internal and external sources of innovation – From “absorptive capacity” to “open innovation”? (with M. Cloudt and V. van de Vrande)

**Bruce Tether** (Imperial College London). Distributed and Distributing Innovation: Competing through Services and Networks – Changes to Skills and the Organisation of Innovation

**Jarle Hildrum** (AFI-WRI, Oslo). Does recent theorizing about distributed innovation offer something new to innovation studies?

**Paola Criscuolo** (Imperial College London):.Does R&D internationalisation pay?

**Bronwyn Hall**. Innovation and Financial Markets

### (4) Innovation and development

Innovation – the ability to combine, recombine and commercialize knowledge – is not limited to the rich part of the world or to “high tech” industries. But just how different are developing countries, or “catching up” countries, from advanced countries when it comes to the opportunities and demands facing firms (and what are the consequences)? This is a controversial issue, and the evidence has been patchy at best. Recently, several developing countries have carried out relatively large-scale surveys on innovation activities that may lead to an opportunity for providing more solid evidence on the subject.

The following papers addressing the issue were presented followed by a joint discussion led by Jan Fagerberg.

**Henny Romijn** (Eindhoven University of Technology). Does Innovation Matter for LDCs? Discussion and research agenda

**Martin Srholec**. A multilevel perspective on innovation in developing countries

**Micheline Goedhuys** (University of Antwerp). The role of innovation in low tech sectors in developing countries – a cross country comparison (with N. Janz and P. Mohnen)

**Eduardo Viotti** (University of Brasilia). Innovation in Brazilian, Argentine and European industries – A comparison of Innovation surveys (with A.R. Baessa)

**Patarapong Intarakumnerd** (National Science and Technology Development Agency, Thailand). Measuring Innovation in Catching-up Economies – An Experience from Thailand

The four central topics in “innovation in firms” were synthesized and followed by discussion on future agenda led by Bengt Åke Lundvall.

#### 9.3.1\* Workshop I: Output / follow-up

The first workshop follow-up was twofold. First, selected papers presented at the workshop were given a chance to revise and submit to a special issue on “Innovation in Firms” (co-edited by Jan Fagerberg, David Mowery, Paul Nightingale and Bart Verspagen) of the peer-review journal *Industrial and Corporate Change*. Second, a policy seminar on “innovation in firms” was arranged at Research Council of Norway (NFR) on 2 November 2007. The program is summarized below.

**Per Koch** (Director, NFR) and **Jan Fagerberg**. Welcome Introduction

**Bengt Åke Lundvall** (University of Aalborg). Modes of learning and innovation policy

**Bart Verspagen**. The variety of innovation strategies – How (Norwegian) firms face global challenges

**Frode Berge** (Norwegian State Secretary). The Norwegian Government’s Work on the White Paper on Innovation

**Ben Martin**. Management of Innovation – Lessons for Policy

**Ingvald Fergestad** (Senior Vice President, Telenor). Industry’s Perspective

### 9.3.2 Workshop II: The Changing Role of Public Sector Research in Innovation

In much of the literature on innovation systems, universities and public research institutes are seen as central organizations, although their role and importance may vary between industries and between regions and countries. Why these public research organizations are seen as central is still a matter of disagreement, however, as is the question of whether recent attempts to increase commercialization from universities is a worrying development or not. In Europe, the issue remains a controversial one with policymakers partly imitating Bayh-Dole legislation and researchers taking a more cautious approach. In the light of the complexity of the issues regarding the role of universities in innovation systems, this workshop focused on some selected themes that according to our judgment required urgent attention:

#### **Research relationships between public research and firms**

Firms within many industries have for a long time carried out research collaboration with universities, colleges and public research institutes. Various types of contract research, collaborative projects, sponsored research and consulting agreements generate specific problem-solving knowledge transfer as well as general knowledge with relevance to industry or other innovating actors. Issues include networking between public research organizations and firms in different countries, industries and disciplines, the role of research institutes in UI (University-Industry) relationships, the relationship between UI research relations and other activities like teaching, consulting etc.

#### **Technology transfer/commercialization and IPR**

Extensive organizational and legal changes have been implemented in most parts of the world throughout the last couple of decades, not least following the Bayh-Dole Act of the U.S. IPR and other regulations have been changed to give higher education institutions more opportunities and more formal responsibilities for commercialization of research. Although some of these changes are very recent, there is a need to summarize the changes, analyze their origins and, if possible, consider their effects in a comparative context. Intermediary organizations like technology transfer offices have multiplied, and their structure seems to differ considerably among different nations and university systems (see e.g. the EU report on “Institutions for knowledge transfer from science to enterprises in Europe”). There are many different motives for these changes, but high expectation to the possible economic benefits of direct commercialization of university research is an important one, at least in some countries. Still the effects of these initiatives on the “economic payoff” to university research remain controversial. The effects of the initiatives on the conduct, quality, and dissemination of university research also have been the focus of considerable research and controversy.

Issues include academic entrepreneurship and faculty commercialization activities, technology transfer and its support structure, the relationship between commercializa-

tion and other activities like publishing and networking with industry. In addition, there is a need to discuss how relations between public research organizations have been promoted by policymakers including attempts at changing legislations.

The workshop was arranged at Lysebu, Lysebu 12, Oslo, from 26 to 28 March 2008.

It began with introductory presentations by Magnus Gulbrandsen and David Mowery. The remaining program may be summarized as follows:

**(1) UI Relations: What do we know, where do we go?** (with discussion led by Jan Fagerberg) **Ben Martin**. UI relations in longer-term historical perspective – what's new? and is it threatening?

**Jerry Thursby** (Georgia Institute of Technology). University Licensing – Implications for Faculty Research (with M. Thursby)

**Francesco Lissoni** (Università Bocconi). Academic entrepreneurs – critical issues and lessons for Europe (with C. Franzoni)

**Benoit Godin** (Institut National de la Recherche Scientifique, Montreal). The Place of Universities in Science, Technology, and Innovation Policies

**(2) A broader picture of UI relations** (with discussion led by Sjur Kasa)

**Reijo Miettinen** (University of Helsinki). Relation between commercialisation of research results, research and teaching

**Mike Wright** (Nottingham University Business School). The business school – Technology Transfer Office (TTO) relationship

**Magnus Gulbrandsen**. Research institutes and UI relations

**(3) Interaction between universities and industry, recent empirical evidence**

(with discussion led by David Mowery)

**Alice Lam** (University of London). Work roles, careers and professional orientations of academic scientists in university-industry links

**Maria-Theresa Larsen** (Copenhagen Business School). Too close for comfort? The effect of university-industry collaboration on the scientific performance of university professors

**(4) Academic patenting and its impacts** (with discussion led by Magnus Gulbrandsen)

**Jeannette Colyvas** (Northwestern University). Measures, metrics, and myopia: the challenges and ramifications of sustaining academic entrepreneurship (with W. Powell)

**Aldo Geuna** (University of Sussex). The impact of academic patenting on university research and its transfer (with O. Babalola, G. Crespi and P. D'Este)

**Marie Thursby** (Georgia Institute of Technology). Inventor moral hazard in university licensing – the role of contracts (with E. Dechenaux and J. Thursby)

#### **(5) Geography and industry perspectives on UI relations**

(with discussion led by Paul Nightingale)

**Arvids Ziedonis** (University of Michigan). The Geographic Reach of Market and Non-Market Channels of University Research Commercialization (with D. Mowery)

**Rudi Bekkers** (Eindhoven University of Technology). Analysing preferences for knowledge transfer channels between universities and industry: To what degree do sectors matter?

**Pablo D'Este** (University of Sussex). Gaining from interaction with university: multiple methods for building absorptive capacity (with K. Bishop)

#### **(6) Entrepreneurial academics, new evidence** (with discussion led by Ben Martin)

**Janet Bercovitz** (University of Illinois). The Quest for Better Relevance: building a better innovation team (with M. Feldman)

**Andrea Bonaccorsi** (Sant'Anna School of Advanced Studies, Pisa). Tradeoffs between commercialisation and basic research/publishing are circumstantial and local

**Waverly Ding** (University of California – Berkeley). Divergent Paths or Stepping Stones: a comparison of scientists' diversity and entrepreneurial activities (E. Choi)

The workshop was concluded with final remarks made by David Mowery and discussion led by Maryann Feldman.

### **9.3.2\* Workshop II: Output / follow-up**

As follow-up, selected papers presented at the workshop were given a chance to revise and submit to a special issue (co-edited by Magnus Gulbrandsen, Maryann Feldman and David Mowery) of the peer-review journal *Research Policy*.

### **9.3.3 Workshop III: Evolutionary theory and policy**

It is a widely held view that the global economy has undergone important changes that challenge established understandings and practices. The importance of knowledge for competitiveness, welfare and economic growth is now acknowledged by most policy-makers, as is the impact of the ICT revolution, and it has been asserted that the combination of

these factors with innovation (which is on everybody's lips these days) represents a qualitative shift in how the economy (including policy) works. Policy makers have tried to accommodate these new trends in various ways. However, in many cases the policies that come out of this recognition, such as the European Union's "Lisbon agenda", are not very novel and arguably not so useful either. It is as if the new perspectives that have developed during the last decades, such as evolutionary and innovation systems approaches etc., have only managed to influence policymakers' awareness of what the important challenges are (the choice of agenda) but not their capacity to deal with these challenges. The question we wished to address was if we can do better in this regard.

This workshop was explorative in character and had four sessions. The first of these focused on how (if) evolutionary theory can help thinking about policy, the second considered how policy designs (innovation policy for example) have developed in the last decade or so (and the extent to which evolutionary ideas have had a say in this), the third asked the question of what evolutionary thinking has to contribute to the arguably most challenging policy issue of our times, climate change, and the final session tried to bring all these things together and consider what might be done next.

The workshop was arranged at Refsnes Gods, Godset 5, Moss, from 20. to 22. March 2008. It started with introductions by Jan Fagerberg and Sjur Kasa. The rest of the program is summarized below:

**(1) What are possible contributions from evolutionary theorizing to policy discussions?**

Staffan Jacobson (Chalmers University of Technology) led the session. The following spoke about the possible relevance of central evolutionary concepts and ideas for policy:

**Richard Nelson** (Columbia University, New York). Variety, selection and retention

**Jane Calvert** (University of Edinburgh). Knowledge

**Michelle Gittelman** (Rutgers Business School, New Jersey). Inertia

**Peter Murmann** (Australian School of Business). Co-evolution

**Bart Verspagen**. Trajectories, paths & (multiple) equilibria

**(2) To what extent has evolutionary thinking already influenced political action (and not only the rhetoric)? Are there good examples? What can we learn from these attempts?**

David Mowery led the session, which included contributions by:

**Bjørn Terje Asheim** (Lund University). Regional level

**Paul Nightingale**. National experiences from the UK

**Tarmo Lemola** (Advansis, Helsinki). National experiences from Finland

**Staffan Jacobsson** and **Charles Edquist**. National experiences from Sweden

**Susana Borrás** (Copenhagen Business School). European level

**Michael Harris** (National Endowment for Science, Technology and the Arts, UK).

Policy makers perspective

**(3) Can evolutionary ideas help us to face the challenge from climate change? If so, how?**

Bengt Åke Lundvall (University of Aalborg) led the discussion following interventions by:

**Sjur Kasa.** Policy responses to impacts of climate change

**Marko Hekkert** (Utrecht University). How can we promote low carbon technologies?

**Phil Cooke** (Cardiff University). Green Innovation

**Knut Alfsen** (University of Oslo). The Norwegian Low-Emission Committee

**(4) Where to go from here?** Magnus Gulbrandsen led discussion of the last session which considered the main lessons from the workshop, and what should be done as follow-up.

The following speakers were asked to give introductions to this discussion. Merle Jacob (University of Oslo), Ben Martin, Stan Metcalfe and Michael Harris.

**9.3.3\* Workshop III: Output / follow-up**

As follow-up, a policy seminar on “innovation policy and environmental challenges” was arranged at Research Council of Norway (NFR) on 23 May 2008. The program is summarized below.

**Sjur Kasa.** Welcome Introduction

**Staffan Jacobsson.** Tradable Green Certificates – a cost-efficient policy driving technical change or a rent-generating machine?

**Marko Hekkert.** Innovation System Management – a new policy framework for accelerating low carbon technologies

**Phil Cooke.** Green Innovation, Social Capital & Regional Development

**Knut Alfsen.** Recommendations from the Norwegian Low-Emission Committee

**9.3.4 Tuesday In-house seminars**

A series of in-house seminars on “understanding innovation” was held nearly every Tuesday in the Turret Room (3rd floor) at CAS during the academic year 2007/2008. Both internal group members (see above) and external distinguished scholars were invited to present and discuss their research with other group members and registered attendees from outside. The program is summarized below:

August 21 **Sandro Mendonça** (Technical University of Lisbon). The changing role of science in the innovation process – from Queen to Cinderella

August 28 **Cristina Chaminade.** What do we know about globalization of innovation and what are the challenges for the future?

September 4 **Jan Fagerberg.** Innovation studies - a new scientific field

September 11 **Magnus Gulbrandsen.** The rationales for public support for applied research



September 18 **David Mowery**. R&D globalization in semiconductors and other US high-tech industries

September 24 **Erik Reinert** (Tallinn University of Technology). Innovation and Poverty

October 9 **Thomas Hoff**. Innovation and Psychology

October 16 **Martin Srholec**. A multilevel approach to analysis of innovation

October 23 **Sjur Kasa**. Governance and networks as institutional context of innovation

November 6 **Maryann Feldman**. Academic Entrepreneurs – Organizational Change at the Individual Level

November 13 **Ben Martin**. The Changing Role of the University

November 20 **Tommy Clausen**. Firm heterogeneity within industries – How important is ‘industry’ to innovation?

December 4 **Bengt Åke Lundvall** (University of Aalborg). Innovation System Research and Policy – Where it came from and where it might go

January 29 **Anders Underthun**. “Scalar politics and innovation”

February 5 **Manuel Mira Godinho** (Technical University of Lisbon). Simulating the prospects of technological catching-up

February 12 **Susan Cozzens**. Innovation and Inequality

February 26 **Bjørn Terje Asheim** (Lund University). Perspectives and development tendencies in regional innovation research and policy

March 4 **Bart Verspagen**. Should Universities Own Patents for Knowledge Transfer?

March 11 **Reijo Miettinen** (University of Helsinki). National Innovation System – Scientific concept or political rhetoric

April 15 **Stan Metcalfe**. Alfred Marshall on Management, Innovation and the Representative Firm

April 22 **Brownyn Hall**. R&D and firm performance

June 3 **Magnus Gulbrandsen**. Social science and industrial innovation – Einar Thorsrud and post-war work research in Norway

June 10 **Charles Edquist**. Identification of Policy Problems in Systems of Innovation through Diagnostic Analysis

### 9.3.5 Wednesday CAS luncheon seminars

A number of members of our research group were also invited to present their research at CAS luncheon held almost every Wednesday in the Turret Room (3rd floor) at CAS during the academic year 2007/2008. Written accounts of these presentations were requested to submit for peer-review so as to be published in the CAS yearbook on Interdisciplinary Communications. Our contributions are summarized as follows.

September 19 **Jan Fagerberg**. Schumpeter - the innovation theorist

September 25 **Cristina Chaminade**. Will China and India change the global landscape of innovation? What do we know and what are the challenges for innovation studies?

October 10 **Martin Srholec**. Analysis of innovation – Frontiers and extensions

November 28 **Koson Sappasert**. Acknowledging Organizational Innovation

December 5 **Magnus Gulbrandsen**. The role of basic research in innovation

December 13 **Ben Martin**. Academic misconduct in the republic of science – does self-policing work?

January 9 **Sjur Kasa**. Environmental problems and techno-economic paradigms – A historical perspective

January 23 **Thomas Hoff**. Design of everyday technology from a psychological viewpoint

January 30 **Anders Underthun**. The multi-scalar politics of natural gas – the making of a global commodity versus the claim for a localised national asset

February 20 **Susan Cozzens**. Equality as a Problem in Science and Technology Policy

March 12 **Paul Nightingale**. Speech Act Theory and Innovation

June 4 **Bart Verspagen**. Estimating the Value of Patented Inventions

#### **9.4 Evaluation**

There is no doubt that this year has been a very productive one for the participants in the group who generally enjoyed the stay and working conditions offered by CAS. The reactions from the foreign participants in particular indicate that CAS has found a way to work that is both considered attractive and productive.

The project has functioned on several levels. A central activity was the workshops, which generally must be considered as very successful, at least based on the outputs and reactions from the participants. Results from the two first workshops are at the time of writing in the process of being assessed for publication in the two most central journals in this area. The effect of the third workshop, more explorative in character, is more difficult to assess, but participants found this workshop particularly helpful. For instance a very senior participant expressed the view that this workshop was likely to have a lasting influence on the research agenda in this area.

In addition to this, participants have worked individually and in smaller groups on selected themes, and very important progress has been made. For example, a number of participants have worked on the history of innovation studies, its cross-disciplinary nature and conceptual issues, work that eventually will find its way to journals in this area. Another important output, started earlier but finalized during the stay at CAS, is the book edited by Fagerberg, Mowery and Verspagen on the working of the Norwegian innovation system ("Innovation, Path-Dependency and Policy", Oxford University Press, forthcoming). The stay has also led to several important contributions of the role of innovation in the global economy and initiated much needed new work on the subject involving scholars from different continents.

The one year constraint imposed on the projects is an unusual one. It has its charm but also represents a challenge. As is generally acknowledged, one year is normally too short a period for producing important new research results. Our advice would therefore be that the board of CAS considers ways to relax this constraint on the work. This could for instance involve inviting preparatory and follow-up work and provide funding for such activities. This might allow the groups to have a longer time horizon for their work (say three years) without necessarily demanding more office space.

#### **9.5 List of publications**

Research works written by our group members during their stay are listed below. The extent of each work conducted while at CAS varies, from being mostly done to only begun, revised or finished during the stay(s).

### 9.5.1 Papers or Books already published or accepted for publication

Chaminade, C. (2008) "Innovation in China" (with J. Vang), article written partly for the Nordic Institute of Asian Studies – NIAS, published in the Asia Portal, <http://www.asiaportal.info/infocusblog/?p=22>

Chaminade, C. (2009) *Handbook of Innovation systems and developing countries. Building domestic capabilities in a global setting*. (coedited with B.-Å. Lundvall, K.J. Joseph and J. Vang) Edward Elgar: Cheltenham, forthcoming, <http://www.edward-elgar.co.uk/>

Chaminade, C. (2009) "Regional innovation systems, globalization and developing countries: supporting capacity building at system level" (with R. Padilla and J. Vang) in C. Chaminade, B.-Å. Lundvall, K.J. Joseph and J. Vang (eds) *Handbook of Innovation systems and developing countries. Building domestic capabilities in a global setting*. Edward Elgar: Cheltenham, forthcoming, <http://www.edward-elgar.co.uk/>

Chaminade, C. "Regional innovation system and the global location of innovation activities" (with C. Yun Chung and J. Vang), *Industry and Innovation*, forthcoming, <http://www.gbhap.com/journals/titles/13662716.asp>

Clausen, T. (2008), Sources and Impacts of R&D and Innovation in the Norwegian *Innovation System: Firm, sectoral and policy perspectives*. PhD dissertation, University of Oslo, <http://ask.bibsys.no/ask/action/show?pid=080080898&kid=biblio>

Clausen, T. (2008) "Industrial R&D policy in Norway: Who gets the funding and what are the effects?" in J. Fagerberg, D.C. Mowery and B. Verspagen (eds) *Innovation, path dependency and policy: The Norwegian case*, Oxford University Press: Oxford, forthcoming, <http://www.oup.com/uk/catalogue/?ci=9780199551552>

Clausen, T. and B. Verspagen (2008) "Historical fingerprints? A taxonomy of Norwegian Innovation" (with F. Castellacci and S.E. Nås) in J. Fagerberg, D.C. Mowery and B. Verspagen (eds) *Innovation, path dependency and policy: The Norwegian case*, Oxford University Press: Oxford, forthcoming, <http://www.oup.com/uk/catalogue/?ci=9780199551552>

Cozzens, S.E. (2008) "It's About More Than Money" (with I. Feller), *Issues in Science and Technology*, June 2008, <http://www.issues.org/24.4/#>

Cozzens, S.E. "Innovation and inequality" (with R. Kaplinsky), in C. Chaminade, B.-Å. Lundvall, K.J. Joseph and J. Vang (eds) *Handbook of Innovation systems and developing countries. Building domestic capabilities in a global setting*. Edward Elgar: Cheltenham, forthcoming, <http://www.edward-elgar.co.uk/> (working paper version at <http://www.smartech.gatech.edu/dspace/handle/1853/23051>)

Fagerberg, J. and M. Srholec (2008) “National Innovation Systems, Capabilities and Economic Development”, *Research Policy*, forthcoming, <http://www.sciencedirect.com/science/journal/00487333> (working paper version at <http://ideas.repec.org/p/tik/inowpp/20071024.html>)

Fagerberg, J. and M. Srholec “Technology and development: Unpacking the relationship(s)” in C. Chaminade, B.-Å. Lundvall, K.J. Joseph and J. Vang (eds) *Handbook of Innovation systems and developing countries. Building domestic capabilities in a global setting*. Edward Elgar: Cheltenham, forthcoming, <http://www.edward-elgar.co.uk/> (working paper version at <http://ideas.repec.org/p/tik/inowpp/20080623.html>)

Fagerberg, J. and B. Verspagen “Innovation Studies – the emergence of a new scientific field”, *Industrial and Corporate Change*, forthcoming, <http://icc.oxfordjournals.org/> (working paper version at <http://ideas.repec.org/p/tik/inowpp/20080622.html>)

Fagerberg, J., D.C. Mowery and B. Verspagen (2008) (eds) *Innovation, path dependency and policy: The Norwegian case*, Oxford University Press: Oxford, forthcoming, <http://www.oup.com/uk/catalogue/?ci=9780199551552>

Fagerberg, J., D.C. Mowery and B. Verspagen (2008) “Innovation in Norway” in J. Fagerberg, D.C. Mowery and B. Verspagen (eds) *Innovation, path dependency and policy: The Norwegian case*, Oxford University Press: Oxford, forthcoming, <http://www.oup.com/uk/catalogue/?ci=9780199551552>

Gulbrandsen, M. (2008) “‘We really don’t want to move, but...’ Identity and strategy in the internationalization of industrial R&D” (with H. Godø), *Journal of Technology Transfer*, 33(4): 379-392, <http://www.springerlink.com/content/q1734v31v8347725/?p=134b292549734ea6ba188f91e3052ofe&pi=4>

Gulbrandsen, M. (2008) “Internationalisation of Industrial R&D” in Å. Gornitzka and L. Langfeldt (eds) *Borderless Knowledge: Understanding the “New” Internationalisation of Research and Higher Education in Norway*, Springer: New York, <http://www.springer.com/education/higher+education/book/978-1-4020-8282-5?detailsPage=toc>

Gulbrandsen, M. (2008) “Crossing the borders”, (with Å. Gornitzka and L. Langfeldt) in Å. Gornitzka and L. Langfeldt (eds) *Borderless Knowledge: Understanding the “New” Internationalisation of Research and Higher Education in Norway*, Springer: New York, <http://www.springer.com/education/higher+education/book/978-1-4020-8282-5?detailsPage=toc>

Gulbrandsen, M. (2008) “The relationship between a university and its technology transfer office: the case of NTNU in Norway”, *NIFU STEP anthology*, NIFU STEP: Oslo. (also under review at *International Journal for Technology Transfer and Commercialization*),

<http://www.nifustep.no/index.php/layout/set/print/content/download/29107/140417/file/NIFU%20STEP%20Rapport%20%204-2008.pdf#page=83>

Gulbrandsen, M. (2008), "Influences on the commercial success of academic patents" (with A. Klitkou and E. Iversen) in C.S. Krishna (ed.) *Academic Patents. Emerging Issues and Challenges*, Amicus Books/Icfai University Press: Hyderabad, pp. 16-47, [http://www.amicus.iupindia.org/Academic\\_cont.asp](http://www.amicus.iupindia.org/Academic_cont.asp).

Gulbrandsen, M. (2008) "Public R&D and industrial innovation in Norway - a historical perspective" (with L. Nerdrum) in J. Fagerberg, D.C. Mowery and B. Verspagen (eds) *Innovation, path dependency and policy: The Norwegian case*, Oxford University Press: Oxford, forthcoming, <http://www.oup.com/uk/catalogue/?ci=9780199551552>

Gulbrandsen, M. (2008) "University-industry relations in Norway" (with L. Nerdrum) in J. Fagerberg, D.C. Mowery and B. Verspagen (eds) *Innovation, path dependency and policy: The Norwegian case*, Oxford University Press: Oxford, forthcoming, <http://www.oup.com/uk/catalogue/?ci=9780199551552>

Gulbrandsen, M. (2008) "The technical-industrial research institutes in the Norwegian innovation system" (with L. Nerdrum) in J. Fagerberg, D.C. Mowery and B. Verspagen (eds) *Innovation, path dependency and policy: The Norwegian case*, Oxford University Press: Oxford, forthcoming, <http://www.oup.com/uk/catalogue/?ci=9780199551552>

Gulbrandsen, M. "Research institutes: key actors in innovation systems or obsolete remnants of the linear model?", in E. Moen and R. Whitley (eds) *Anthology*, Research Council of Norway: Oslo, forthcoming, (for information on the workshop where this was presented, see [http://ekstranett.innovasjon Norge.no/templates/Page\\_Meta\\_\\_\\_\\_\\_56932.aspx](http://ekstranett.innovasjon Norge.no/templates/Page_Meta_____56932.aspx))

Hoff, T. (2008) (eds) *Spaces of Mobility: The Planning, Ethics, Engineering and Religion of Human Motion* (with S. Bergmann & T. Sager), Equinox Publishing: London, <http://www.equinoxpub.com/books/showbook.asp?bkid=279>

Hoff, T. (2008) "Introduction" (with S. Bergmann and T. Sager) in S. Bergmann, T. Hoff and T. Sager (eds) *Spaces of Mobility: The Planning, Ethics, Engineering and Religion of Human Motion*, Equinox Publishers: London, <http://www.equinoxpub.com/books/showbook.asp?bkid=279>

Hoff, T. (2008) "The bodily basis of control in technically aided movement" (with K.I. Øvergård & C.A. Bjørkli) in S. Bergmann, T. Hoff and T. Sager (eds) *Spaces of Mobility: The Planning, Ethics, Engineering and Religion of Human Motion*, Equinox Publishers: London, <http://www.equinoxpub.com/books/showbook.asp?bkid=279>

Hoff, T. (2008) (eds) *Embodied Minds – Technical Environments: Conceptual Tools for Analysis, Design and Training* (with C.A. Bjørkli), Tapir Academic Press: Trondheim, <http://butikk.tapirforlag.no/en/node/1183>

Hoff, T. (2008) “Introduction” (with C.A. Bjørkli) in T. Hoff and C.A. Bjørkli (eds) *Embodied Minds – Technical Environments: Conceptual Tools for Analysis, Design and Training*, Tapir Academic Press: Trondheim, <http://butikk.tapirforlag.no/en/node/1183>

Hoff, T. (2008) “Ecological Interaction Properties” (with K.I. Øvergård) in T. Hoff and C.A. Bjørkli (eds) *Embodied Minds – Technical Environments: Conceptual Tools for Analysis, Design and Training*, Tapir Academic Press: Trondheim, <http://butikk.tapirforlag.no/en/node/1183>

Hoff, T. (2008) “On Representations of In-Vehicle Information Systems – Effects of Graphical (GUI) vs. Speech Based User Interfaces” (with C.A. Bjørkli, G. Jenssen, T.A. Øritsland & P. Ulleberg) in T. Hoff and C.A. Bjørkli (eds) *Embodied Minds – Technical Environments: Conceptual Tools for Analysis, Design and Training*, Tapir Academic Press: Trondheim, <http://butikk.tapirforlag.no/en/node/1183>

Hoff, T. (2008) “Theory and Practice of Ecological Interfaces: A Case Study of an In-Car Touch Based Audio System Design” (with H. Bjelland & C.A. Bjørkli) in T. Hoff and C.A. Bjørkli (eds) *Embodied Minds – Technical Environments: Conceptual Tools for Analysis, Design and Training*, Tapir Academic Press: Trondheim, <http://butikk.tapirforlag.no/en/node/1183>

Kasa, S. (2008) “The Group of 77 in the international climate negotiations: recent developments and future directions” (with G. Heggelund and A.T., Gullberg), *International Environmental Agreements: Politics, Law and Economics*, 8(2): 113-127, <http://www.springerlink.com/content/nopmr5ol43711456/>

Kasa, S. (2008) “Globalizing Unsustainable Food Consumption: Trade Policies, Producer Lobbies, Consumer Preferences, and Beef Consumption in Northeast Asia”, *Globalizations*, 5(2): 151-163, <http://www.informaworld.com/smpp/content-content=a793876077~db=all-jumptype=rss>

Kasa, S. “Politikk, forskning og norske familiereformer” in B.S. Tranøy (ed) *Norwegian welfare research*, Universitetsforlaget: Oslo, forthcoming, <http://www.universitetsforlaget.no/>

Kasa, S. “The performance of the Norwegian Carbon dioxide, Capture and Storage Innovation System; A functional approach” (with J. van Ruijwen, M. Hekkert & K. van Alphen), *Energy Policy*, forthcoming, [http://www.elsevier.com/wps/find/journaldescription.cws\\_home/30414/description](http://www.elsevier.com/wps/find/journaldescription.cws_home/30414/description) (working paper version at [http://www.uu.nl/content/Ruijven\\_Jochem\\_van\\_stageverslag.pdf](http://www.uu.nl/content/Ruijven_Jochem_van_stageverslag.pdf))

Metcalfe, J.S. (2008) "The Open, Evolving economy: Alfred Marshall on Knowledge, Management and Innovation" in J.L. Gaffard, (ed) *Knowledge and Evolution: Proceedings of the Schumpeter Conference 2004*. Springer: Heidelberg, <http://www.springer.com/?SGWID=5-102-0-0-0>

Metcalfe, J.S. (2009) "Technology in Economic Theory", *Cambridge Journal of Economics*, forthcoming, <http://cje.oxfordjournals.org/>

Metcalfe, J.S. (2009) Two chapters in *Restless Capitalism*, Princeton University Press: New Jersey, forthcoming, <http://press.princeton.edu/>

Metcalfe, J.S. and P. Nightingale (2008) "Technological paradigms: past, present and future" (with F. Malerba and N. von Tunzelmann), *Industrial and Corporate Change*, 17(3): 467-484, <http://icc.oxfordjournals.org/cgi/content/full/17/3/467>

Mowery, D.C. (2008) "Introduction: Running Faster to Keep Up" (with J. Macher), in D.C. Mowery and J. Macher (eds) *Running Faster to Keep Up: Globalization of R&D and U.S. Economic Welfare*, National Academies Press: Washington DC, <http://www.nap.edu/> (previous version at <http://www7.nationalacademies.org/step/Introduction%20of%20Industry%20Chapters.07.pdf>)

Mowery, D.C. (2008) "The "Non-Globalization" of Innovation in the Semiconductor Industry" (with A. DeMinin and J. Macher), in D.C. Mowery and J. Macher (eds) *Running Faster to Keep Up: Globalization of R&D and U.S. Economic Welfare*, National Academies Press: Washington DC, <http://www.nap.edu/> (working paper version at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1093277](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1093277))

Mowery, D.C. "Plus ca change: Industrial R&D in the "Third Industrial Revolution"", *Industrial and Corporate Change*, forthcoming, <http://icc.oxfordjournals.org/>

Mowery, D.C. "Measuring Dynamic Capabilities: Practices and Performance in Semiconductor Manufacturing" (with J. Macher), *British Journal of Management*, forthcoming, <http://www.ingentaconnect.com/content/bpl/bjom> (previous version at <http://faculty.msb.edu/jtm4/Papers/MM.BJM.2006.pdf>)

Nightingale, P. (2008) "Meta-paradigm change and the theory of the firm", *Industrial and Corporate Change*, 17(3): 533-583, <http://icc.oxfordjournals.org/cgi/content/full/17/3/533>

Verspagen, B. "The use of modeling tools for policy in evolutionary environments", *Technological Forecasting and Social Change*, forthcoming, [http://www.elsevier.com/wps/find/journaldescription.cws\\_home/505740/description#description](http://www.elsevier.com/wps/find/journaldescription.cws_home/505740/description#description) (previous version at <http://www.mnp.nl/bibliotheek/rapporten/550033001.pdf#page=19>)



### 9.5.2 Works in Progress

Chaminade, C. "Assessment of capabilities, abilities and resources of policy makers" (with S. Borrás and C. Edquist) in S. Borrás, C. Chaminade and C. Edquist, *Innovation Policy, Work in Progress*.

Chaminade, C. and K. Sappasert "Measuring systemic failures in a National Innovation System using innovation survey data" (with P. Intarakumnerd), Paper to be presented at the 6th GLOBELICS international conference, Mexico City, 22.-24. September 2008, [http://globelics\\_conference2008.xoc.uam.mx/abstracts.html](http://globelics_conference2008.xoc.uam.mx/abstracts.html)

Clausen, T. "Firm heterogeneity within industries: how important is 'industry' to innovation", *TIK Working papers on Innovation Studies* (submitted to *Research Policy*), <http://ideas.repec.org/p/tik/inowpp/20080410.html>

Clausen, T. "Search pathways to innovation", *TIK Working papers on Innovation Studies* (submitted to *Industrial and Corporate Change*), <http://ideas.repec.org/p/tik/inowpp/20080311.html>

Clausen, T. "Outlining the distinguishing characteristics of an evolutionary theory of innovation", Work in Progress (to be submitted to *Technological Forecasting and Social change*).

Clausen, T. "Using external knowledge in the R&D process", Work in Progress (submitted to *R&D Management*).

Clausen, T. "Input, output and behavioural additionality: Concepts and relationships" (with G. Alsos, E.L. Madsen and E. Ljungren), paper presented at the DRUID summer conference 2008 (to be submitted to *Research Policy*), <http://www2.druid.dk/conferences/viewabstract.php?id=3445&cf=29>

Clausen, T. and B. Verspagen "Formal and informal external linkages and firms' innovative strategies: A cross-country comparison" (with I. Freitas, R. Fontana), paper presented at the 12th ISS Conference in Rio de Janeiro, 2.-5. July 2008, <http://www.files.scire.coppe.ufrj.br/iss2008/773/f55.pdf>

Cozzens, S.E. "Good Jobs, Better Lives, and Innovation: Questions for Korea," in *Proceedings of 2007 STEPI international symposium*, [http://www.stepi.re.kr/eng/board/FileDown.asp?BD\\_NO=925&FILE\\_NO=1](http://www.stepi.re.kr/eng/board/FileDown.asp?BD_NO=925&FILE_NO=1)

Edquist, C. "Identification of Policy Problems in Systems of Innovation through Diagnostic Analysis", paper to be presented at the Prime International Conference, Mexico City, 24.-26. September 2008, [http://prime\\_mexico2008.xoc.uam.mx/abstracts.html](http://prime_mexico2008.xoc.uam.mx/abstracts.html)

Feldman, M. "The Quest for Better Relevance: building a better innovation team" (with J. Bercovitz), paper presented at the 2nd CAS 'understanding innovation' workshop on the changing role of public sector research in innovation, Oslo, 26.-28. March 2008, [http://www.cas.uio.no/research/0708innovation/workshop\\_Lysebu.php](http://www.cas.uio.no/research/0708innovation/workshop_Lysebu.php)

Feldman, M. "Organizational Legacy and Firm Performance" (with T. Reichstein and F. Valentin), paper presented at the DRUID summer conference 2008, <http://www2.druid.dk/conferences/viewabstract.php?id=1689&cf=9>

Feldman, M. "Under the Lens: Optical Science and Industrial Clusters in the U.S." (with I. Lendel), paper submitted to *Economic Geography*.

Gulbrandsen, M. "Immiseration of university professors in Norway?", paper presented at the 29th annual EAIR forum, Austria, 26.-29. August 2007 (to be submitted to *Higher Education*), <http://www.eair.nl/innsbruck/results1.asp?achternaam=Gulbrandsen&wat=achternaam>

Gulbrandsen, M. "Academic patenting and university research in Norway" (with A. Klitkou), paper presented at the SPRU 40th anniversary conference on the future of science, technology and innovation policy, UK, 11.-13. September 2006 (submitted to *Scientometrics*), <http://www.sussex.ac.uk/Units/spru/events/ocs/viewabstract.php?id=87>

Gulbrandsen, M. "The role of public support programs for entrepreneurship: A principal-agent perspective" (with E. Rasmussen), Work in Progress (to be presented at the annual RENT meeting, Portugal, November 2008), [http://www.eiasm.org/frontoffice/event\\_announcement.asp?event\\_id=587](http://www.eiasm.org/frontoffice/event_announcement.asp?event_id=587)

Gulbrandsen, M. "Explaining board formation and evolution of board composition in academic spin-outs" (with E. Bjørnåli), paper presented at the dynamics of science-based entrepreneurship workshop, Italy, 31. March-2. April 2008 (submitted to *Journal of Technology Transfer*), <http://www.prime-noe.org/Local/prime/dir/News/Prime%20Agenda/Sestri%20Levante%20conference/THE%20DYNAMICS%20OF%20SCIENCE-BASED%20ENTREPRENEURSHIP%20-%20Final%20program.pdf>

Gulbrandsen, M. "Research institutes and university-industry relations", paper presented at the 2nd CAS 'understanding innovation' workshop on the changing role of public sector research in innovation, Oslo, 26.-28. March 2008, [http://www.cas.uio.no/research/0708innovation/workshop\\_Lysebu.php](http://www.cas.uio.no/research/0708innovation/workshop_Lysebu.php)

Gulbrandsen, M. *The Precarious University* (with B. Stensaker), Work in Progress, possibly on Open University Press. <http://mcgraw-hill.co.uk/openup/>

Gulbrandsen, M. “Intellectual property rights” in M. Gulbrandsen, R. Søgne, E. Kallerud and L. Langfeldt (eds) *Textbook on Research Policy* (to be submitted to Tapir: Trondheim), <http://butikk.tapirforlag.no>

Gulbrandsen, M. “Excellence in research policy” in M. Gulbrandsen, R. Søgne, E. Kallerud and L. Langfeldt (eds) *Textbook on Research Policy* (to be submitted to Tapir: Trondheim), <http://butikk.tapirforlag.no>

Gulbrandsen, M. “The role of social science in organisational innovation”, Work in Progress.

Gulbrandsen, M. “Are the concepts basic research, applied research and experimental development still useful? An empirical investigation among university scientists” (with S. Kyvik), submitted to *Research Evaluation*, <http://www.ingentaconnect.com/content/beechn/rev>

Hall, B.H. “Which firms participate in open source software development? A study using data from Debian” (with R. Ghosh and K. Haaland), paper presented at the DRUID summer conference 2008, <http://www.dime-eu.org/files/active/o/WP73-IPR.pdf>

Hall, B.H. “Innovation and Productivity in SMEs: Empirical Evidence for Italy” (with F. Lotti and J. Mairesse), to be presented at the workshop on drivers and impacts of corporate R&D in SMEs, Seville, September 2008, [http://elsa.berkeley.edu/~bhhall/papers/HallLottiMairesse07\\_w13296.pdf](http://elsa.berkeley.edu/~bhhall/papers/HallLottiMairesse07_w13296.pdf)

Hall, B.H. “Do R&D Tax Credits Increase Innovation? Panel Evidence from US Firms” (with N. Bloom, C. Criscuolo and J. Van Reenen), presented at the International Conference on Knowledge for Growth, Toulouse, 7.-9. July 2008, [http://www.knowledge-conference-france2008.eu/index.php?option=com\\_program&Itemid=14](http://www.knowledge-conference-france2008.eu/index.php?option=com_program&Itemid=14)

Hoff, T. “Models and Control Strategies Used by Experienced Marine Navigators” (with K.I. Øvergård and C.A. Bjørkli), paper submitted to *Cognition, Technology, and Work*.

Kasa, S. and A. Underthun “Building inclusive innovation policies in exclusive space: A Norwegian case study”, to be resubmitted to *Environment and Planning A*, [http://www.cicero.uio.no/publications/detail.aspx?publication\\_id=5876&lang=EN](http://www.cicero.uio.no/publications/detail.aspx?publication_id=5876&lang=EN)

Kasa, S. and A. Underthun “The Politics of Natural Gas in Norway: Responses of Networked Governance and Metagovernance” (with M. Reitan), paper presented at the National Conference in Political Scienceeko, Tromsø, 28-30 April 2008 (submitted to *Scandinavian Political Studies*).

Kasa, S. and A. Underthun “Socio-political foundations of national innovation strategies: The case of natural gas based strategies in Norway”, paper presented at the Performing Regions/Regional Performance: Regions and Regionalism in and beyond Europe Conference, Institute for Advanced Studies, Lancaster University, 17.-19. September 2007, <http://www.lancs.ac.uk/ias/annualprogramme/regionalism/Conference%20Booklet%20for%20website.pdf>

Martin, B.R. “The Evolution of Science Policy and Innovation Studies”, TIK Working Paper on Innovation Studies, <http://ideas.repec.org/p/tik/inowpp/20080828.html>

Martin, B.R. “Research Misconduct – Does Self-Policing Work?”, Work in Progress (for a planned journal special issue on the growing problem of plagiarism among academics), [http://www.sussex.ac.uk/spru/documents/martin\\_bio\\_abstract.doc](http://www.sussex.ac.uk/spru/documents/martin_bio_abstract.doc)

Martin, B.R. “U-I Relations in Longer-Term Historical Perspective – What’s New? Is It Threatening?”, paper presented at the 2nd CAS ‘understanding innovation’ workshop on the changing role of public sector research in innovation, Oslo, 26-28 March 2008, [http://www.cas.uio.no/research/0708innovation/workshop\\_Lysebu.php](http://www.cas.uio.no/research/0708innovation/workshop_Lysebu.php)

Metcalf, J.S. “University and Business Relations: Challenges and Prospects”, Working paper, Manchester Institute of Innovation Research, <http://www.mbs.ac.uk/research/workingpapers/index.aspx?AuthorId=2651>

Mowery, D.C. “Pioneering Inventors or Thicket-Builders: Which U.S. firms Use Continuations in Patenting?” (with D. Hegde and S.J.H. Graham), submitted to *Management Science*, <http://faculty.haas.berkeley.edu/hegde/Pioneers%20or%20thickets%20HMG%20112007.pdf>

Mowery, D.C. “The Geographic Reach of Market and Nonmarket Channels of University Research Commercialization” (with A. Ziedonis), paper presented at the Conference on Corporate Strategy, Fuqua School of Business, Duke University, 4-5 April, 2008, [http://faculty.fuqua.duke.edu/areas/strategy/Conference2008/Papers/S3\\_ZiedonisMowery.pdf](http://faculty.fuqua.duke.edu/areas/strategy/Conference2008/Papers/S3_ZiedonisMowery.pdf)

Sapprasert, K. “On Factors explaining Organizational Innovation and its Effects”, TIK Working Paper on Innovation Studies (submitted to *Industrial and Corporate Change*), <http://ideas.repec.org/p/tik/inowpp/20080601.html>

Sapprasert, K. “Innovation in Services: Assessing the Impact of ICT on the Growth of Service Firms”, TIK Working Paper on Innovation Studies (to be submitted to *Structural Change and Economic Dynamics*), <http://ideas.repec.org/p/tik/inowpp/20070531.html>

Sapprasert, K. *I-volution* (coauthored with Pun-Arj Chairatana and Patarapong Intarakumnerd), Work in Progress (to be submitted to Matichon: Bangkok), <http://www.matichonbook.com/index.php?mnuid=1&selmnu=0703>

Sapprasert, K. "The legal obstacles to process innovation in the maritime industry: the case of electronic bills of lading" (with I. Kamlang), Work in Progress (to be submitted to *TIK Working papers on Innovation Studies*), <http://ideas.repec.org/s/tik/inowpp.html>

Srholec, M. "A Multilevel Approach to Geography of Innovation", TIK Working Paper on Innovation Studies (submitted to *Regional Studies*), <http://econpapers.repec.org/paper/tikinowpp/20071010.htm>

Srholec, M. "A Multilevel Analysis of Innovation in Developing Countries", UNU-MERIT Working Paper No. 40/2008 (submitted to *Industrial and Corporate Change*), <http://econpapers.repec.org/paper/dgrunumer/2008040.htm>

Srholec, M. and B. Verspagen "The Voyage of the Beagle in Innovation Systems Land. Explorations on Sectors, Innovation, Heterogeneity and Selection", UNU-MERIT Working Paper No. 8/2008 (submitted to *Industrial and Corporate Change*), <http://econpapers.repec.org/paper/dgrunumer/2008008.htm>

## 10. Nature-inspired Chemical Process Design

Report by Signe Kjelstrup  
Group leader 2007/2008  
September 15, 2008

### 10.1 General description

Nature-inspired chemical process design means that knowledge gained from studies of nature is transported or converted into designs of chemical process units. The year at the Centre of Advanced study was thus devoted to both issues.

As a natural process of energy conversion, we chose to study the structure and function of the Ca-ATPase from sarcoplasmic reticulum. This is an ion pump in nature, which runs on chemical energy, and converts this to osmotic energy. The man-made power producing unit of interest, was the polymer electrolyte fuel cell. This cell burns fuel in oxygen to create electrical energy. The human lung was studied as an efficient natural flow system for oxygen.

Both systems were studied from a molecular as well as an overall performance level. Common to both problems is the issue of energy conversion, and in particular the dissipation (loss) of energy in the process. Biological systems perform often rather efficiently, and we wanted to know why and how this is so in our examples. On the other hand, we also set out to use information on dissipated energy, to help increase the efficiency of the fuel cell.

The biological pump was studied from three perspectives. Colleagues in quantum mechanics studied the structure at the binding sites. The people doing molecular dynamics simulation studied transport of heat and ions. The different parts were tied together by a non-equilibrium thermodynamic theory, investigated by yet some other members. Likewise, we studied molecular processes in the fuel cell, in particular the gas access to the electrodes. A main effort went in to optimize the structure of the catalyst layer in the cell. All subgroups devoted time to method developments.

The efforts during the year led to the following breakthroughs:

- New methods in quantum mechanics were developed, which can improve the famous density functional theory, now in use.
- A new formulation of active transport was developed, that include an explanation of thermogenesis.
- First evidence was found for water polarization in a temperature gradient.
- A first model of the breathing of the reindeer was set up.
- The performance of the human lung was understood in terms of its structure and energy dissipation.
- A solution was found for the structure of the optimal catalyst in the fuel cell.
- A relation was proven between the heat of transfer and the enthalpy.

In addition, several other interesting new findings are now being reported, making us very happy with the stay. During the year, we also celebrated that:

- Fernando Bresme was awarded the McBain Medal in Colloid and Interface Science, Royal Society of Chemistry/SCI.
- The work of Bresme F., Lervik A., Bedeaux D. and Kjelstrup S. in *Phys. Rev. Lett.*, 101, 020602 (2008), was selected to appear in the July 15, 2008 issue of *Virtual Journal of Biological Physics Research*. It also featured in the *American Physical Society* at <http://physics.aps.org/synopsis-for/10.1103/PhysRevLett.101.020602>.
- The work of I. G. Cuesta, J. Sánchez Marín, T. B. Pedersen, H. Koch, and A. Sánchez de Merás, in *Phys. Chem. Chem. Phys.* 10 (2008) 361, was chosen as Cover Article of issue 3, 21 January 2008.

## 10.2 Participants and research activities

The following researchers were involved in the project:

Professor Signe Kjelstrup, NTNU

Professor Henrik Koch, NTNU

Professor Ilse Dick Bedeaux, NTNU

Ass. prof. Jean-Marc Simon, University of Bourgogne

Professor Marc-Olivier Coppens, Rensselaer Polytechnic Institute

Ass. prof. Daniel Barragan, University of Colombia

Professor Peter Pfeifer, University of Missouri

Professor Miguel Rubi, University of Barcelona

Ass. prof. Alfredo Sanchez de Meras, University of Valencia

Dr. Inmaculada Garcia Cuesta, University of Valencia

Ass. prof. John Pharoah, Queens University

Dr. Stefan Gheorghiu, Institute of Complex Studies

Ass. prof. Fernando Bresme, Imperial College

PhD student Linus Boman, NTNU

**Signe Kjelstrup** (group leader) stayed at CAS the entire year, except 4 weeks in January, 1 in April and 2 in June. In collaboration with other team members she organised the team's activities, including two upstart meetings, one excursion, and two group contributions to international conferences. She is co-author of 13 of the publications.

**Henrik Koch** was at CAS interrupted by research visits to Valencia, Tokyo and Nagoya. In collaboration with Linus Boman and Alfredo Sanchez de Meras new low scaling algorithms were developed aiming at large biological systems. An ab initio study of model systems for the calcium pump was carried out in collaboration with Yuji Sugita, Inmaculada Garcia Cuesta and Alfredo Sanchez de Meras. He is co-author of 3 of the publications.

**Dick Bedeaux** was at CAS the entire year, except 4 weeks in January, 1 in April and 3 in June. In collaboration with Signe Kjelstrup, Leopoldo de Meis and Jean-Marc Simon a first law analysis of the Ca-ATPase pump was given. Together with Signe Kjelstrup the work was extended to a second law analysis. He is co-author of 14 of the publications.

**Jean-Marc Simon** was at CAS the entire year, except 2 weeks in May in Tokyo in the group of Yuji Sugita at Riken institute, one week in August for the conference Diffusion Fundamentals II in L'Aquila (Italy), and one week in September for the conference Thermodynamics-2007 in Paris. He was involved in the biological project (transport of calcium), in the fuel cell project (adsorption and diffusion of H<sub>2</sub> on graphite) and in the method development in non-equilibrium thermodynamics. He is co-author of 4 of the publications.

**Marc-Olivier Coppens** was at CAS from 1 February 2008 on, with a few interruptions for work at Rensselaer and at Delft, an appendicitis operation in the Netherlands, and conferences in Italy and Mexico. He was involved in conceiving, optimizing and designing a new nature-inspired fuel cell, as well as in discussions on diffusion, and initiated a project based on the design of novel energy-efficient processes inspired by arctic animals, in particular the Svalbard reindeer. He is author or co-author of 19 of the publications.

**Daniel Barragan** was at CAS for 3 months and was involved in the study of dynamics of active transport of calcium ions between cytosol and endoplasmic/sarcoplasmic reticulum (ER) via SERCA-pumps. The main hypothesis is concerned with the presence of a instability associated to pumping of ions. This instability should justify variations of concentrations and temperature of the entire system in time. Applying the formalism of irreversible thermodynamics developed by Kjelstrup and Bedeaux, we want to understand the relevance of instabilities in the performance of the system. He is co-author of 6 of the publications.

**Peter Pfeifer** stayed at CAS for 2 months, engaging actively in work on the performance of the lung in terms of its entropy production, and on the optimal catalyst layer of the fuel cell. Pfeifer also participated in discussions on the role of hydrogen. One visit was made to Washington for the DOE Hydrogen program review. Several papers are planned.

**Miguel Rubi** was at CAS for 3 weeks distributed in three different periods. During his stay he was involved in the formulation of a non-equilibrium thermodynamics theory to study small systems outside equilibrium such as molecular motors and pumps, nano-clusters and nano-structures in general. He is co-author of 7 of the publications.

**Alfredo Sanches de Meras** was at CAS for 6 weeks and was involved in developing subsystem algorithms for large systems and reduced scaling algorithms. On the application side the main focus was model systems of the calcium pump. He is co-author of 7 of the publications.

**Inmaculada Garcia Cuesta** was at CAS for 3 weeks and was involved in developing subsystem algorithms for large systems and reduced scaling algorithms. On the application side the main focus was model systems of the calcium pump. She is co-author of 3 of the publications.

**John Pharoah** was at CAS during May and June with exception of attending the World Hydrogen Energy conference in Australia in June. He was involved in conceiving novel fuel cell designs taking inspiration from nature as well as in understanding how a reindeer nose achieves moisture and heat exchange. Through interactions with Arnoldus Blix from the University of Tromsø he developed an effective and efficient mathematical



model of a simplified reindeer nose system. He is co-author of 4 of the publications.

**Stefan Gheorghiu** visited CAS for 5 weeks in May and June 2008, working on transport in biological structures, with an emphasis on heat and gas exchange in realistic models of mammalian lungs. While at CAS, he performed a complete calculation of the entropy production in ramified gas-exchange units, which produced some unexpected insight into the advantages of a natural architecture for such processes. The purpose of the study was the development of quantitative tools for the design of a nature-inspired hydrogen fuel cell.

**Fernando Bresme** had several short visits to CAS over the year. Bresme and Lervik studied heat transfer in the Ca-ATPase and structural aspects of water at equilibrium and non equilibrium conditions. The first evidence for water polarization under a thermal gradient was found. A new non-equilibrium molecular dynamic procedure was made to compute the thermal diffusivity of biological motors. This work is part of Mr Lervik's MSc Thesis 'Energy dissipation in biomolecular motors'. Bresme is co-author of 6 of the publications.

**Linus Boman** stayed at CAS during the spring semester (except on Thursdays due to teaching obligations). Developed electronic structure methods for accurate calculations applicable to relatively large systems such as an alpha-helix glycine structure. Submitted three publications still under review. All work is included in his Ph.D. thesis delivered June 2008.

### 10.3 Symposia, conferences

- We arranged two one-day symposia to start each semester topic.
- We participated in CTT at the University of Oslo.
- We arranged a book launching ceremony. S. Kjelstrup and D. Bedeaux, Non-equilibrium thermodynamics of heterogeneous systems, Series on Advances in Statistical Mechanics, Vol.16, World Scientific, 2008.
- Part of our group participated in the 12th International ATPase Conference, Aarhus (August 2008).

### 10.4 Excursion

Part of the group travelled to Tromsø and Svalbard. We were very welcomed July 1 at Avdeling for arktisk biologi by Lars Folkow and Arnoldus Schytte Blix. We saw the premises and discussed a first note on the reindeer nose heat and mass exchanger set up by Jon Pharoah, before leaving for Svalbard.

Our boat was Viking Explorer, 50 feet long, and well installed with a laboratory and dining room for 6. We started on a long journey along Forlandet. It was around midnight when we finally anchored at the Glacier of July 14th. To wake up with the sun shining on the glacier was a glorious experience. In the morning mood with ice bergs floating around the boat and the fog lifting, we cruised around the bay in the Zodiac, watching first a bearded seal on an ice flake, then eight grassing reindeer under the birds nesting, and bird colonies on the ice. The glacier was calving, leading to interesting wave patterns. Around 3 o'clock we started on our route to Kongsfjord and the sun was shining. The

ocean was like a mirror, but no whales to see. The mountains Three Crowns appeared, and the Blomstrand glacier was welcoming us for dinner and night in the Blomstrand bay. We started with a cruise in front of Kings glacier. The calves of the glacier were enormous pieces of ice, indicating a large activity.

Ny Aalesund was a surprising experience. Prof. II UNIS, Geir Gabrielsen, Polar Research Institute, was interested in hearing about our models for energy budgets in animals. There are so many nations here doing research. India for instance, which one would not expect to be here in the outset, and Korea both have large facilities, as well as Japan, Netherlands and others. At the Dutch house we had the most amazing sight. An arctic fox with 7 puppies was hunting geese chickens from under the house. We watched the puppies play and eat for an hour before the mother went off hunting again. The geese raise their young ones together. The terns nesting in the village were also aggressively protecting their young ones, scaring us away from walking on the road. Contrary to the stationary persons, we preferred to party outside in the late sun. Returning to the boat around 01.30, we decided to have drink with our recently picked 10 000 year old ice from the glacier.

### **10.5 Achievements and evaluation**

The invitation to CAS gave a unique opportunity to invite collaborators and make a concentrated efforts for a new line of research.

The efforts were rewarding. It is easy to see that the group and its members will benefit in various ways.

The list of breakthroughs and awards already mentioned, speaks for itself.

Collaborative efforts will certainly be kept up, to pursue the problems that we started to study at CAS. These are of course not solved in one year. Many new questions arise and can benefit from improved methods which are now available.

Partners will also group for new endeavours. For instance, there are now applications for funding to EU, to allow Spanish co-workers come to NTNU. We have applied to the Research Council of Norway for funding to look at energy efficiency in arctic animals, as well as in industrial processes. Collaborators in US, Canada and Great Britain have strongly supported this application.

We have in this year made the foundation for future work and also established new connections that could turn into very fruitful collaborations in the future.

### **10.6 Publications in refereed journals and proceedings published, accepted for publication and submitted**

Akhavan, A., J. R. van Ommen, J. Nijenhuis, X. S. Wang, M.-O. Coppens and M. Rhodes, Improved drying in a pulsation-assisted fluidized bed. *Ind. Engng. Chem. Res.* Accepted. Special issue in honor of Prof. L.S. Fan, 2009.

Aquilante, F., T. B. Pedersen, R. Lindh, B. Olof Roos, A. Sánchez de Merás and H. Koch, Accurate *ab initio* density fitting for multiconfigurational self-consistent field methods J. Chem. Phys. 129 (2008) 024113.

Arias, J.M., Barragán, D., Physical adsorption on solids: Thermodynamic aspects. Submitted.

Atiyeh, H., K. Karan, B. A. Peppley, A. Phoenix, E. Halliop and J. G. Pharoah, Experimental investigation of the influence of microporous layer on water transport and performance of PEM fuel cells, Journal of Power Sources, 170(1), pp 111-121, 2007.

Barragán, D., Entropy production and Newton's cooling law. Submitted.

Barragán, D., Strategies for making a competency-based teaching of physical chemistry. Submitted.

Bedeaux, D. and S. Kjelstrup, The measurable heat flux that accompanies active transport by Ca-ATPase, Phys. Chem. Chem. Phys. Accepted.

Boman, L. and H. Koch, Coupled cluster response functions in parameter subspaces, Int. J. Quantum Chem. Submitted.

Boman, L., H. Koch and A. Sanchez de Meras, Method specific Cholesky decomposition: Coulomb and exchange energies. J. Chem. Phys. Submitted.

Boman, L. and H. Koch, Hybrid electronic structure methods. J. Chem. Phys. Submitted.

Boman, L., Cholesky decomposition based methods in electronic structure theory. Ph.D. thesis.

Bresme, F. and Wynveen, A.,  
On the Influence of solute polarizability on the hydrophobic interaction. J. Chem. Phys., 126, 044501 (2007).

Bresme, F., Computer simulations and thermodynamics of anisotropic nanoparticles at fluid interfaces. European Physics Journal B DOI: 10.1140/epjb/e2008-00032-2 (2008).

Bresme, F., Lervik, A., Bedeaux, D. and Kjelstrup, S., Water polarization under thermal gradients. Phys. Rev. Lett., 101, 020602 (2008).

Bresme, F., Chacon, E., Tarazona, P. and Tay, K., The intrinsic structure of hydrophobic interfaces: the oil-water interface. Phys. Rev. Lett., 101, 056102 (2008).

Bresme, F., Chacon, E. and Tarazona, P., Molecular Dynamics investigation of the intrinsic structure of water-fluid interfaces via the Intrinsic Sampling Method. Phys. Chem. Chem. Phys., DOI: 10.1039/b807437m (2008).

Bresme, F. and Wynveen, A., Interactions of polarizable media in water and the hydrophobic interaction, In: G. Franzese and M. Rubi, editor, Aspects of Physical Biology: Biological water, protein solutions, transport and replication, Berlin Heidelberg, Springer, 2008, Pages: 43 – 62.

Burada, P. S., Schmid, G., Talkner, P., Hänggi and J. M. Rubi, Entropic particle transport in periodic channels, *Biosystems*, 93 (2008) 16-22.

Chassagne, C. and D. Bedeaux, The electrokinetic response of a colloidal spheroid. *J. of Colloid and Interf. Science* accepted.

Christensen, D., J. Nijenhuis, J. R. van Ommen and M.-O. Coppens, Residence times in fluidized beds with secondary gas injection. *Powder Techn.* 180, 321-331 (2008).

Christensen, D., D. Vervloet, J. Nijenhuis, B. G. M. van Wachem, J. R. van Ommen and M.-O. Coppens, Insights in distributed secondary gas injection in a bubbling fluidized bed via discrete particle simulations. *Powder Techn.* 183, 454-466 (2008). (Special issue in honor of Prof. R. Pfeffer)

Christensen, D., J. Nijenhuis, J. R. van Ommen and M.-O. Coppens, The influence of distributed secondary gas injection on the performance of a bubbling fluidized bed reactor. *Ind. Engng Chem. Res.* 47, 3601-3618 (2008). (Special issue in honor of Prof. E.B. Nauman)

Coppens, M.-O. and G. Wang, Optimal design of hierarchically structured porous catalysts. Invited book chapter for *Design of Heterogeneous Catalysts* (U. Ozkan, ed.), Wiley, NY, 2008. In press.

Coppens, M.-O., Multi-scale nature inspired chemical engineering. Invited book chapter for *Bridging scales in Science and Engineering* (J. Fish, ed.), Oxford University Press, Oxford, UK, 2008. In press.

Cortés, F., Suárez, M. F. and Barragán, D., Conductimetric and Amperometric study of the Bromate-Phenol-Sulfuric Acid. *Oscillating Reaction*. Submitted.

Cuesta, I. G., J. Sánchez Marín, T. B. Pedersen, H. Koch, and A. Sánchez de Merás, Variation of polarizability in the  $[4n + 2]$  annulene series: from  $[22]$ - to  $[66]$ -annulene. *Phys. Chem. Chem. Phys.* 10 (2008) 361. Cover Article of issue 3, 21 January 2008.

Cuesta, I. G., A. M. Sánchez de Merás, S. Pelloni and P. Lazzeretti, Understanding the Ring Current Effects on magnetic shielding of hydrogen and carbon nuclei in naphthalene and anthracene. *J. Comput. Chem.* (2008). In press.

Denkova, A. G., E. Mendes and M.-O. Coppens, Effects of salts and ethanol on the population and morphology of triblock copolymer micelles in solution. *J. Phys. Chem. B* 112(3), 793-801 (2008).

Denkova, A. G., E. Mendes and M.-O. Coppens, Kinetics and mechanism of sphere-to-rod transition of tri-block copolymer micelles in aqueous solutions. Submitted for publication, 2008.

Glavatskiy, K. S. and D. Bedeaux, Non-equilibrium properties of a two-dimensional isotropic interface in a two-phase mixture as described by the square gradient model Phys. Rev. E 77 (2008) 061101.

Haas, O. E., S. Kjelstrup, A. L. Ramstad, J. M. Simon and P. Fouquet, A quasi-elastic neutron scattering investigation of the hydrogen surface self diffusion on polymer electrolyte membrane fuel cell catalyst support. J. Phys. Chem. C, 112 (2008) 3121-3125.

Harvey, D. A., J. G. Pharoah and K. Karan, Comparison of Approaches to Modelling the PEMFC Catalyst Layer, Journal of Power Sources, 179, pp 209-219, 2008.

Hijkoop van, V. J., A. J. Dammers, K. Malek and M.-O. Coppens, Water diffusion through a membrane protein channel: a first passage time approach. J. Chem. Phys. 127(8), 085101. 2007.

Inzoli, I., J. M. Simon, S. Kjelstrup and D. Bedeaux, Thermal diffusion and partial molar enthalpy variations of n-butane in silicalite-1, J. Phys. Chem. B. Accepted.

Johannessen, E., J. Gross and D. Bedeaux, Non-equilibrium thermodynamics of interfaces using classical density functional theory. J. Chem. Phys. Accepted.

Karan, K., H. Atiyeh, A. Phoenix, E. Halliop, J. G. Pharoah and B. A. Peppley, An Experimental Investigation of Water Transport in PEMFCs: The Role of Microporous Layers, Electrochemical and Solid-State Letters, 10(2), pp. B34-B38, 2007.

Kjelstrup, S., J. M. Rubi and D. Bedeaux, A thermodynamic description of active transport, in Aspects of Physical Biology: Biological Water, Protein Solutions, Transport and Replication. G. Franzese and M. Rubi eds., Springer Lect. Notes Phys. 752, 2008, pp. 155-173.

Kjelstrup, S. and D. Bedeaux, Non-equilibrium thermodynamics of heterogeneous systems, Series on Advances in Statistical Mechanics, Vol.16, World Scientific, 2008.

Kjelstrup, S., L. de Meis, D. Bedeaux and J. M. Simon, Is the  $\text{Ca}^{2+}$ -ATPase from sarcoplasmic reticulum also a heat pump? European Biophysics Journal. Accepted.

Kjelstrup, S., D. Bedeaux, I. Inzoli and J. M. Simon, Criteria for validity of thermodynamic equations from non-equilibrium molecular dynamics simulations, Energy, 33 (2008) 1185-1196.

Kjelstrup, S. and D. Bedeaux, Transport coefficients for heat and ion transport in  $\text{Ca}^{2+}$ -ATPase isoforms, Biophys. J. Submitted.

Kjelstrup, S. and D. Bedeaux, Heat and mass transfer across phase boundaries: Estimates of coupling coefficients, *Atti dell' Accademia Peloritana dei Pericolanti Classe di Scienza, Matematiche e Naturale*, Messina, Italy, Vol LXXV, CIS0701013 (2007) - Suppl. I.

Lervik, A., Energy dissipation in biomolecular motors, M.Sc. Thesis, NTNU Trondheim, Norway.

López Cacheiro, J., T. B. Pedersen, B. Fernández, A. Sánchez de Merás, and H. Koch, The CCSD(T) model with Cholesky decomposition of orbital energy denominators. *J. Chem. Phys.* Submitted.

Malek, K. and M.-O. Coppens, Molecular simulations of solute transport in xylose isomerase crystals. *J. Phys. Chem. B* 112(5), 1549-1554 (2008).

Naumov, S., R. Valiullin, J. Kärger, R. Pitchumani and M.-O. Coppens, Tracing pore connectivity and architecture in nanostructured silica SBA-15. *Microp. Mesop. Mat.* 110, 37-40 (2008).

Paternina, E. J. and Barragán, D., Kinetic study of the catalyzed decomposition of hydrogen peroxide on activated carbón. Accepted in *Química Nova*.

Perez-Madrid, A., Rubi, J. M. and Lapas, L. C., Heat transfer between nanoparticles: Thermal conductance for near-field interactions, *Phys. Rev B*, 77 (2008) 155417.

Pérez Mondéjar, V., I. G. Cuesta, P. Lazzeretti, J. Sánchez-Marín and A. Sánchez de Merás, Electronic Structure of the Ground and Excited States of b-Carboline *Chem. Phys. Chem.* 9 (2008) 896.

Pharoah, J. G., K. Karan and D. Harvey, Effective Transport Properties of Fuel Cell Catalyst Layers', 2nd European Fuel Cell Technology and Applications, Rome, Italy, 2007.

Pitarch-Ruiz, J., A. Sánchez de Merás, J. Sánchez-Marín, A. M. Velasco, C. Lavín, and I. Martín, Low-Lying Rydberg States of HCl *J. Phys. Chem. A* 112 (2008) 3275.

Pitchumani, R., A. Schmidt-Ott and M.-O. Coppens, Statistics-aided optimal design of the continuous aerosol-based synthesis of nanostructured silica supports. *J. Nanoscience and Nanotechnology*, 2008 (special issue, invited). In press.

Pitchumani, R., A. Schmidt-Ott and M.-O. Coppens, Continuous synthesis by spray drying of remarkably stable mesoporous silica and aluminosilica catalysts, using industrial raw materials. *Microp. Mesop. Mater.*, 2008. In press.

Rubi, J. M., M. Nasprea, S. Kjelstrup and D. Bedeaux, Energy Transduction in Biological Systems: A Mesoscopic Non-Equilibrium Thermodynamics Perspective, *J. Non-Equilib. Thermodyn.* 32 (2007) 351-378.

Simon, J. M., I. Inzoli, D. Bedeaux and S. Kjelstrup, Numerical evidence for a thermal driving force during adsorption of butane in silicalite, *Mol. Sim.*, 33 (2007) 839-841.

- Vainstein, M. H., Rubi, J. M. and Vilar, J. M. G., Stochastic population dynamics in turbulent fields *European Physical Journal*, 146 (2007) 177-187.
- VanDoormaal, M. A. and J. G. Pharoah, Determination of Permeability in Fibrous Porous Media using the Lattice Boltzmann Method with Application to PEM Fuel Cells, *International Journal for Numerical Methods in Fluids*, 2008. Accepted.
- Vilar, J. M. G. and Rubi, J. M., Failure of the work-Hamiltonian connection for free-energy calculations, *Phys. Rev. Lett.* 100 (2008) 020601.
- Villanueva, J. and Barragán, D., Thermodynamic dissipation in a nonlinear chemical system. Submitted.
- Volpe, G., Perrone, S., Rubi, J. M. and Petrov, D., Stochastic resonant damping in a noisy monostable system: Theory and experiment, *Phys. Rev E*, 77 (2008) 051107.
- Wang, J., J. C. Groen, W. Yue, W. Zhou and M.-O. Coppens, Facile synthesis of ZSM-5 composites with hierarchical porosity. *Mater. Chem.* 18, 468-474 (2008).
- Wang, G. and M.-O. Coppens, Calculation of the optimal macropore size in nanoporous catalysts and its application to DeNO<sub>x</sub> catalysis. *Ind. Engng Chem. Res.* 47, 3847-3855 (2008).
- Wang, G., C. R. Kleijn and M.-O. Coppens, A tailored strategy for PDE-based design of hierarchically structured porous catalysts. *Int. J. Multiscale Comp. Engng* 6(2), 179-190 (2008).
- Wang, J., J. C. Groen, W. Yue, W. Zhou and M.-O. Coppens, TUD-C: a tunable, hierarchically structured mesoporous zeolite composite. *Microp. Mesop. Mater.* 2008, Submitted.
- Wang, J., J. C. Groen and M.-O. Coppens, Formation mechanism of scaffolded mesoporous silica with a controlled pore size. Submitted to *J. Phys. Chem.* 2008.
- Wang, G., C. R. Kleijn and M.-O. Coppens, Multi-scale PDE-based design of hierarchically structured porous catalysts. Invited book chapter for *Advanced Computational Methods in Science and Engineering* (B. Koren and C. Vuik, ed.), Springer Lecture Notes in Computational Science and Engineering, 2008. In press.
- Wegrowe, J. E., Santos, S. M., Ciornei, M. C. and Rubi, J. M., Magnetization reversal driven by spin injection: A diffusive spin-transfer effect, *Phys. Rev. B*, 77 (2008) 174408.
- Zschiegner, S., S. Russ, R. Valiullin, M.-O. Coppens, A. J. Dammers, A. Bunde and J. Kärger, Normal and anomalous diffusion of non-interacting particles in linear nanopores. *Eur. Phys. J.: Special Topics* 161(1), 109-120 (2008).
- Zvolinschi, A. and S. Kjelstrup, A process maturity indicator for industrial ecology *J. Industrial Ecology*, 12 (2008) 159-172.

## 10.7 External seminars, lectures

Non-isothermal adsorption of n-butane on silicalite by transient non-equilibrium molecular dynamics simulation, Conference on Thermodynamics 2007, Reuil-Malmaison (France) September 2007, I. Inzoli, S. Kjelstrup, D. Bedeaux, J.M. Simon, oral presentation by J.M. Simon.

What can we learn from a continuous description of heat and mass transport for evaporation and condensation? D. Bedeaux and E. Johannessen, Invited talk by D. Bedeaux at the Technical University in Delft, Netherlands, 2007.

The second law of thermodynamics and statistical mechanics, Keenan Symposium at the MIT on the second law, Cambridge, Mass., US, October 2007, Invited plenary talk by D. Bedeaux.

Can activated processes be described by non-equilibrium thermodynamics (NET)? Keenan Symposium at the MIT on the second law, Cambridge, Mass., US, October 2007, short plenary presentation by S. Kjelstrup.

Kjelstrup, Signe. How can we better describe coupled heat and mass transfer in natural processes?. Geotechnology Colloquia: SPARKS, TUDelft, Jan 2008.

Simulation of transport properties of heterogeneous systems using non-equilibrium molecular dynamics, AIST institute, Tsukuba, Japan, April 2008, invited seminar by J.M. Simon.

Simulation of transport properties of heterogeneous systems at a molecular scale, RIKEN Institute, Tokyo, Japan, April 2008, invited seminar by J.M. Simon.

Molecular dynamics simulation, a tool to test the principle of the non-equilibrium thermodynamics: application to surfaces and interfaces, TU-Darmstadt, Germany, May 2008, invited seminar by J.M. Simon.

Mesoscopic non-equilibrium thermodynamics for biological systems, Symposium on the New frontiers of theory-based chemical research, University of Oslo, invited talk by S. Kjelstrup, May 2008.

The Measurable Heat Flux in Active Transport by  $\text{Ca}^{2+}$ -ATPase, Conference on the Statistical Mechanics of Molecular Biophysics, Sitges, Spain, June 2008, presentation by D. Bedeaux.

Thermal diffusion and partial molar enthalpy variations of n-butane in silicalite-1, 8th International Meeting on Thermodiffusion, Bonn, Germany, June 2008, I. Inzoli, J.M. Simon, S. Kjelstrup, D. Bedeaux, presentation by D. Bedeaux.

Dielectric response of a spheroidal colloid, ISIS 2008 conference and COST D43 Workshop, Krakow, Poland, C. Chassagne and D. Bedeaux, presentation by C. Chassagne.

Invited keynote speaker 2nd International Symposium on Biothermodynamics; 2008-02-21 -



2008-02-22, Signe Kjelstrup Heat production in molecular pumps. How can we describe it?

Invited keynote speaker at the Jahrestagung, the German Annual Meeting of Chemical Engineers, Aachen, Germany, October 2007, Marc-Olivier Coppens.

Invited lecture at 5th Chemical Engineering Conference for Collaborative Research in Eastern Mediterranean Countries (EMCC5), Cetraro, Italy, May 2008, Marc-Olivier Coppens.

Invited plenary speaker, and session chair at the Mexican Congress on Chemical Reaction Engineering (MCCRE 2008), Ixtapa-Zihuatanejo, Guerrero, Mexico, June 2008, Marc-Olivier Coppens.

Invited keynote at 6th Congress of the International Society for Theoretical Chemical Physics (ISTCP-VI), Vancouver, Canada, July 2008, Marc-Olivier Coppens.

INSIDE-PORES Workshop, Alicante, Spain (September 2007): oral presentation, Posters, by J. Wang.

Jahrestagung (Annual Meeting) of the German Chemical Engineers, Aachen, Germany (October 2007): invited keynote lecture, Marc-Olivier Coppens.

A.I.Ch.E. Annual Meeting, Salt Lake City, U.S.A. (November 2007): chair of 3 sessions, and 7 oral presentations (CRE Division Travel Award for G. Wang), Marc-Olivier Coppens.

Nanoporous Materials V, Vancouver, Canada (May 2008): 1 oral and 2 poster presentations, Marc-Olivier Coppens.

5th Chemical Engineering Conference for Collaborative Research in Eastern Mediterranean Countries (EMCC5), Cetraro, Italy (24-29 May 2008): invited lecture, Marc-Olivier Coppens.

Mexican Congress on Chemical Reaction Engineering (MCCRE 2008), Ixtapa-Zihuatanejo, Guerrero, Mexico (15-19 June 2008): invited plenary, Marc-Olivier Coppens.

6th Congress of the International Society for Theoretical Chemical Physics (ISTCP-VI), Vancouver, Canada (19-24 July 2008): invited keynote, Marc-Olivier Coppens.

### 10.8 Posters

Adsorption kinetics of mixtures of n-hexane and 2-methylpentane on silicalite by non-equilibrium molecular dynamics, Conference on Diffusion Fundamental II, L'Aquila (Italy) August 2007, J.-M. Simon, J.-P. Bellat, poster.

Surface resistance to heat and mass transfer in a silicalite membrane. A nonequilibrium molecular dynamics study, Conference on Diffusion Fundamental II, L'Aquila (Italy) August 2007, I. Inzoli, J.M. Simon, S. Kjelstrup, poster.

Dynamical behaviour of H<sub>2</sub> molecules on graphite surface; A molecular dynamics study.

Conference on Diffusion Fundamental II, L'Aquila (Italy) August 2007, J.M. Simon, O.E. Haas, S. Kjelstrup, A. L. Ramstad, poster.

Transport properties of a reacting binary fluid, A non-equilibrium molecular dynamics simulations study, Conference on Thermodynamics 2007, Reuil-Malmaison (France) September 2007, J. Xu, S. Kjelstrup, D. Bedeaux, J.M. Simon, poster.

Transfer Coefficients for Evaporation of a System with a Lennard-Jones Long Range Spline Potential, Conference on Thermodynamics 2007, Reuil-Malmaison (France) September 2007 J. Ge, S. Kjelstrup, D. Bedeaux, J.M. Simon, B. Rousseau, poster.

Heat Transfer through the  $\text{Ca}^{2+}$ -ATPase/water interface, 12th International ATPase Conference, Aarhus, Denmark, 2008. A. Lervik, F. Bresme, S. Kjelstrup, D. Bedeaux and M. Rubi. Poster.


Heat Transfer through the  $\text{Ca}^{2+}$ -ATPase/water interface, CCP5 Annual Conference, Surfaces and Interfaces, London, UK, 2008. A. Lervik, F. Bresme, S. Kjelstrup, D. Bedeaux and M. Rubi. Poster.

15th International Zeolite Conference, Beijing, China (12-17 August 2007): oral presentation, two posters, Marc-Olivier Coppens.

2nd Diffusion Fundamentals Conference, L'Aquila, Italy (August 2007): scientific committee, posters, Marc-Olivier Coppens.



Professor Signe Kjelstrup with group members on excursion to Svalbard, July 2008



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**CENTRE FOR ADVANCED STUDY**  
at the Norwegian Academy of Science and Letters

**SENTER FOR GRUNNFORSKNING**  
ved Det Norske Videnskaps-Akademi

Drammensveien 78, NO 0271 Oslo, Norway  
Telephone: (+47) 221 22500, Telefax: (+47) 221 22501  
E-mail: [cas@cas.uio.no](mailto:cas@cas.uio.no)  
[www.cas.uio.no](http://www.cas.uio.no)