

CENTRE FOR ADVANCED STUDY  
SENTER FOR GRUNNFORSKNING

**ANNUAL REPORT 2007**





## Center for Advanced Study

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 six Norwegian universities and one high-level research college, 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 and the Norwegian School of Economics and Business Administration in Bergen.

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
KD	Ministry of Education and Research
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
UiS	University of Stavanger
UiT	University of Tromsø
USIT	University of Oslo's Centre for Information Technology
UiB	University of Bergen
UiO	University of Oslo

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## The Board



**Professor Aanund Hylland**  
Chairman  
University of Oslo – NASL



**Pro-Rector Gerd Bjørhovde**  
Vice Chairman  
University of Tromsø – UHR



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



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



**Professor Eivind Hiis Hauge**  
The Norwegian University of Science and Technology – UHR, until 28.02.07



**Professor Ivar Langen**  
University of Stavanger – UHR, from 01.03.07



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



**Secretary General Professor Reidun Sirevåg**  
Observer  
The Norwegian Academy of Science and Letters

## Alternates



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



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



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



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



**Professor Rune Nilsen**  
*Alternate (for Hauge)*  
University of  
Bergen – UHR, until  
28.02.07

Foto: Garm Kallestad, Scamp/NTNU Info



**Pro-Rector Astrid Læg Reid,**  
*Alternate (for Langen)*  
The Norwegian  
University of  
Science and  
Technology – UHR,  
from 01.03.07



**Secretary General  
Anne Lise Ryel**  
*Alternate (for Heløe)*  
The Norwegian  
Cancer Society  
– RCN

## The administration



**Professor Willy Østreng**  
*Scientific Director*



**Unn Haaheim Hagen**  
*Office Manager*



**Maria M. L. Sætre**  
*Adviser*



**Marit Finnemyhr Strøm**  
*Executive Officer*

# Research groups 2006/2007 - Participants spring 2007

## Spin and Charge Flow in Nanostructures:



**Arne Brataas**  
*(group leader)*  
Professor, NTNU,  
Norway



**Asle Sudbø**  
*(group leader)*  
Professor, NTNU,  
Norway



**Egor Babaev**  
Assistant Professor,  
AlbaNova University  
Center, Sweden



**Gerrit E. W. Bauer**  
Professor, Delft Uni-  
versity of Technology,  
The Netherlands



**Yaroslav Blanter**  
Assistant Professor,  
Delft University  
of Technology, The  
Netherlands



**Carlos Egues de  
Menezes**  
Professor, University  
of São Paulo, Brazil



**Daniel Huertas-  
Hernando**  
Postdoctoral Fellow,  
NTNU, Norway



**Allan H.  
MacDonald**  
Professor, The  
University of Texas  
at Austin, USA



**Fabricio Macedo de  
Souza**  
Postdoctoral Fellow,  
International Centre  
for Condensed Mat-  
ter Physics, Brazil



**Jan Martinek**  
Dr., Polish Academy  
of Sciences, Poland



**Gil Refael**  
Assistant Professor,  
California Institute  
of Technology, USA



**Bernd Rosenow**  
Postdoctoral Fellow,  
Harvard University,  
USA



**Mats Wallin**  
Professor, AlbaNova  
University Center,  
Sweden



**Gergely Zarand**  
Professor, Budapest  
University of  
Technology and  
Economics, Hungary



**Kjetil Borkje**  
Research Fellow,  
NTNU, Norway



**Martin Sigurd  
Grønsløth**  
Research Fellow,  
NTNU, Norway



**Jan Petter Morten**  
Research Fellow,  
NTNU, Norway



## Research groups 2006/2007 – Participants spring 2007

### Metamorphoses: Resurrection, Taxonomies and Transformative Practices in Early Christianity:



**Turid Karlsen Seim**  
*(group leader)*  
Professor, UiO,  
Norway



**Jorunn Økland**  
Senior Lecturer,  
University of  
Sheffield, UK



**Samuel Rubenson**  
Professor, Lund Uni-  
versity, Sweden



**John J. Collins**  
Professor, Yale  
University Divinity  
School, USA



**Adela Y. Collins**  
Professor, Yale  
University Divinity  
School, USA



**Denise Buell**  
Associate Professor,  
Williams College,  
USA



**Hugo Lundhaug**  
Researcher, UiO,  
Norway



**Karen L. King**  
Professor, Harvard  
Divinity School,  
USA



**Antti Marjanen**  
Researcher,  
University of  
Helsinki, Finland



**Liv Ingeborg Lied**  
Researcher, UiO,  
Norway



**Einar Thomassen**  
Professor, UiB,  
Norway

## Research groups 2006/2007 – Participants spring 2007

### Changing Family Patterns in Norway and other Industrialized Countries: Determinants, Consequences and Projected Trends:



**Øystein Kravdal**  
*(group leader)*  
Professor, UiO,  
Norway



**Nico Keilman**  
*(group leader)*  
Professor, UiO,  
Norway



**Juha Alho**  
Professor, University  
of Joensuu, Finland



**Emily Grundy**  
Professor, London  
School of Hygiene  
and Tropical Medi-  
cine, UK



**Hans-Peter Kohler**  
Professor, Univer-  
sity of Pennsylvania,  
USA



**Iliana Kohler**  
Research Associate,  
University of  
Pennsylvania, USA



**Ron Rindfuss**  
Professor, University  
of North Carolina,  
USA



**Arnstein Aassve**  
Chief Research  
Officer, University of  
Essex, UK



**Fiona Steele**  
Postdoctoral Fellow,  
International Centre  
for Condensed Mat-  
ter Physics, Brazil



**Wendy Sigle-  
Rushton**  
Lecturer, London  
School of Economics  
and Political Science,  
UK



**Anne Reneflot**  
Research Fellow,  
UiO, Norway



**Svenn-Erik  
Mamelund**  
Postdoctoral Fellow,  
UiO, Norway



**Tapani Valkonen**  
Professor, University  
of Helsinki, Finland

## Research groups 2007/2008 - Participants autumn 2007

### 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 Bour-  
gogne, France



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



**Yuji Sugita**  
Associate Chief  
Scientist, Theoretical  
Biochemistry Labora-  
tory, RIKEN, Japan



**Kirill Glavatskiy**  
Research Fellow,  
NTNU, Norway



**Isabella Inzoli**  
Research Fellow,  
NTNU, Norway

### 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**  
Lecturer, University  
of Gävle, Sweden

## Research groups 2007/2008 – Participants autumn 2007

### Understanding Innovation:



**Jan Fagerberg**  
*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*



**Tommy Clausen**  
*Researcher, Nordland  
Research Institute,  
Norway*



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



**David C. Mowery**  
*Professor, Univer-  
sity of California at  
Berkeley, USA*



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



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

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## 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 2007, the Board was composed of the following members:*

Professor Aanund Hylland, University of Oslo (Chair) – NASL  
Pro-rector Gerd Bjørhovde, University of Tromsø (Deputy Chair) – UHR  
Professor Kenneth Hugdahl, University of Bergen – NASL  
Professor Liv Bliksrud, University of Oslo – NASL  
Professor Eivind Hiis Hauge, Norwegian University of Science and Technology – UHR, until 28 February 2007  
Professor Ivar Langen, University of Stavanger – UHR, from 1 March 2007  
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 Bliksrud)  
Professor Rune Nilsen, University of Bergen – UHR (for Hiis Hauge), until 28 February 2007  
Prorector Astrid Læg Reid, Norwegian University of Science and Technology – UHR (for Langen), from 1 March 2007  
Secretary General Anne Lise Ryel, The Cancer Society – RCN (for Heløe)

The Board of Directors held four meetings in 2007. The following main issues were discussed and/or decided:

Selection of research groups for 2009/2010 – Financial Statements for 2006 – Budget for 2007 – Directors' Report for 2006 – application for funds from

the Ministry of Education and Research 2008 – mid-year accounts for 2007 – transfer of funds to the Operating Fund – distribution of funds between the research groups 2006/2007 – the process of identifying candidates for 2010/2011 – evaluation of the appointment process for the research groups 2009/2010 – the Centre’s publications – the Centre’s evaluation process – bodies/players that can nominate applicants for places at the Centre – relevant partners for the Centre – participation in the *European Network of Institutes of Advanced Study* (NetIAS) – cooperation with CAS’ sister organisations in the Nordic countries – discussion of the progress made by the research groups 2007/2008 – sundry redecoration and maintenance projects.

### 1.1 Management and administration

The administration consisted of four employees and two part-time independent consultants. Willy Østreng is employed as Scientific Director on a fixed-term contract and is responsible for the Centre’s routine operations and professional activities. Office Manager Unn Haaheim Hagen heads the day-to-day administrative activities, while Adviser Maria M. L. Sætre’s main purview is the administration of the Centre’s technical activities, including updating and maintaining the website, handling the archives and library services, and preparing the Centre’s publications. Executive Officer Marit Finnemyhr Strøm is in charge of the switchboard, the registration of researchers, postal and information services as well as general administrative assistance. In addition, Project Manager Bjarne Røsjø of *Bjarne Røsjø Media A/S* has been co-editor of and a writer for the CAS Newsletter. He has also been involved in the production of the Centre’s book project: *Complexity. Interdisciplinary Communications 2006/2007* and the *Annual Report for 2006*. Dag Christian Bjørnsen of the *University of Oslo’s Centre for Information Technology* (USIT) has been responsible for the operation of computer systems and computer assistance for the researchers two days a week – Tuesdays and Thursdays. He worked at CAS full-time in August and the last week of July to ensure that the IT needs of the new research groups were met in a satisfactory manner. Temporary office help was hired on an hourly basis as needed to lighten the workload.

The regular administrative staff has weekly meetings to discuss matters of importance for the 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.

Cooperation with the liaison committees at the six universities and the Norwegian School of Economics and Business Administration (NHH) has been strengthened further, not least through the reorganisation of the committees and the continuation of the annual meetings between these committees and the Scientific Director. CAS' Liaison Committee consists of the universities' own research policy bodies, such as research boards, research committees and/or deans' offices. This change ensures that the Centre's programmes now receive more attention from our partners than was previously the case. The Scientific Director also meets university administrators directly through the meetings of these committees.

Among its professional initiatives, the Centre continued arranging its Wednesday seminars in 2007. 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 has planning meetings prior to the publication of every issue, based on discussions at the administration 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. It has also been decided to enhance the general scientific popularity of the CAS Newsletter by publishing themed issues on the humanities, social sciences and natural sciences. Work has commenced on giving the Newsletter and the Centre's other publications a new image and a more modern design. This process, which involves two independent agencies, will be completed in 2008.

## **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 12 days in 2007. The organisation's activities do not pollute the outdoor environment.



## 2. The Centre's Objective 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 the natural sciences/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 calibre. 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 38 joint seminars were organised in 2007, furnishing material for the publication of the book: *Complexity. Interdisciplinary Communications 2006/2007*. The contributions to this book, the fourth 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 2006 and continued in spring 2007 worked on the following topics:

- **Metamorphoses: Resurrection, Taxonomies and Transformative Practices in Early Christianity**  
headed by Professor Turid Karlsen Seim, University of Oslo
- **Changing Family Patterns in Norway and other Industrialized Countries: Determinants, Consequences and Projected Trends**  
headed by professors Nico Keilman and Øystein Kravdal, University of Oslo
- **Spin and Charge Flow in Nanostructures**  
headed by professors Arne Brataas and Asle Sudbø, Norwegian University of Science and Technology

The purpose of the project **Metamorphoses: Resurrection, Taxonomies and Transformative Practices in Early Christianity** was to analyse how notions of and experience with metamorphoses were expressed in early Christian times. This point of departure required that the group needed new interpretational perspectives on pre-Constantine Christianity which did not primarily understand it in terms of uniform, evolutionistic categories, but as a synthesis of many different groups and faiths. Despite Christianity's claim of exclusivity and experiences with conflicts and persecutions, the earliest Christians depended on the mindsets, modes of speech and means of action which already existed. They were bound by the existing discourse in their efforts slowly to create a new one. This paved the way for the following issues: Which frame of reference characterised their metamorphosis and their experience of being 'new people'? Which analogies did they benefit from, and what parameters did they use to establish hallmarks of change? How could they assert that change actually existed?

The group wished to link together topics revolving around metamorphosis that had previously been studied separately. In the light of this, the project covered the following fields: 1. Metamorphosis and taxonomy: Discontinuity and continuity, 2. The genesis of a 'third race'. Metamorphosis through the introduction of a new social order. 3. Resurrection exercises: Asceticism as transformative practice. 4. Resurrection: A renegotiation of the relationship between continuity and change. Here, the conventional Jewish-Christian belief in the resurrection of the flesh was compared with a supposed Greek notion of immortality.

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 **Changing Family Patterns in Norway and other Industrialised Countries: Determinants, Consequences and Projected Trends** aimed at analysing the major changes in family patterns that industrialised countries have undergone in recent decades. This trend is caused and reinforced by far-reaching social changes such as improved financial circumstances and a strengthening of the individual freedom of women and men alike. The group wished to analyse the positive and negative consequences of this trend. The project was divided into three sub-projects. The first dealt with the forces behind changing families, especially the weakened link between matrimony and births. The group also analysed the background for the growing number of dissolutions of marriages and cohabitational relationships. The other sub-projects addressed the consequences of changing families, not least the effect of family break-ups on the health, education and careers of children and adults. In this context, the group also studied the possibilities of repercussions on subsequent family behaviour. These two sub-projects were largely based on Norwegian register data, which was analysed using modern statistical multi-process and multi-level techniques. This data was supplemented by interview surveys. The third sub-project was intended to improve the models by extrapolating family behaviour. Special emphasis was attached to stochastic extrapolations that contained family characteristics. The models that already existed contained nothing but age, gender and information on individuals, that is, no data on relationships. The project's paramount objective was to produce knowledge about the determinants for this and the consequences of changing families that can be used a planning tools for extrapolating future trends.

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

The goal of the project **Spin and Charge Flow in Nanostructures** was to develop new, improved insight into theoretical models for nanostructures and thus to improve the understanding of experimental findings. The research comprised the study of characteristics of pure and complex structures consisting of normal metals, ferromagnets, conventional super conductors, high-temperature super conductors and semi-conductors. Studies were made of the spin flow as well as the charge flow. The study of spin and charge flow in nanostructures was expected to reveal interesting new phenomena of importance for theory-building and experimental work.

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

The 2007/2008 research groups commenced working in August 2007. The research topics for these groups are:

- **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

*CAS Newsletter* No. 2, 2006, describes the 2006/2007 groups' activities, while *CAS Newsletter* No. 1, 2007, discusses selected research topics relating to these projects.

*CAS Newsletter* No. 2, 2007, describes the 2007/2008 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 2007, the Board made its final decision on the nominations of the groups to be at the Centre in 2009/2010. The Centre had received 17 nominations, which was fewer than the year before. After two rounds of discussions, the Board forwarded seven proposals for an international peer review in spring 2007. A total of 36 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 2009/2010:

- **Ethics in Antiquity: The Quest for the Good Life,**  
headed by professors Øivind Andersen and Eyjólfur Kjalar Emilsson, University of Oslo
- **Should States Ratify Human Rights Conventions?,**  
headed by Professor Andreas Føllesdal, University of Oslo
- **Coevolutionary Interactions and Adaptations in a Metapopulation Context,**  
headed by Professor Eivin Røskaft, Norwegian University of Science and Technology

The selection process for 2010/2011 was initiated in autumn 2007. After having tightened up the requirements for the nomination process, the Centre received a total of 15 nominations, of which 13 went further to the next round.

## 4. Other Academic Activities

In 2007, the Scientific Director produced several publications. He also edited a book and had articles accepted by peer-reviewed journals. Further, he was invited to address national and international conferences and meetings in his field of research.

## 5. Objectives and Results

During the year, 87 researchers made professional contributions to the Centre's six projects. Of that number, 69 researchers had long-term stays (from one to eleven months) at the Centre, of whom 40 were non-Norwegians. There has been a significant international element; 52 researchers from 17 countries<sup>1</sup> and four continents participated in the research. Of this number, 10 were women, 9 of whom had long-term stays. The number of younger researchers was also substantial in 2007: 19 post-doc fellows and PhD students were associated with the projects. That is 5 fellows more than the year before.

In spring 2007, 55 researchers worked at the Centre, 47 of whom were on long-term stays. Of that number, 16 were Norwegian and 31 were from other countries. During this period, the Centre was the place of work for 10 post-doc fellows and PhD students. In addition, a large number of third party seminar and conference participants provided professional contributions to the individual project groups, cf. the group reports further back in this Annual Report.

In autumn 2007, 32 researchers worked at the Centre. Of that number, 22 long-term stays were divided between 13 Norwegian and 9 foreign researchers. Two of the three group leaders at CAS this autumn were women. This marked a first in the history of CAS. Besides the group members, there were many external seminar and conference participants, cf. the project reports further back in this Annual Report.

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 2007, the Centre organised seven workshops/seminars of this type. Several of the groups have also planned follow-up seminars after they leave CAS. In addition, a series of internal working seminars was organised by the groups, (cf. the group reports further back in this Annual Report).

The interaction between the researchers from abroad and those from Norway and the many lectures given 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 (cf. the group reports further back in this Annual Report).

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<sup>1</sup> Brazil, Colombia, Denmark, Finland, France, Iran, Japan, Canada, The Netherlands, Poland, Russia, Spain, Great Britain, Sweden, Germany, Hungary and the US

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 2007. Some works have already been published, but most of them are either being evaluated, are available in manuscript form or are still being worked on and evaluated. A complete survey of the results of the work carried out in 2007 will not be available for several years. The reports from the three research groups for 2006/2007 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 129 works, including several books. To this may be added the 31 articles published in the book: *Complexity. Interdisciplinary Communications 2006/2007*, CAS, Oslo 2008.

The following goals were also reached in 2007:

- The selection procedure for new research groups maintains a high international standard and is being improved continuously. Selection spans an 8-month period before nine or so of the best projects are subjected to an independent international evaluation. The 'finalists' for the 2009/2010 academic year were evaluated by an average of 5.1 peers from several countries.
- The CAS Newsletter maintains a high standard. It is published twice a year in Norwegian (circulation: 12 000) and English (circulation: 1000) 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 and other interested parties.
- Contact with Norwegian researchers outside the Oslo area has improved. In 2009/2010, 13 of a total of 18 group leaders were nominated by partners other than the University of Oslo. The University of Bergen made four nominations, the Norwegian University of Science and Technology three, the University of Life Sciences two, the University of Tromsø three and the Norwegian School of Economics and Business Administration (NHH) one.
- Contact with the various disciplines is ensured through the Liaison Committees established at all the universities and the Norwegian School of Economics and Business Administration. 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. After this change, CAS has direct access to the academic trendsetters and decision-makers

among its partners. This has enhanced the value and importance of the annual meetings the Scientific Director has with the Liaison Committees.

- Some academic seminars under the auspices of the Centre have been organised at universities outside Oslo. The point is to afford academics other than those directly involved in the group work at CAS an opportunity to be involved in the Centre's work by participating in discussions. This will help expand the Centre's national catchment area to include academics other than those who are members of the respective groups. The Centre will examine the possibility for further developing this programme and making it a more permanent part of CAS' cooperation with universities and colleges.
- 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. For example, the Research Council and CAS joined forces to organise a seminar on *Innovation in firms* in November 2007.
- Efforts to establish closer contact with international sister organisations were further strengthened in 2007. 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 to be defined as qualifying for EU research funding. Efforts to prepare a joint research project organised by the European *NetIAS* institutes were commenced after the *NetIAS* meeting in Bologna in spring 2007. The aim of this project is two-pronged, and funding is being sought over the EU's research budget. First of all, the project is intended to define the 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.
- The interdisciplinary component of the Centre's work has been strengthened by the continuation of the weekly luncheon seminars and through the establishment of a separate budget item for this type of research. Future calls for proposals will also urge candidates to draw up cross-sectoral project proposals.
- The 2007/2008 academic year represents a milestone in the Centre's work to stimulate interdisciplinary research. For the first time in the history of CAS, all project groups have interdisciplinary objectives and compositions.



- External mediation of research results takes place through peer-reviewed publication channels. Moreover, popularised articles are published in the CAS Newsletter 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 has been published in a print-run of 850 copies and has been distributed free of charge to a number of research groups in Norway and abroad. It is also available to interested institutions/individuals on request.

## 6. Financial Affairs

### 6.1 The Centre for Advanced Study

CAS received a State grant that came to MNOK 14.77 in 2007. This was an increase from the previous year of NOK 556 000, or 3.9 per cent. This increase compensated for inflation and wage adjustments, but is still below the level recommended by the Bjørge Committee for the Centre 10 years ago, which was about MNOK 16. If this amount were adjusted for the changing value of the NOK, the sum of approximately MNOK 1 still remains before the State grant reaches the recommended level. The absence of any genuine increase in the past three years impedes the work of building up a satisfactory reference library and a collection of books and journals in science and the humanities. 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 far beyond the reach of CAS.

A reassignment of priorities in connection with the Centre's budget for 2007 made it possible to increase the allocations for 2008/2009 to MNOK 3.3 per research group. This was 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 fellowships and buying foreign researchers out of their duties, and the amounts include accommodation, travel, conference and seminar expenses. Until recently, the available resources were far 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 MNOK 4 at the 2007 level.

As in previous years, the university agreements represent considerable additional funding, since visiting researchers from the Norwegian universities and the Norwegian School of Economics and Business Administration are generally paid by their respective home institutions while at CAS. This supplementary funding represented 5.4 full-time equivalents in 2007. This marked a decline of 3 full-time equivalents year-on-year.

The Centre's Income Statement for 2007 shows an operating profit of NOK 468 506. The budget for 2007 was set up with a budget deficit of approx. MNOK 1.

The balance sheet shows a balance of NOK 3 846 790. Of this amount, NOK 1 629 375 are current liabilities. In 2007, the sum of MNOK 3 was transferred from the Centre for Advanced Study to the Operating Fund at the Centre for Advanced Study.

The accounts for 2007 have been 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 2007. 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 the basic capital, which is inviolable, and disposable funds. In February 2007, MNOK 3 was transferred to the Operating Fund from the total capital in the Centre's accounts. The amount was recognised directly against available funds. No funds were drawn from the Operating Fund in 2007. Net interest income came to NOK 648 379, which was added to the Fund, bringing the Operating Fund's aggregate capital at year end to NOK 16 604 250.

Internal accounts for 2007 have been 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 2007. The accounts have been audited by the company Nitschke A/S.

*Centre for Advanced Study, 18 February 2008*



### **Opening Ceremony 2007**

September 4th the opening of the 16th 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

To the Board of the Foundation  
Centre for Advanced Study

## AUDITORS' REPORT FOR 2007

We have audited the Annual Accounts of the Centre for Advanced Study for 2007, which show a deficit of NOK 272,074,-. 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 2007 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, 18 February 2008

NITSCHKE AS

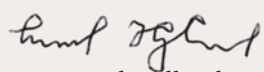
Morten Hurum  
State-authorized auditor

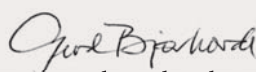
## 7. Accounts

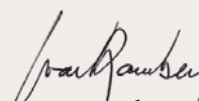
### 7.1 Centre for Advanced Study


<b>Balance at 31 december</b>	<b>2007</b>	<b>2006</b>
<b>Assets:</b>		
<i>Cash</i>		
Cash, bank deposits etc.	(Note 4) 3 846 790	7 472 630
<i>Total cash:</i>	3 846 790	7 472 630
<b>Total assets</b>	<b>3 846 790</b>	<b>7 472 630</b>
<b>Liabilities and capital and reserves;</b>		
<i>Capital and reserves</i>		
Basic capital	(Note 5) 118 400	117 200
Capital account	(Note 7) 2 099 015	5 372 289
<i>Total capital and reserves</i>	2 217 415	5 489 489
<i>Short-term liabilities</i>		
Payable to the Norwegian Academy of Science and Letters	100 000	100 000
Payable tax deductions, National Insurance contributions, holiday pay etc.	432 811	434 309
Other short-term liabilities	(Note 6) 1 096 564	1 448 832
<i>Total short-term liabilities</i>	1 629 375	1 983 141
<b>Total liabilities and capital and reserves</b>	<b>3 846 790</b>	<b>7 472 630</b>

Oslo 18 February 2008  
Board of the Centre for Advanced Study

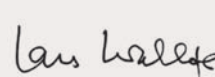
  
Aanund Hylland,  
Chairman of the Board

  
Gerd Bjørhovde,  
Vice-Chairman

  
Ivar Ramberg

  
Kenneth Hugdahl

  
Egil Leer

  
Lars Walløe

## Centre for Advanced Study

### Profit and loss account

2007

2006

#### Income from operations and running expenses:

##### *Income from operations:*

State grant from Ministry of Education  
and Research

14 770 000 14 214 000

##### *Total income from operations*

14 770 000 14 214 000

##### *Operating expenses:*

Expenses relating to research fellows (Note 1)

9 035 036 7 217 511

Salaries, fees etc. (Note 2)

2 537 935 2 356 761

Office furniture, furnishings, computer  
equipment

294 340 95 060

Other operating expenses (Note 3)

3 371 195 3 274 468

Total operating expenses

15 238 506 12 943 800

#### **Operating result**

**-468 506 1 270 200**

#### Financial income and financial expenditure:

Income from interest

215 885 193 651

Bank charges

19 453 11 329

#### **Net financial income**

**196 432 182 322**

Annual balance

-272 074 1 452 522

which is to be allocated as follows:

To the Basic capital

1 200 1 200

To/(from) the Capital account

-273 274 1 451 322

## The 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	2007	2006
<b>Note 1 Expenses relating to research fellows:</b>		
Fellowships etc., researchers	4 501 625	3 006 896
Rent for researchers' flats	2 000 749	1 588 728
Travel expenses	622 660	615 491
Publications, printing, equipment		22 544
437 728		
Seminars/Workshops	1 587 090	1 209 517
Miscellaneous expenses research groups	300 368	359 151
<b>Sum;</b>	<b>9 035 036</b>	<b>7 217 511</b>
<b>Note 2 Salaries/fees:</b>		
Salaries/holiday pay	1 961 799	1 889 201
Pension premiums	223 731	172 790
National Insurance Contributions		310 530
253 865		
Manpower services	0	1 706
Auditors' fees	36 250	34 125
Social expenditure	5 625	5 074
<b>Sum;</b>	<b>2 537 935</b>	<b>2 356 761</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 648 719

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

Auditing expenses cover in their entirety auditing services



## The Centre for Advanced Study

Notes on the Accounts	2007	2006
<b>Note 3 Other operating expenses:</b>		
Lighting, heating, cleaning, rent, insurance, security	957 474	992 463
Telephone, fax, postage	133 136	131 570
Equipment, copying, computing	653 823	604 380
Books, library service, printing	514 359	536 388
Operating equipment, maintenance	393 547	215 629
Running the canteen, social measures and representation	422 375	394 994
Travel expenses	66 589	94 704
Miscellaneous expenditure	229 892	304 340
<b>Sum;</b>	<b>3 371 195</b>	<b>3 274 468</b>

### Note 4 Bank deposits:

Of the bank deposits entered in the books, the sum of NOK 233,147 represents withheld tax deductions

Specification of bank deposits on 31.12.:

DnB NOR, account 8200.01.17044	NOK	233 147	224 511
DnB NOR, account 1607.83.68385	NOK	3 586 419	7 224 447
DnB NOR, account 1644.14.60264	NOK	4 717	4 539
DnB NOR, account 8210.04.35809	NOK	1 298	1 561
Total bank deposits	NOK	3 825 581	7 455 058
Cash balance 31.12.	NOK	21 209	17 572
<b>Total cash, bank etc.</b>	<b>NOK</b>	<b>3 846 790</b>	<b>7 472 630</b>

### Note 5 Basic Capital:

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

### Note 6 Other short-term liabilities:

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

### Note 7 – Capital Account:

In 2007, NOK 3 000 000 was transferred to the Operating Fund of the Centre for Advanced Study.

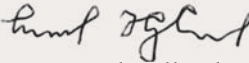
The amount was charged to capital accounts in 2007.

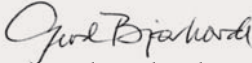
## 7.2 Operating Fund at the Centre for Advanced Study

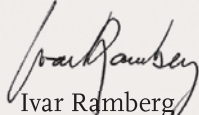
Balance at 31 december		2007	2006
<b>Assets:</b>			
<i>Cash</i>			
Bank deposit	Note 1	16 602 952	12 954 573
<i>Total cash</i>		16 602 952	12 954 573
<hr/>			
<b>Total assets</b>		<b>16 602 952</b>	<b>12 954 573</b>
<hr/>			
<b>Liabilities and capital and reserves:</b>			
<i>Capital and reserves:</i>			
Basic capital	Note 2	1 371 610	1 306 710
Disposable funds	Note 3	15 231 342	11 647 863
<i>Total capital and reserves</i>		16 602 952	12 954 573
<hr/>			
<b>Total liabilities and capital and reserves</b>		<b>16 602 952</b>	<b>12 954 573</b>

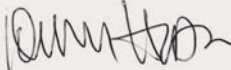
Oslo 18 February 2008

Board of the Centre for Advanced Study

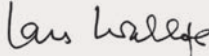
  
Aanund Hylland  
Chairman of the Board

  
Gerd Bjørhovde,  
Vice-Chairman

  
Ivar Ramberg

  
Kenneth Hugdah

  
Egil Leer

  
Lars Walløe

## Operating Fund at the Centre for Advanced Study

<b>Profit and loss account</b>	<b>2007</b>	<b>2006</b>
<b>Income from operations and running expenses:</b>		
<i>Income:</i>		
Income from interest	648 379	304 949
<b>Annual balance</b>	<b>648 379</b>	<b>304 949</b>
<b>which it is proposed to allocate as follows:</b>		
To the basic capital	64 900	30 500
To Disposable funds	583 479	274 449
	<b>648 379</b>	<b>304 949</b>

### Notes on the Accounts for the period ending 31 December 2007

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 2007:

DnB NOR, account 8200.06.22903, balance	16 602 952	12 954 573
<b>Total</b>	<b>16 602 952</b>	<b>12 954 573</b>

#### Note 2 Basic capital

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

#### Note 3 Disposable funds

The Centre for Advanced Study made NOK 3 000 000 available for allocation.

The amount was booked directly to disposable funds.

To the Board of the Operating Fund  
Centre for Advanced Study

## AUDITORS' REPORT FOR 2007

We have audited the Annual Accounts of the Centre for Advanced Study for 2007, which show a surplus of NOK 648,379-. 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 2007 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, 18 February 2008

NITSCHKE AS

Morten Hurum  
State-authorized auditor



### **Opening Ceremony 2007**

Introductory greeting by Professor Aanund Hylland, Chairman of the Board



### **Opening Ceremony 2007**

Professor Gro Steinsland, University of Oslo held the lecture: “Myths and Power in the Transformation of the Nordic countries from Viking to Medieval Age”

The Japanese Ambassador H.E. Mr. Hisao Yamaguchi in conversation with Scientific Director Willy Østreng

Group leaders 2007/2008:

Professors Gro Steinsland, Jan Fagerberg and Signe Kjelstrup





### **Opening Ceremony 2007**

Reception in the Academy's Tapestry Room

Professor Gro Steinsland, UiO, in conversation with Dr. Olof Sundqvist, University of Gävle, Sweden

Professors Dick Bedeaux and Signe Kjelstrup, both from NTNU.





## 8. Metamorphoses: Resurrection, Taxonomies and Transformative Practices in Early Christianity

Report by Turid Karlsen Seim  
Group Leader 2006/2007

### 8.1 General description

The project aimed at exploring how ideas and experiences of transformation were expressed in Early Christianity. It assumed new patterns of interpreting Pre-Constantinian Christianity not so much in uniform and evolutionary terms but as a diversity of groups and beliefs. Despite a claim to exclusiveness and experiences of conflict and persecution, the early Christians depended upon and actively exploited existing forms of thought, speech and behaviour. They yielded to given discourses while slowly establishing new ones. What were the frameworks within which transformative ideas such as resurrection and also experiences of having become “a new being” were shaped; the analogies to which they referred; and the parameters by which transformation was being noted and actually asserted? How was Christianity conceived and received by people not already culturally and religiously informed or shaped by it?

The focus on transformation helped connect areas of research that so far have been studied separately, and the project covered the following main areas:

- Transformation and Taxonomy – a study of how various constructions of cosmological order accommodated or challenged transformative movements. We explored the interplay between spatial and temporal categories; the terms used to express differences and likenesses between terrestrial and celestial realms; and the role these terms served as boundary-markers.
- Resurrection, Recognition and the Resurrected Body. A comprehensive and nuanced reading of a variety of Greco-Roman, Jewish and Christian sources affirmed that faith in resurrection was a hallmark of Christian identity but that the way in which resurrection and the resurrected body was perceived and explained varied greatly but yet had – also in the case of Jesus – an emphasis on transformative change and polymorphism/multiformity rather than on the solid bodily continuity that gained ground in later Christian doctrine in the West.
- Resurrection Rehearsed. The focus was on asceticism as transformative practice -including transformation as designed by a hierarchical configuration of gender; martyrdom and the ascetic agon as transformation, and the idea that likeness to the angels might be attained and life in paradise rehearsed already before death. By Jesus’ resurrection death was rendered invisible as one always looked past and beyond it. The capacity to see what is spiritually true

already in this life of the flesh and past the flesh was cultivated. Yet flesh and sense perception continued to be observed as the visible surface on which, with proper vision, one could discern the state of the invisible, spiritual interior.

- The Generation of a Third Race: The focus was on transformation through conversion into a new social order. In antiquity human agency was conceptualized not so much in terms of individual, autonomous freedom, but in terms of “instrumental agency” to spiritual forces both good and evil. In this area especially the pedagogies and practices regarded as necessary for ongoing development and change were studied. Since exorcism, baptism, and chrism were important as practices that signified and performed transformation, this will be further pursued in a follow-up workshop May 2008 on Rituals of Transformation.

The group worked extensively and collectively with primary sources in Greek, Coptic, Syriac, Hebrew, and Latin and a diversity of Christian sources was interpreted in a comparative interplay with Jewish and Greco-Roman texts. The project did not assume an overarching theoretical model beyond the line of approach indicated above. Each participant had the freedom to contribute from his or her own position and field of expertise, and this created not tensions but a multifaceted ongoing exchange that proved itself fruitful for the outcome of the project.

The expectation was that each participant as a minimum requirement should contribute with a major article to a collective volume and that the individual contributions should be shaped by an interactive process within the group to ensure as much internal correlation as possible. The weekly group meetings were instrumental in this respect. They also helped uphold a sense of continuous work and certain focal points even when the composition of the group changed. The closing symposium, at which all the participant throughout the year were present, and the lively exchange that followed also beyond the stay at CAS, confirmed the commitment to the project.

The collective volume (final title still pending) will be edited by Turid Karlsen Seim and Jorunn Økland, and the content is further described below. It has been accepted for publication by a Berlin/New York publisher, DeGruyter, with a deadline for submission beginning of 2008, and they will use it to launch a new series. This is sign of a startling growth of interest in topics such as metamorphoses since this CAS-project was first conceived five years ago. It also shows that the project is seen as being at the cutting edge of research in the field.

## 8.2 Participants

Professor Turid Karlsen Seim, University of Oslo (group leader)  
Professor Denise Kimber Buell, Williams College  
Professor Troels Engberg-Pedersen, University of Copenhagen  
Professor Adela Yarbro Collins, Yale University  
Professor John J. Collins, Yale University  
Professor Karen L. King, Harvard University  
Professor Antti Marjanen, University of Helsinki  
Professor Samuel Rubenson, Lund University  
Professor Vigdis Songe-Møller, University of Bergen  
Professor Einar Thomassen, University of Bergen  
Senior Lecturer Jorunn Økland, University of Sheffield  
Post.doc. Istvan Czachesz, University of Groningen  
Post.doc. Liv Ingeborg Lied, University of Oslo  
Post.doc. Outi Lehtipuu, University of Helsinki  
Post.doc. Hugo Lundhaug, University of Oslo

**Turid Karlsen Seim** (group leader) was at CAS for the entire year, except for some weeks on medical leave. Her main field of expertise in the group was New Testament texts, especially the Johannine Literature and Luke-Acts. In collaboration with the other group members, she was responsible for the academic activities, including the seminars, the international conferences in collaboration with external partners, and, together with Jorunn Økland, for the concluding symposium. They are co-editing the collective volume generated by the project.

**Denise Kimber Buell** stayed at CAS from mid-May and to the end of June. In view of her recent and much praised book *Why This New Race? Ethical Reasoning in Early Christianity* (2005), she contributed with a study of the pedagogies and practices regarded as necessary for ongoing development and change at a time when humans were perceived not as autonomous agents but as instruments for divine or spiritual forces both good and evil

**Troels Engberg-Pedersen** spent only the two last weeks of April at CAS. However, he was an active participant throughout the year in seminars and conferences. With his background in classics and studies of ancient philosophy, especially the Stoics, as well as of the Pauline Literature, he represented a strong voice in the group's constantly ongoing deliberations on one of the core texts (1 Corinthians 15)

**Adela Yarbro Collins** was at CAS from the beginning of May to end of June. She is an eminent New Testament scholar who increasingly and insistently has used the Greco-Roman context as an interpretative framework in opening up new possible and often provocative meanings of New Testament texts. Her voice was important particularly in activating the potential of a Roman discourse in interpreting the resurrection of Jesus and the story of the empty tomb.

**John J. Collins** was at CAS from the beginning of May to end of June. He also visited shortly in late September when he in collaboration with CAS was invited to give the biannual Mowinckel-lecture at The Faculty of Theology, University of Oslo. An outstanding scholar of early Jewish Literature, he added an indispensable dimension to the project not least since early Jewish apocalypticism and mysticism are factors without which early Christian ideas about transformation would not be fully comprehensible. Collins also played an important role in suggesting channels for publication and secured publication of Liv Ingeborg Lied's dissertation in a highly recognized series by Brill.

**Karen L. King** arrived at CAS in late May and stayed a month. Originally a longer stay was foreseen but for medical reasons that was not possible. All the more important was the contribution she was able to make towards the conclusion of the project period. A world leading specialist on the Coptic Nag Hammadi library and related texts, she used theses and other material in a challenging analysis of the aging body in ancient Christian discourse on immortality/immortality within the wider framework of polymorphy

**Antti Marjanen** was at CAS from beginning of March to mid-April. During the period he also presented a paper at the conference on Transformations of Gender. Being known for his work on so-called Gnostic texts, he widened the scope also for the benefit of the project to Apocryphal Acts and Early Martyrdom Accounts in pursuit of male women martyrs. His study yielded surprising results in that he found that explicit gender transformation language was largely missing. Marjanen's contribution is the only one in the collective volume which explicitly applies a gender perspective but it is by implication embedded in some of the other articles as well. However, the March conference (see below) from which other individual contributions will be submitted for publication had this as its main focus.

**Samuel Rubenson** spent three months at CAS from the beginning of December to the end of February. His erudition in Early Syriac and Egyptian Christianity was invaluable to the project, as was his work on the earliest monastic letters on the experience of transformation through ascetic practices. Ruben-

son's presence in group had special impact on the work of two of the younger scholars, Hugo Lundhaug and Liv Ingeborg Lied. Lundhaug gained support for a late dating of his source material from the apparent affinity with Rubenson's, and Lied was greatly helped in dealing with some of the complexities in her Syriac texts.

**Vigdis Songe-Møller** was at CAS in the fall from beginning of October to mid-November and returned for the seminar in February. Her distinguished knowledge of ancient Greek philosophy made her an excellent resource person in the project for questions related to this area. However, stirred by the project, she developed an interest in Pauline studies. This led the group at large to have to (re)consider some basic questions which was an extremely helpful exercise. It also resulted in an intriguing reading of one of the core texts (1 Corinthians 15) by Songe-Møller herself.

**Einar Thomassen** spent four months at CAS from beginning of January to end of April. Trained in comparative religion and an internationally recognized expert on Valentinian Christianity/Gnosticism, he was a welcome resource person in the group. His critical mind helped clarify positions in discussion, and his analysis of transformation in Valentinian soteriology helped profile some important issues of broader interest to the project.

**Jorunn Økland** was at CAS for the whole academic year. She is internationally known for her studies of Paul's Corinthian correspondence which also proved her ability creatively to address theoretical and methodological questions with a deeply rooted gender conscience. In the project she was concerned, with issues related to body, subjectivity and the understanding of the self in relation to a much debated Pauline passage (2 Cor 12). During the year Økland occasionally took on responsibilities on behalf of the group leader in her absence. She will also serve as co-editor of the collective volume for DeGruyter.

**Istvan Czachesz**, Hungarian with a doctoral degree from Groningen, spent most of the fall semester at CAS from mid-September to end of December. He worked on metamorphoses, especially the grotesque employing cognitive theory. His stay at CAS led to the finalization of his habilitation thesis, *The Grotesque Body in Early Christian Literature: Hell, Scatology, and Metamorphosis*, submitted to the University of Heidelberg, which he successfully defended in June 2007. It also helped him qualify for his present position at the Collegium of the University of Helsinki.

**Liv Ingeborg Lied** was fully employed at CAS from January through June after having submitted her doctoral dissertation (*The Other Lands of Israel: A Study*

of the Land Theme in 2 Baruch) at the University of Bergen in December and had it approved in May. Mastering Syriac, she continued to work on a part of a text (2 Baruch) extant only in this language and of great importance to our CAS project. The problem of post-resurrectional continuity and recognition was central to her research. Contacts established with senior scholars in the CAS group assisted her in having her dissertation contracted for publication in a prestigious series as well as being invited to an international seminar later this year.

**Hugo Lundhaug** was a faithful and fully employed member of the CAS group through the whole academic year. Having submitted his doctoral thesis, *“There is a Rebirth and an Image of Rebirth”: A Cognitive Poetic Analysis of Conceptual and Intertextual Blending in the Exegesis on the Soul (NHC II,6) and the Gospel of Philip (NHC II,3)*, in June 2006, he had to wait until June 2007 when he successfully defended it at the University of Bergen. In his thesis he applied cognitive metaphor theory in the interpretation of a complex and much debated NagHammadi text (The Gospel of Philip) with remarkable results, and at CAS he applied this theoretical approach to another NagHammadi text of great relevance for the project, The Treatise on the Resurrection. During his year at CAS he was also as one among very few who were granted a post.doc.scholarship from the Norwegian Research Council.

## 8.3 Academic Activity

### 8.3.1 Introvert Activities

During the year the group established a weekly meeting place where participation was required but the style was informal and non-pretentious. The content varied from joint sheet reading of texts to discussions of papers in progress. It also created a sense of constantly ongoing process where newcomers were initiated into the ongoing work and added their own contribution to that of others. Joint social events and dinners also contributed to the community building.

The concluding three day symposium at the Academy of Science and Letters was also an internal affair where all group members over the year participated by giving a paper with ample time for discussion. Both the papers and the deliberative sessions were strategically aimed at making the project cohere sufficiently to hold a final collective volume together. This resulted in a further sharing of papers in progress for cross-reference, until the final versions are being submitting as this report is being written.

The number and titles of the papers presented at the symposium were almost identical to those listed for the collective publication, see below.

### 8.3.2 Extrovert activities

Two seminars were arranged both followed by a reception at The Centre for Advanced Study. The invitation was sent to colleagues, also doctoral students primarily in the Oslo area.

#### **Thursday November 9th, 15:00-19:00.**

Dr. István Czachesz presented a paper on “Animals, Metamorphoses, and Universal Ontology in Early Christian Literature” with Professor Ingvild S. Gilhus, University of Bergen as respondent. 12 persons participated

#### **Tuesday, February 13th, 15:00-19:00**

The Complexities of 1 Corinthians 15.35-57.

Introductions by Vigdis Songe-Møller, Troels Engberg-Pedersen, Jorunn Økland, Anders Lund Jacobsen (Aarhus University) and Hugo Lundhaug followed by discussion.

22 persons participated.

#### **Thursday, May 31<sup>st</sup>, at 18:00**

A Meeting with Denise Buell, Adela Collins, John J. Collins, and Karen King. Reception for Norwegian Colleagues.

18 persons participated.

### 8.3.3 Collaborative events

These events were effective in making the project known to a broader audience, and involved also doctoral students.

#### A. The 2006 Mowinckel Lecture at the Faculty of Theology, 25 September

Prof. John J. Collins, Yale University/CAS was invited to give the 2006 honorary Mowinckel Lecture. He spoke on *Mowinckel's 'He That Cometh' in Retrospect*. The lecture was followed by The Mowinckel Seminar the same day with John J. Collins: *Some Issues in the Study of Apocalyptic Literature* and Contributions also by Turid Karlsen Seim UiO/CAS and Outi Lehtipuu, Helsinki/CAS. The Mowinckel Lecture was presented in collaboration with The Metamorphoses Project at the Centre for Advanced Study, The Norwegian Academy of Science and Letters.



- B. Joint Conference with the Nordic PhD Network for the Study of Early Christianity in Greco-Roman Context, March 12.-14, 2007: *TRANSFORMATIONS OF GENDER IN EARLY CHRISTIANITY; THEORETICAL AND MATERIAL APPROACHES*.

The conference took place at the Academy of Science and Letters and focused on theoretical and thematic discussions of gender in the study of Early Christianity. Special emphasis was put on the new theoretical approach within history, “the linguistic turn,” represented by the work of Professor Elizabeth A. Clark, Duke University. Professor Clark has authored or co-authored eleven books. *Ascetic Piety and Women’s Faith: Essays on Late Ancient Christianity*, won the 1986 Adele Mellen prize for distinguished contributions to scholarship. Dr. Clark has been President of the American Academy of Religion, of the American Society of Church History, and of the North American Patristic Society. Other relevant books and articles: *Reading Renunciation: Asceticism and Scripture in Early Christianity*. Princeton: Princeton University Press, 1999. (420 pp.); “Women, Gender, and the Study of Christian History.” *Church History* 70 (2001): 395-426

**The following papers were read:**

**Elizabeth A. Clark**, Duke University: *Late Ancient Christian texts in light of “the Linguistic Turn.”*

**Jorunn Økland**, University of Sheffield /CAS, “*Noises from the Margin: What are Feminist Studies of Early Christianity for?*”

**Halvor Moxnes**, University of Oslo, “*Manly Eunuchs? Contradictions and gender ambiguity in Early Christianity*”

**Turid Karlsen Seim**, University of Oslo/CAS, “*The Mystery of the Two Becoming One Flesh. Readings of Gen 2.24 in the New Testament and Beyond*.”

**Antti Marjanen**, Helsinki University/CAS *Male Women Martyrs: the function of gender transformation language in Early Christian Martyrdom Accounts.*”

**Short presentations and discussions of PhD students’ projects:**

- Sissel Undheim, Bergen
- Rosie Ratcliffe, London

- Marianne Bjelland Kartzow, Oslo
- Rebecca Solevåg, Oslo
- Rikard Roitto, Linköping
- Andreas Westergren, Lund
- Carmen Cvetkovic, Durham
- Peder Solberg, Bergen
- Carmen Cvetkovic (St.Andrews/ Aarhus),
- Kirsten Hartvigsen (no paper) (UiO)
- Lars Erik Rikheim (UiO)
- Thorsten Rørbæk. (Aarhus)
- Lene Tegllund (Aarhus)

#### **Further participants From the CAS project group**

- Outi Lehtipouu, Helsinki/CAS
- Liv Ingeborg Lied, UiB/CAS
- Hugo Lundhaug, UiO/CAS
- Troels Engberg-Pedersen, Copenhagen/CAS
- Einar Thomassen, UiB/CAS

## **8.4 Publications**

### **8.4.1 Collective volume (Final title still pending)**

*Metamorphoses: Resurrection, Taxonomies and Transformative Practices in Early Christianity* (400 p.), Editors: Turid Karlsen Seim and Jorunn Økland, Publisher: DeGruyter

*Introduction by* **Turid Karlsen Seim** and **Jorunn Økland**

**Denise Buell, Williams College**

*What Changes and How? Instrumental Agency and Developable Bodies in Second Century Treatments of Conversion*

**István Czachesz, University of Groningen**

*Metamorphosis and Mind: Cognitive Explorations of the Grotesque in Early Christian Literature*

**Adela Yarbro Collins, Yale University**

*Ancient Notions of Translation, Apotheosis and Resurrection and the Empty Tomb Story in Mark.*

**John J. Collins, Yale University**

*The Angelic Life*

**Troels Engberg-Pedersen, University of Copenhagen**

*Transformation in 1 Corinthians 15 – a Philosophical Reading of Paul on Body and Spirit.*

**Karen L. King, Harvard University**

*Polymorphism, Death, and Immortality. Images of the “puer-senex” and the Aging Body in Ancient Christian Discourse of Immortality.*

**Outi Lehtipuu, University of Helsinki**

*“Flesh and Blood Cannot Inherit the Kingdom of God”. The Transformation of the Flesh in Early Christian Debates Concerning Resurrection.*

**Liv Ingeborg Lied, University of Bergen**

*Recognizing the Righteous Remnant? Resurrection, Recognition and Eschatological Reversals in 2 Baruch 47-52.*

**Hugo Lundhaug, University of Oslo**

*These are the Symbols and Likenesses of the Resurrection: Conceptualizations of Death and Transformation in the Treatise on the Resurrection (NHC I, 4)*

**Antti Marjanen, University of Helsinki**

*“Male Women Martyrs: The Function of Gender Transformation Language in Early Christian Martyrdom Accounts”*

**Samuel Rubenson, Lund University**

*As already translated to the Kingdom while still in the body. The Transformation of the Ascetic in Early Monastic Letters.*

**Turid Karlsen Seim, University of Oslo**

*Resurrection and Transformation in Luke-Acts: The Significance of Space*

**Vigdis Songe-Møller**

*With what kind of body will they come?*

*Metamorphosis and the Concept of Change: From Platonic Thinking to Paul's Notion of the Resurrection of the Dead.*

**Einar Thomassen, University of Bergen**

*Change and Unchangeability in Valentinian Soteriology.*

**Jorunn Økland, University of Sheffield**

*The Cybernetics of Resurrection Bodies: On Subjectivity, Continuity, and the Body in Paul's Corinthian Letters"*

**8.4.2 Academic activity for Turid Karlsen Seim (Group Leader)****Papers at international conferences:**

*Kjærlighet, kropp og kjønn i lys av Efeserne 5.21-33.* Nordisk patristikermøte, Lund, August 2006

*The Resurrected Body in Luke-Acts.* Annual Meeting of SBL/AAR in Washington DC, November 2006

*Keiser og Galileer – maktstrategier i Det nye testamente. En postkolonial lesning.* Løgumkloster, Danmark, Januar 2007 (to be published BIBLIANA, København 2008)

*The Mystery of the Two Becoming One Flesh. Readings of Gen 2.24 in the New Testament and Beyond.* Joint Conference CAS and The Nordic Network of Early Christianity in a Greco-Roman Context March 2007

*Taxonomy and Transformation. Another Look at 1 Cor15:38-41.* Annual Meeting of SBL/AAR in San Diego, November 2008 (based on research at CAS)

**Evaluation Assignments**

Referee (as member of the Editorial Boards) for ten articles submitted to the Journal of Biblical Literature and New Testament Studies.

Member of Evaluation Panel, Finnish Academy, Helsinki February 2007.

Chair of Evaluation Panel, Riksbankens Jubileumsfond, Stockholm April 2007.

Evaluation work related to membership in the Holberg Academic Committee and the Scientific Advisory Board of the University of Vienna.

## Publications

“I Jesu følge... En kommentar til Halvor Moxnes’ Hva er kristendom?” *Norsk Teologisk Tidsskrift* 108 (2007), 81-87

Book review (Ann Graham Brock, Mary Magdalene, the First Apostle: The Struggle for Authority) *Catholic Biblical Quarterly* 2007 (5 p. in print)

”Kjærlighet, kropp og kjønn. Efeserne 5.21-33 – tolkning og resepsjon” *Eros och agape: Barmhärtighet, kärlek och mystik i den tidiga kyrkan*. *Patristica Nordica* 7. Skellefteå: Artos (21 p. in print)

Entry on the Gospel of Luke in the *Cambridge Dictionary of Christianity*, ed. Daniel Patte (Cambridge University Press: forthcoming 2008)

“Resurrection Revisited. The Significance of a Spatial Perspective” *Complexity. Interdisciplinary Communications* 2006/2007. (Ed. Willy Østreng) Oslo: Centre for Advanced Study, forthcoming 2008

In progress:

*The Mystery of the Two Becoming One Flesh. Readings of Gen 2.24 in the New Testament and Beyond*, to be submitted to *Journal of Early Christian Studies* or *New Testament Studies*.

### 8.4.3 Further individual publications

#### Czachesz, Istvan:

*The Grotesque Body in Early Christian Literature: Hell, Scatology, and Metamorphosis*, Habilitationsschrift, University of Heidelberg, 2007 (pp. vi + 237).

“Early Christian Views on Jesus’ Resurrection: Toward a Cognitive Psychological Interpretation,” *Nederlands Theologisch Tijdschrift* 61 (2007), 47-59.

“Theory Forming in Biblical Studies: Contributions to an Interdisciplinary Dialogue,” in W. Østreng (ed), *Complexity. Interdisciplinary Communications* 2006/2007, Oslo: Centre for Advanced Study, in press.

Review of J.A. Draper (ed), *Orality, Literacy, and Colonialism in Antiquity* in *Journal for the Study of Judaism* 38 (2007), 368-370.

“Kontraintuitive Ideen im urchristlichen Denken,” in G. Theißen and P. von Gemünden (eds), *Erkennen und Erleben. Beiträge zur psychologischen Erfor-*

schung des frühen Christentums, Gütersloh: Gütersloher Verlagshaus, 2007, 197-208.

“Magic and Mind: Toward a Cognitive Theory of Magic, With Special Attention to the Canonical and Apocryphal Acts of the Apostles,” in T. Nicklas & Th.J. Kraus (eds), *Neues Testament und Magie: Verhältnisbestimmungen*, special issue of *Annali di Storia dell’Esegesi*, 2007, in press.

**Lehtipuu, Outi:**

“Biblical Body Language: Spiritual and Bodily Resurrection.” In *Anthropology in Context: Studies on Anthropological Ideas within the New Testament and its Ancient Context*. Eds. by M. Labahn & O. Lehtipuu. Leuven: Peeters, forthcoming 2008.

**Lied, Liv Ingeborg:**

“Land and Diaspora: Spatial Perspectives”. *Complexity. Interdisciplinary Communications* 2006/2007; *Interdisciplinary Communications* 2006/2007. (ed. Willy Østreng). Oslo: Centre for Advanced Study, forthcoming 2008

“The Other Lands of Israel: A Study of the Land Theme in 2 *Baruch*” (Dr.art. Thesis Bergen: Universitetet i Bergen, 2007), contracted for publication in *Supplements to the Journal for the Study of Judaism*, Brill (2008/9).

Work in progress:

“Scripture and/or Pseudepigrapha and/or Stories and Images? The Pseudepigrapha in Syria”, paper at symposium on *Stories and Images – The Bible in the Early Church: Antioch and Syria*, Lund September 2007.

**Lundhaug, Hugo:**

“In Her Nature She is a Woman’: Conceptual Blending in the Exegesis on The Soul (NHC II, 6),” in *Explaining Christian Origins and Early Judaism: Contributions from Cognitive and Social Science* (ed. Petri Luomanen, Ilkka Pyysiäinen, and Risto Uro; *Biblical Interpretation Series* 89; Leiden: Brill), in press.

“Cognitive Poetics and Ancient Texts,” in *Complexity* (ed. Willy Østreng; *Interdisciplinary Communications* 2006/2007; Oslo: Centre for Advanced Study), forthcoming 2008

Work in progress:

“Transformation and Redefinition: Resurrection of the Flesh in the Gospel Of Philip (NHC II, 3),” finished article, not yet submitted.

“Den kristnes oppstandelse som Kristus: Filipsevangeliets bruk av Johannesevangeliet og Første Korinterbrev,”

“Koptiske fortolkninger av 1 Kor 15:35-57

“The Exegesis on the Soul (NHC II, 6) and Fourth Century Egyptian Christianity.”

“The Gospel of Philip (NHC II, 3) and Fourth Century Egyptian Christianity.”

“Cognitive poetics and historico-religious (re)contextualisation: can the two approaches be constructively combined in the study of the Coptic versions of the Gos. Phil. and Ex. Soul and their function(s) within IVth-century Egyptian Christianity?”, prøveforelesning for dr. art. graden, Universitetet i Bergen, 06.06.07.

**Thomassen, Einar:**

“Forord.” *Judasevangeliet*, ed. R. Kasser, M. Meyer, G. Wurst, Oslo: Lille måne 2007, 7–9.

*Forthcoming:*

“Kjetteri i middelalderen: katarene.” Completed and to be published in a book of articles about Christian heresies edited by Tomas Hägg.

*L'Interprétation de la Gnose (NH XI,1)* (Bibliothèque Copte de Nag Hammadi). Commented edition together with Wolf-Peter Funk and Louis Painchaud. Revision of manuscript. To be published in 2008.

“From life cycle rituals to rituals of initiation.” Paper presented at the conference The Rites of Passage of the Life Cycle in Antiquity at the Getty Museum 20-21 April, 2007. Publication in a conference volume Is envisaged

**Økland, Jorunn:**

*Edited Books*

*Marxist Feminist Criticism of the Bible* (Jorunn Økland and Roland Boer (eds.); Sheffield; Sheffield Phoenix Press, forthcoming Dec. 2007).

*The Way the World Doesn't End: The Apocalypse of John in Culture and Ideology* (Jorunn Økland and William John Lyons (eds.); Sheffield; Sheffield Phoenix Press, forthcoming 2008).

### Articles

'Au commencement' – I begynnelsen eller i kjelleren? Irigaray, opphavsmyster og andre åpninger. *Agora: Journal for Metafysisk Spekulasjon* 1/2008 (in print)

Textual Reproduction as Surplus Value: Paul on Pleasing Christ and Spouses, in light of Simone de Beauvoir. *Marxist Feminist Criticism of the Bible* (Jorunn Økland and Roland Boer (eds.); Sheffield; Sheffield Phoenix Press, forthcoming Dec. 2007).

The Metamorphosis of a Corinthian Goddess: From Demeter to Ceres. In *Corinth in Context: Comparative Perspectives on Religion and Society* (Steven Friesen and Daniel Showalter (eds.); Cambridge, Mass.: Harvard University Press,) forthcoming 2008.

"The Transformation of Corinthian Goddesses". *Complexity. Interdisciplinary Communications* 2006/2007. (ed. Willy Østreng) Centre for Advanced Study, forthcoming 2008

Hva er det som står opp? *Nytt Norsk Kirkeblad* 3 (2007) 22-27.



## 9. Changing Family Patterns in Norway and Other Industrialized Countries: Determinants, Consequences and Projected Trends

Report by Nico Keilman and Øystein Kravdal  
Group leaders 2006/2007

### 9.1 Main goals

Norway and other industrialized countries have experienced massive changes in family behaviour over the last few decades: the age at marriage has increased, a larger proportion has remained unmarried, informal cohabitation has become more common, and rates of union disruption have escalated. At the same time, women got fewer children, and those who became mothers did so later in life. These changes are, of course, closely linked to each other. For example, people who do not live in a stable relationship usually do not want a child, and conversely, the childless may see little need to formalize a consensual union and they may find it easier to dissolve a relationship.

The intention of the project was to learn more about the reasons for and consequences of these changes in family changes, with special emphasis on the Norwegian setting. The drift away from the formal marriage has been particularly pronounced in Norway and other Nordic countries. Yet, fertility is relatively high. This situation makes Norway very interesting from an international perspective. In addition, the country has quite unique register data that allow detailed exploration of demographic behaviour. However, it would obviously also be important to contrast the development in Norway with that seen in other industrialized countries.

Another goal of the project was to develop better tools for analysing and forecasting future family patterns.

### 9.2 Group members

The participants in the project were:

Group leaders: Nico Keilman and Øystein Kravdal, University of Oslo

Chief research officer Arnstein Aassve, University of Essex

Professor Juha Alho, University of Joensuu

PhD student Hans Henrik Bull, University of Oslo

Professor Emily Grundy, London School of Hygiene and Tropical Medicine

Professor Hans-Peter Kohler, University of Pennsylvania

Research associate Iliana Kohler, University of Pennsylvania

PhD student and researcher Torkild Lyngstad, University of Oslo  
Post-doctoral fellow Sven-Erik Mamelund, University of Oslo  
Professor Michael Murphy, London School of Economics  
PhD student Anne Reneflot, University of Oslo  
Professor Ron Rindfuss, University of North Carolina and East-West Center,  
Honolulu  
Senior lecturer Wendy Sigle-Rushton, London School of Economics  
Research scholar Vegard Skirbekk, International Institute for Applied Systems  
Analysis Reader Fiona Steele, University of Bristol  
Professor Tapani Valkonen, University of Helsinki

Several other demographers – in Norway, Finland, Pennsylvania and North Carolina – were indirectly involved through co-operation with these participants.

### **9.3 Achievements**

More work was done on fertility, and less on other family changes, than originally intended. This was because the register data on cohabitation have more limitations than was assumed when the proposal to CAS was written, and because an attempt to get funding from the Norwegian Research Council for a special survey among cohabitants failed (in spite of extremely positive reviewer reports). In addition, the interests among some of the project participants had drifted more towards fertility.

Most of the work was based on Norwegian register data. Participants from other countries were very enthusiastic about the potentials of those data and wanted to use them rather than data from their own country (or other countries). Thus, less comparative work was done than originally planned, but we have learned more about Norway, and when the publications from the project appear, several researchers in this field may become aware of the potentials of the data, which may trigger further initiatives to analyse Norwegian family behaviour.

The methodological part of the project proceeded as planned. A method for stochastic family forecasts was developed, and as part of that, methodological papers on marriage markets and the two-sex problem were also written.

The results from the project are reviewed in more detail below.

## The high fertility in Norway

It is a common, but so far poorly substantiated, idea that good access to childcare – as part of a generally generous family policy – is an important reason for the relatively high fertility in the Nordic countries. The paper by Rindfuss et al. (2007a) supports this hypothesis: Women living in municipalities where many children are in day care have a higher chance of becoming mothers, and becoming mothers early, than other women. The analysis is based on Norwegian register data and a method that takes into account that there may be certain unobserved constant characteristics behind both a high day care coverage and fertility. A similar paper that also considers second, third and fourth births has been submitted (Rindfuss et al. 2007b).

Yet another example of Norway's generous family policies is the cash allowance that was introduced in 1998 to parents who could not find a place in a day care centre for their child, or who preferred to stay at home or use other types of child care. The amount is the same as the state subsidy for a child in day care. In principle, this arrangement will reduce childbearing costs for those who would stay at home anyway. Moreover, some women with low earnings or a strong preference for taking care of their child themselves may choose not to have their child in day care (feeling that they gain something from that), thus leaving slots to others who otherwise might have had to stay home (thus also benefiting). One would expect these advantages to have some effects on fertility, but no attempts had been made to assess such effects until Aassve and Lappegård (2007) did their work. They used a propensity score matching method, a method that is not (yet) very common in mainstream demography.

Norway is a very rich country, and ideas about gender equality and a strong public responsibility for individual well-being are well rooted in the population. This probably contributes to the high level of support to families, and especially to working mothers (and fathers). Accordingly, Myrskylä et al. (2007) showed that fertility currently is higher in the countries with the highest HDI indices (Human Development Index) than in those that score lower on this index. Southern European countries are among the latter, though it is not obvious that they would have followed the Nordic example if their incomes were higher. (Poor countries with very low HDI have, of course, the highest fertility.)

## The education-fertility relationship

The generous Norwegian policies are one set of factors behind the relatively high fertility. A second consequence of these policies may be that they contribute to reducing the educational differentials in fertility. Throughout the world, women with high education generally bear fewer children than the less educated. One reason, among several, is that they can earn higher incomes and thus have more to forego by staying home to care for a child. However, when it is possible to combine work and motherhood, by purchasing childcare at an almost fixed price, this contribution to the fertility gap becomes smaller. Based on Norwegian register data, which provide a rare opportunity to compare fertility differentials across several years, the paper by Kravdal and Rindfuss (2007) reports a progressively weaker negative relationship between education and fertility, both generally and for first, second and third births in particular. In addition, the paper includes a similar analysis for men, which has never been done before. Various possible behavioural mechanisms are discussed.

Such an analysis of long-term trends in the education-fertility relationship has to be based on information about the educational level at a quite high age, when reproduction is largely completed. This is because of limitations in the data. Unfortunately, this means that a negative relationship may be partly a result of a reverse causality: childbearing affects the opportunity for and interest in taking more education. For one of the birth cohorts considered, those born in 1964, this problem could be avoided by considering education at lower ages (as a time-varying explanatory factor in the statistical models). A paper by Kravdal (2007b) discusses the advantages and disadvantages of using this approach and presents interpretations of the education effect estimates that appear.

In work just started, Rindfuss et al. (2007c), take an international perspective. The authors have collected data from about 10 industrialized countries about the relationship between education and completed fertility, showing – as expected – a relatively weak relationship in Norway and other Nordic countries. Possible reasons for these differences are discussed in the paper.

A review paper on the same topic has been written by Skirbekk (2007a). He has done a meta-analysis of more than 300 papers dealing with the education-fertility relationship (based on a variety of measures and methods) in a diversity of settings, from year 1300 up to present time. Special attention is paid to the secular trend in the relationship. His conclusion accords with the Kravdal-Rindfuss idea about a narrowing of the educational gap in fertility over time.

## **Other fertility analyses**

There is increasing interest among demographers in the effects of social learning and influence on individual behaviour, and especially fertility. Lyngstad and Prskawetz (2007) have contributed to this literature by analysing how a person's chance of having a birth depends on whether a sibling has recently had a child.

## **Determinants of family behaviour**

Just like fertility, family behaviour is determined by a wide range of factors, such as individual socio-economic resources and preferences, norms, policies and the resources and demographic characteristics of other people. Lyngstad's PhD dissertation, which he submitted while he was at CAS, deals to a large extent with how a couple's chances of divorce are affected by the income and the education of the couple, as well as the education of their parents and of other people in the municipality where they live. Also the importance of the age structure in the municipality is addressed. In addition, the dissertation includes a paper – finished during the stay at CAS – about whether the death of a child influences the parents' divorce rate (Lyngstad 2007a). Since so few experience this sad event, the question is hard to answer without a large data material, such as that available from Norwegian registers. Obviously, this kind of research does not contribute to our knowledge about why disruption rates are on the upturn, but it adds to our general knowledge about family processes, and there may be a lesson to be learned for health personnel who try to help people who have lost a child.

Another paper in this research area, by Syse and Kravdal (2007), deals with the effect of cancer on divorce rates. This work is also based on Norwegian register data.

Lyngstad's dissertation has a summary that is more ambitious than usual: in addition to presenting his own core results and placing them within a broader perspective, he reviews all literature on divorce determinants since about 1990 (Lyngstad 2007b). This part, written entirely during the months at CAS, will soon be submitted to a journal as a review article.

Skirbekk (2007b) has done a quite different type of research. He has used data from value surveys in a wide range of countries to analyse the trends and differentials in people's reported attitudes to divorce and single motherhood. Such measures capture social norms and individual preferences (as well as perhaps earlier family behaviour). Recent trends in norms and preferences

may give us some ideas about what kind of family behaviour to expect in the future. The analysis also sheds light on the factors driving the changes in attitudes, such as secularization, which has often been considered a key force behind the family changes in industrialized countries.

### **Consequences of family and fertility patterns for people's health**

A large number of studies, some of them dating back to the 19<sup>th</sup> century, have shown a high mortality among men and women who are not married, although there is much uncertainty about the mechanisms involved. Almost nothing is known about the mortality among cohabitants. Some attention has also been paid to the effect that childbearing may have on women's mortality. In particular, there has been a strong interest in the health consequences of very early or very late childbearing, or of having many children in total. However, the existing evidence in this research area is rather mixed. Given the movement away from marriage, the later entry into parenthood and the decrease in completed fertility, such issues are obviously important.

Cohabitants are not generally identified in the Norwegian population register, but there is information about those who have a child together. This group turns out to have somewhat higher mortality than the married, according to a study by Mamelund (2007a). This analysis illustrates the importance of controlling well for the number of children and their age.

In two other investigations, the focus was on externalities: Does it matter whether *other* people are married? Using Norwegian register data, Kravdal (2007a) showed that there is no clear link between individual mortality and the proportion never-married or divorced in the municipality, contrary to some suggestions about a beneficial effect of being surrounded by many who are married. Since there are measurements at several points in time in each municipality, it is possible to control for unobserved constant factors that may affect both the family structure and mortality. This is shown to have some importance for the conclusion.

In a similar analysis based on Finnish data and a higher level of aggregation, Valkonen et al. (2007a) reach a similar conclusion. In that work, more complex indicators of community family structure are used, but a model without control for fixed unobserved factors is employed. During the work with the construction of the family structure variables, interesting regional patterns showed up, and inspired further ecological analysis of family patterns (Valkonen et al. 2007b).

The relationships between childbearing and mortality were analysed by Grundy and Kravdal (2007), who focused on ages 45-68, and Mamelund (2007b), who included also those aged 20-44 and addressed the importance of the child's current age in particular. An important and novel aspect of both studies is that men are included. Generally, if the effects are quite similar for men and women, the explanation is likely to lie in social factors (influenced by or influencing childbearing) rather than those related to the reproductive physiology. Not surprisingly, a low mortality appears among men and women who have recently had a child. Further, the studies confirm the high mortality among those who have become parents early. However, having a large number of children is not associated with a particularly high mortality, in contrast to the findings in most other studies. This may be yet another manifestation of the supportive Norwegian welfare society, or it may reflect that the high fertility is wanted to a larger extent than in other settings or that it is linked to for example religiosity rather than (unmeasured) low level of socio-economic resources.

The next step in this project will be to check whether these fertility effects differ by cause of death and whether short birth intervals are harmful.

Kravdal (2007c) takes a different perspective. He asks: Is people's mortality affected not only by whether they are married, but also by the educational level of the spouse? Whereas own education is a very well established mortality determinant, there is disagreement about the importance of the education of spouse, as well as that of parents' education. No one has studied the effect of siblings' and in-laws' education. Also, little attention has been paid to the importance of the average education in the community (whereas various aggregate economic variables have attracted much attention). The conclusion is that such education variables have a negative effect, if any, but that that own education is much more important. There is one exception, probably resulting from selection: having better-educated parents increases mortality.

Iliana Kohler's project also borders on this topic. She has used the large Norwegian register material to check regional variations in the seasonality of births over a 100-year period and the possible effect of month of birth on a person's mortality. These mortality variations, which may reflect nutritional factors, exposure to infection, or the existence of older siblings, turn out to be small (less than 3%).

Finally, Hans Henrik Bull has analysed the relationship between family situation and the chance of stillbirths. His recent PhD dissertation (defended while at CAS) had focused on marriage decisions in the rural parish of

Rendalen in the period 1750-1900. During his stay at CAS, he reanalysed part of the Rendalen data set and found that an unstable family relationship for a pregnant woman increased her chances of experiencing a stillbirth. Bull also demonstrated an inherited effect of stillbirths: being born to a mother who had experienced a stillbirth increased the risk for a woman of experiencing a stillbirth herself.

### **Other consequences of family changes**

In parallel with the sharp rise in divorce rates and in the increasing prevalence of consensual unions, which are even less stable than marriages, there has been a growing interest in the importance of union break-ups for the child's well-being. This has especially been the case in the US, where harmful effects have been reported in several studies. However, it is important to find out whether disruptions may be harmful also in a Nordic context.

Reneflot (2007a) describes and discusses the relationship between family experiences up to age 16 and the chance of taking education beyond the high school level. The focus is on children born to married couples between 1974 and 1979. Because of the large register material she is able to consider also groups experiencing rather rare events such as disruption followed by death of the other parent. More importantly, she checks whether disruption effects vary with the level of education of the parents. The main conclusion is that those who never experience disruption have almost twice as high chance of taking post-secondary education as the others, but that there are large variations among the latter. This is part of Reneflot's PhD dissertation. In another paper in the dissertation, which she also worked with while she was at CAS, she assesses the importance of these family structure indicators for the chance of having an early first birth, within or outside marriage (Reneflot 2007b).

It is widely accepted that such analyses of consequences of disruption are problematic because there are several factors that may affect both the chance of divorce and the various child outcomes, and that it is difficult to control well for these factors. In an attempt to solve this problem, Steele et al. (2007) used data similar to those used by Reneflot (2007a) but a multilevel-multiprocess approach. The educational outcomes for all children who have the same mother were assumed to be influenced by a common unobserved factor. Similarly, another unobserved characteristic was assumed to influence the chance of disruption for all marriages a woman is involved in. By estimating education and divorce models simultaneously and allowing these two unobserved factors to be correlated, one essentially controls for constant



unobserved mother-level factors that may have a bearing on both divorce and child's education. By using this method, the effect of divorce becomes weaker than that reported by Reneflot (2007a) and is quite similar to that of experiencing a parental death. In contrast to Reneflot's study, also earlier and later educational transitions are considered, but not the conditional effect of parents' education and not so many different types of disrupted families.

### **Stochastic forecast of family and household structure**

Forecasts of future family trends are important in a number of planning situations, for example housing, transport, and social security. In addition, analyses of other social trends benefit from reliable family projections, such as studies of labour market behaviour and consumption. Forecasts of families and households are traditionally deterministic – probabilistic versions of such forecasts are uncharted territory. Yet it is important to know how reliable statements about future family structures are. Alho and Keilman (2007b) designed a method for computing probabilistic family and household forecasts. They combined an earlier probabilistic forecast for the *population* of Norway with a model that predicts the probability that individuals are in specific family or household situations, given age and sex. They predict a further increase in the numbers of private households and of family households, but the predicted growth in lone parent families is much more uncertain than that of married couple families. In general, prediction uncertainty of population is smaller than uncertainty in the distribution of population subgroups over family and household positions. The approach that Alho and Keilman used can also be employed for developing other types of probabilistic demographic forecasts, for example forecasts of regional populations.

### **Other methodological contributions**

Family forecast models have traditionally been seen as an extension of population forecast models. Family forecast models are confronted with problems caused by pair formation and dissolution. The behaviour of two or more individuals has to be modelled simultaneously. The problem that arises here is known as the two-sex problem (pair formation) or consistency problem (family formation involving more than two individuals). The nature of the problem is well known and theoretical solutions have been proposed, but empirical applications include few behavioural aspects or are inconclusive. Alho and Keilman (2007a) have designed and tested a new method, which

deals with the inconsistencies between the two sexes. Murphy (2007), in a descriptive analysis of couples who married in Norway 1974-2002, shows an increasing variability over time in marriage behaviour.

#### **9.4 Workshop in April 2007**

All participants were invited to a workshop 19-20 April 2007 to present the work they had done at CAS. The following persons discussed the papers, which had been sent to them in advance:

- Associate professor Gunnar Andersson, Max Planck Institute for Demographic Research and Stockholm University
- Professor Gabrielle Doblhammer, Max Planck Institute for Demographic Research and Rostock University
- Professor Henriette Engelhardt, University of Bamberg
- Professor Jan M. Hoem, Max Planck Institute for Demographic Research
- Professor Aat Liefbroer, Netherlands Interdisciplinary Demographic Institute
- Professor Frans van Poppel, Netherlands Interdisciplinary Demographic Institute
- Director Jose Antonio Ortega, Population Division, United Nations
- Senior researcher Marit Rønsen, Statistics Norway
- Professor Elizabeth Thomson, University of Stockholm and University of Wisconsin

#### **9.5 Plans for future co-operation**

The researchers at CAS have concrete plans about further co-operation. For example, Alho and Keilman will continue their work together on stochastic forecasting, and Kravdal will do more work with Rindfuss (and others in North Carolina) on fertility and with Emily Grundy on the link between mortality and fertility. In addition, co-operation with other British participants is very likely (Aassve, Sigle-Rushton, Steele), and Kravdal and H.-P. Kohler plan to use information (from the Norwegian Institute of Public Health) about di-zygotic twins to identify various effects in models for fertility and family behaviour.

To facilitate such co-operation and increase the chance of a successful completion of the projects started at CAS, all participants – as well as the discussants in the 2007 workshop – will be invited to a workshop in the spring 2008.

## 9.6 The potential to attract international interest

Much of the work done at CAS has the potential to attract international interest and influence and stimulate future research. For example, some studies illustrate the value or limitations of various statistical approaches, and may therefore have implications for the way future analyses are designed (Steele et al. 2007; Aassve and Lappegård 2007; Alho and Keilman, 2007b; Kravdal 2007ab). One study deals with a methodological problem in formal demography that has been on the agenda for several decades (Alho and Keilman 2007a). Other contributions have policy implications that should be of broad interest (Rindfuss et al 2007ab, Aassve and Lappegård 2007; Steele et al 2007) or argue that certain questions deserve more attention than they currently attract (Kravdal and Rindfuss 2007; Kravdal 2007c). Some also contribute to shed doubt on existing ideas about empirical regularities (Valkonen et al. 2007ab; Kravdal 2007a; Grundy and Kravdal 2007), or are summaries that may be quoted by many researchers in the future (Lyngstad 2007b; Skirbekk 2007a). The influence of the papers depends of course on the publication channels. Some have already appeared or been accepted for publication in top journals, or encouraging invitations to resubmit have been received (see *Demography*, *American Journal of Epidemiology*, or *American Sociological Review* in the literature list below). Others have been submitted to such journals, or this will soon be done.

Finally, it should be noted that publication of a large number of studies based on Norwegian register data may make colleagues in other countries more conscious about the potentials of those data. If they start using them, we will learn more about the Norwegian society, and the construction of even better data may be stimulated. In addition, other researchers' use of Norwegian data may be a source of inspiration for Norwegian demographers.

## 9.7 The group leaders' other commitments

Keilman and Kravdal could not spend all their time on the project. Keilman is sole editor of a journal, Kravdal is co-editor of another journal, they have served on evaluation committees, and they have had graduate students to supervise.

## 9.8 Publications

The following publications are based on work done while the authors stayed at CAS (finished at CAS, started at CAS, or both).

### 9.8.1 Published

Rindfuss, R.R. D. Guilkey, S.P. Morgan, Ø. Kravdal, B.K. Guzzo. 2007a. Child care availability and first birth timing in Norway. *Demography* 44: 345-372.

Kravdal, Ø. 2007a. A fixed-effects multilevel analysis of how community family structure affects individual mortality in Norway. *Demography* 44: 519-536.

Syse, A. and Ø. Kravdal 2007. Does cancer affect the divorce rate? *Demographic Research* 16: 469-492. Available online at [www.demographic-research.org/Volumes/Vol16/15/](http://www.demographic-research.org/Volumes/Vol16/15/)

### 9.8.2 Accepted for publication

Kravdal, Ø. 2007b Effects of current education on second- and third-birth rates among Norwegian women and men born in 1964: Substantive interpretations and methodological issues. Forthcoming in *Demographic Research*

Kravdal, Ø. 2007c. A broader perspective on education and mortality: Are Norwegian men and women influenced by *other* people's education? Forthcoming in *Social Science and Medicine*.

Grundy, E. and Ø. Kravdal. 2007. Reproductive history and mortality in late middle age among Norwegian men and women. Forthcoming in *American Journal of Epidemiology*

### 9.8.3 In the re-submission stage

Kravdal, Ø. and R.R. Rindfuss. 2007. Changing relationships between education and fertility – a study of women and men born 1940-64. Re-submission to *American Sociological Review*

Steele, F., W. Sigle-Rushton and Ø. Kravdal. 2007. Consequences of Family Disruption for Children's Educational Outcomes in Norway. Re-submission to *Demography*.

Lyngstad, T. and A. Prskawetz. 2007. Is fertility influenced by whether a sibling has just given birth? Re-submission to *Demography*

#### 9.8.4 Submitted

Lyngstad, T. 2007a. Bereavement and divorce: Are parents who lost a child more likely to split up?

Alho, J. and Keilman, N. 2007a. On nuptiality in coherent two-sex stable populations

Skirbekk, V. 2007a. Fertility trends by social status, globally 1270-2005

Aassve, A. and T. Lappegård Evaluation of cash-benefit reform on timing of women's fertility

Rindfuss, R.R, D.K. Guilkey, S.P. Morgan and Ø. Kravdal. 2007c. Child care and completed fertility in Norway.

#### 9.8.5 Soon submitted

Alho, J. and N. Keilman. 2007b On future household structure.

Kohler I. and H.-P. Kohler. 2007. Birth month mortality puzzles in Norway.

Myrskylä, M., Kohler H.-P. and F. Billari. 2007. Human development and low fertility.

Lyngstad, T. 2007b. What we know about divorce determinants. A review of studies since 1990.

Mamelund, S.E. 2007a. Does cohabitation confer less protection? A study of mortality based on Norwegian register data 1990-2002.

Mamelund, S.E. 2007b Does parenthood affect mortality? A study of Norwegian men and women aged 20-67 in the years 1971-2002

Murphy, M. 2007. One marriage market or many?

Reneflot, A. 2007a. Family dissolution and children's educational attainment: the Norwegian story

Reneflot 2007b. Childhood family structure and family formation in early adulthood in Norway.

Skirbekk, V. 2007b Attitudes towards divorce, single motherhood and homosexuality:  
Determinants and trends at the national and individual level

Valkonen T., J. Blomgren, T. Kauppinen, P. Martikainen, and E. Maenpaa. 2007a. The effects of regional differences in the prevalence of new family patterns on male mortality in Finland.

#### 9.8.6 Papers in progress

Rindfuss, R.R., Ø. Kravdal and S. Hayward. 2007b. A comparison of the education-fertility relationship across countries.

Valkonen T., J. Blomgren, T. Kauppinen, P. Martikainen, and E. Maenpaa. 2007b. An ecological analysis of family patterns.

Bull, H.H. 2007. Families at risk. Factors affecting still births in Rendalen.

## 10. Spin and Charge Flow in Nanostructures

Report by Arne Brataas and Asle Sudbø  
Group Leaders 2006/2007

### 10.1 Introduction

Information and communication technologies will revolutionize the society by enhancing the information density of memories and speed of data transfer of hand-held equipment by two orders of magnitude. The next-generation data storage and logic circuits require smaller and faster devices that consume less power, operate with higher reliability and provide new functionalities like non-volatile updatability. Nanotechnology promises to fulfill these demands by designing sensors and devices based on novel physical phenomena. Our project aims to increase our fundamental understanding of transport in nano-scale devices.

Research in theoretical physics has no national boundaries. Nanotechnology is a very competitive field of research. The activity in our research group at CAS brought together world-leading researchers working on the fundamental electronic properties of spintronic, superconducting and semiconducting devices. We believe that this has brought invaluable knowledge on the fundamentals of nanotechnology to Norway.

We further believe the research carried out at CAS during 2006/2007 in our group has set us in an excellent position to continue competing at a high international level.

### 10.2 Members of the group

The following researchers have been members of the research group:

- Arne Brataas (group leader), Professor, Norwegian University of Science and Technology.
- Asle Sudbø (group leader), Professor, Norwegian University of Science and Technology.
- Egor Babaev, Assistant Professor, KTH Stockholm, Sweden.
- Gerrit Bauer, Professor, Delft University, The Netherlands.
- Wolfgang Belzig, Professor, Konstanz University, Germany.
- Yaroslav Blanter, Professor, Delft University, The Netherlands.
- Coon-Saar Chu, Professor, National Chiao Tung University, Taiwan.
- J. Carlos Egues de Menezes, University Sao Paolo, Brazil.

- Yuri Galperin, Professor, University of Oslo, Norway.
- Steven M. Girvin, Professor, Yale University, USA.
- Igor F. Herbut, Professor, Simon Fraser University, Canada.
- Walter Hofstetter, Professor, Johann Wolfgang Goethe Universitaet, Frankfurt, Germany.
- Jürgen König, Professor, Ruhr-Universität Bochum, 44780 Bochum, Germany.
- Alan H. MacDonald, Professor, University of Texas at Austin, USA.
- Sadamichi Maekawa, Professor, Tohoku University, Japan.
- Anatolii Malshukov, Professor, Russian Academy of Science, Russia.
- Shuichu Murakami, Assistant Professor, University of Tokyo, Japan.
- Jan Martinek, Researcher, Polish Academy of Science, Poznan, Poland.
- Yuli Nazarov, Professor, Delft University, The Netherland.
- Flavio S. Nogueira, Assistant Professor, Freie Universitaet Berlin, Germany.
- Gil Refael, Assistant Professor, California Institute of Technology, USA.
- Bernd Rosenow, Professor, University of Cologne, Germany.
- Anders Sandvik, Professor, Boston University, USA.
- John Schliemann, Professor, Universitaet Regensburg, Germany.
- Fabricio M. de Souza, Professor, Instituto de Estudos Superiores da Amazona, Brazil.
- Gen Tatara, Professor, Tokyo Metropolitan University, Japan.
- Zlatko Tesanovic, Professor, Johns Hopkins University, USA.
- Yaroslav Tserkovnyak, Assistant Professor, UC Los Angeles, USA.
- Chandra M. Varma, Professor, UC Riverside, USA.
- Xavier Waintal, Researcher, CEA, France.
- Mats Wallin, Professor, KTH Stockholm, Sweden.
- Gergelyi Zarand, Professor, Budapest, Hungary.
- Malek Zareyan, Professor, Inst. For Advanced Studies in Basic Sciences, Zanjan, Iran.

In total, 14 nations have been represented as member of the group.

In addition to these members of the group, we have has short visits to CAS by postdocs and PhD students from NTNU: Dr. Daniel Huertas Hernando, Dr. Steinar Kragset, Martin Grønsløth, Jan Petter Morten, Kjetil Børkje, Eskil Kulset Dahl, Jørn Foros, Hans Joakim Skadsem, and Jacob Linder.



### 10.3 Workshops, meetings, and seminars

The project has organized two major workshops during its stay.

- A) EU SFINX workshop. The group leaders are also member of the EU 6. Framework “SFINX” STREP project and organized a workshop for SFINX and CAS members on March 1-2, 2007 at CAS. In addition to the scholars present at CAS, 12 SFINX members participated. There were 11 talks on topics ranging from ferromagnetism and Coulomb interaction in quantum-dot spin-valves, chemical order and interface effects on clusters magnetic anisotropy, spin polarized tunneling, graphene, superconductor-ferromagnet systems, thermal spin transfer-torque and thermopower in metals.
- B) SPINOR 2007, Spin and charge flow in nanostructures, June 27-30, 2007. This workshop had participation from 36 researchers from 13 countries, and 34 talks were given. Topics included, but were not limited to: spin transfer in metallic nanostructures, microscopic theory of current-driven magnetization dynamics, thermally assisted current-driven domain-wall motion, novel magnetic order in high-temperature superconductors, quantum critical fluctuations and d-wave pairing in cuprates, magneto-Coulomb effects in single nanoparticle connected to magnetic electrodes, ultrasmall magnets, nuclear spin ferromagnetic phase transitions, magnon-assisted long-range superconducting proximity effect in half-metallic ferromagnets, spin and charge transport in 2DEG with spin-orbit interaction, spin current and non-local spin Hall effect, counting statistics of a superconductor-ferromagnet entangler, and deconfined quantum-critical point in a 2D Heisenberg model.
- C) The project group is planning a follow-up conference for the summer of 2008 where roughly 35 invitees are expected to disseminate results that have sprung out of their stay at CAS during the academic year 2006/2007.

### 10.4 Research results

The research results have been published in a number of papers, and some are in press or in preparation. It is expected that there will be a flow of papers stemming from the research at CAS in our group during 2006/2007 at least for the next year or two. The following is an overview of the themes addressed by the research group “Spin and Charge Flow in Nanostructures”. For a detailed list of publications, we refer to Section 6.

#### 10.4.1 Spin transport in normal metals, ferromagnets, and (ferromagnetic) semiconductors

Technological needs and scientific curiosity are going to drive the miniaturization of magnetic structures into the mesoscopic and nanoscopic regimes in which the basic physics has still to be explored. Theoretical understanding has progressed to the stage where materials-specific predictions can be made. More recently, the study of the dynamics of the magnetization vectors in the presence of charge and spin currents is increasing.

We have contributed to the fundamental understanding of spin transport and magnetization dynamics in nano-scale normal metals, ferromagnets, and semiconductors. In particular, we have considered how an electric current can initiate a motion of the magnetization direction in nano-scale ferromagnet. An improved understanding of this phenomenon is important for all use of nano-scale ferromagnets, for example in future magnetic RAM.

One of the surprising discoveries we have made is that the critical current for when the domain wall starts its motion is much less in III-V ferromagnetic semiconductors than in the conventional ferromagnets Co, Ni, and Fe. This could be of technological importance.

Additionally, we have contributed to an improved understanding of magnetization dissipation and the spin-orbit interaction in normal metals, ferromagnets, and semiconductors. Magnetization dissipation is often introduced phenomenologically while a detailed knowledge of the microscopic origin is lacking. We have made some progress in formulating a linear response theory of the magnetization dissipation in terms of the microscopic parameters. We have also developed theories for magnetization dissipation in current-driven domain wall motion experiments that is in reasonable good agreement with state-of-the-art experiments.

We have also contributed to the understanding of the interplay between spin-transport and Coulomb blockade effects, spin Hall effects, and entanglement in solid state systems. The spin Hall effect is the spin analogue of the Hall effect. The Hall effect denotes the phenomenon that when a system is biased by a longitudinal electric field, a magnetic field can set up a transverse potential. Similarly, the spin-orbit interaction can produce a transverse spin accumulation in response to a longitudinal electric current flow. We have made impact in the field by considering the spin Hall effect in two-dimensional electron gases that can be realized in semiconductor hetero-structures and in other novel materials.

#### 10.4.2 Quantum transport in ferromagnetic, and non-centrosymmetric, and strongly correlated superconductors.

We have investigated in detail conductance spectra and tunnelling characteristics of both spin-and charge flow in hybrid structures of superconductors, metals, and ferromagnets. It has been shown in a number of different settings that dissipation-free charge as well as spin current can be manipulated by a magnetic field, unlike the situation in a conventional superconductor/metal structure.

We have investigated the details of induced spin triplet pairing in a conventional superconductor by the proximity to a ferromagnet, and how this induced spin-triplet pairing affects conductance spectra. This is very useful in determining the symmetry of the superconducting gaps in magnetic superconductors and in superconducting/magnetic systems. The symmetry of the superconducting gap is one of the basic issues to understanding novel superconductivity in a material.

We have set up a general mean-field theory for superconductors exhibiting multiple other broken symmetries, such as ferromagnetism and lack of inversion symmetry. The mean field theory is complicated, but we have succeeded in deriving mean-field stationary self-consistent coupled equations for all the order parameters of the problem, and solved them in special cases. This includes a detailed study of thermodynamic quantities of a ferromagnetic superconductor that has hitherto not been carried out before. For example, we have found a novel anomaly in the specific heat at the lower transition where the minority spin becomes superconducting. Moreover, as a new hallmark of coexistence of ferromagnetism and spin-triplet superconductivity, we have found that when the system goes superconducting, it develops an anomaly in the specific heat which features a non-universal jump which depends on magnetization.

We have further considered tunneling between a spin-singlet superconductor with d-wave symmetry, and graphene. Graphene and high-temperature superconductors share a superficially similar peculiar feature of their electronic structure, namely gapless fermionic excitations only at specific points in the Brillouin-zone. In high-temperature superconductors this is a feature of their d-wave superconductivity and persists when the system is doped, while in graphene it is a consequence of the band-structure and is special to the half filled undoped case. We have found novel oscillations at sub-gap energies in the tunnelling spectra of hybrid structures of this system. These novel oscillations are due to the possibility of having undamped

“relativistic” electrons inside a tunnel barrier, unlike non-relativistic particles. This possibility relates directly to the linear-in-momentum dispersion relation of these relativistic electrons. There, this sheds light on the so-called Klein paradox, much discussed in the current literature. The Klein paradox is precisely the phenomenon that a relativistic particle wave can penetrate through a high barrier where a non-relativistic matter wave would be rapidly damped out. It must be emphasized that the electrons in high-temperature superconductors and graphene are not really relativistic in the sense of moving extremely rapidly. Quite the contrary, the “relativistic” feature of these electrons emerges as a low energy phenomenon. Very close to the Fermi nodes in these materials, the electrons have an energy-momentum relation which is linear, precisely like massless relativistic particles. Hence, this is an interesting and fascinating example of an emergent symmetry, in this case emergent Lorentz-invariance.

## 10.5 The research in a larger perspective

Quite recently, a new field, nanotechnology and mesoscopic physics, has emerged. The word mesoscopic originates from mesos, meaning something in between. Small systems whose dimensions are intermediate between the microscopic and macroscopic are called mesoscopic. Developments in nanotechnology make it possible to realize electronic circuits that are as small as 10 nm. In order to incorporate these systems into modern technologies, it is necessary to understand the physical properties via fundamental research. Researchers are therefore trying to understand the physical properties of systems that are not as small as a single atom, but small enough that the physical properties can be dramatically different from those in a large macroscopic chunk of material. Mesoscopic systems display a variety of physical effects that have needed new or improved theoretical models to describe them. For systems smaller than the inelastic scattering length, quantum size effects in small particles and quantum interference between strongly coupled particles give rise to new phenomena. The discrete electrostatic energy of a small system by the addition of a single electron governs the transport properties at low voltages, a phenomenon known as the Coulomb blockade effect. Quantum confinement creating low-dimensional systems leads to novel physics like the quantum Hall effect and fractional quantum Hall effect awarded with two Nobel Prizes in physics the last two decades. From a theorist’s point of view, mesoscopic systems are laboratories for how electrons propagate in a solid. The parameters of the system are rather well controlled and allow fundamental studies on a series of experimentally controllable feasibility models.

An electron has a spin as well as a charge. It has been shown both in tunnelling experiments from ferromagnets into superconductors and in similar all metal spin devices, that electrons flowing through a ferromagnet acquire some degree of spin polarization. When these electrons are sent into a paramagnetic material, they induce a non-equilibrium magnetization in the paramagnet. Spin-injection refers to a spin-polarized current from a ferromagnet into another material. The non-equilibrium magnetization can be detected by another ferromagnetic contact probe. It is expected that the spin-injection in mesoscopic systems will provide new interesting physical effects that can shed light on fundamental thermodynamic quantities, spin-precession in various systems and contribute to the understanding of transport processes.

Recently, it has been realized that the spin of the electron provides new functionalities in electronics applications. The giant magneto resistance (GMR) in magnetic metallic multilayers discovered less than 15 years ago, has very recently been applied to magneto-resistive read heads for hard disks in high-end desktop computers. The GMR derives from spin-dependent scattering by defects and interfaces. Devices that use the spin of the electron rather than only its charge have been coined “spintronic” circuits in the spirit of conventional electronics. However, the energy dissipation caused by controlling the magnetization by external magnetic fields of the Oersted field of moving charges is a major obstacle to further progress. In order to advance MRAM technologies and to develop new devices such as magneto-electronic circuits, novel principles /functionalities are called for.

It is in this wider perspective it is fruitful to view our research project at CAS. One goal of the research project at CAS was to make a contribution towards a breakthrough by introducing magneto-electronic circuits and devices with new AC characteristics. To this end, fundamental studies of spin-current driven magnetization reversal and control of spin accumulation and spin-injection in metals, as well as quantum transport in hybrid structures of ferromagnets and superconductors, were among the themes studied during our year at CAS.

It must be mentioned, that the Nobel Prize in physics for 2007 was awarded to Albert Fert and Peter Grünberg “**for the discovery of Giant Magnetoresistance**”. As mentioned above, GMR derives from spin-dependent scattering from defects and interfaces, or in other words spin-dependent transport. This discovery is the effect underlying data storage on most modern harddisks, and as such has had tremendous impact. From a more fundamental physics point of view, the discovery heralded the start of the

research field “spintronics”. There is therefore little doubt that the overarching research theme in our group at CAS during 2006/2007 represents a vibrant and growing field in contemporary condensed matter physics.

Another important effect of the activities of the research group is the network-building effect it has had. Several new collaborative projects have sprung out of the collection of so many scientists during this period. We hope and believe that this has led to long-term lasting collaborations between Norwegian and foreign scientists. In a more short-term perspective, we also believe that the research group in a significant manner has contributed to further enhancing the international stature of Norwegian condensed matter physics.

## 10.6 Published results

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### 10.8 Papers in preparation

A. A. Clerk, M. H. Devoret, S. M. Girvin, F. Marquardt, R. J. Schoelkopf, "Introduction to quantum noise, measurements and amplification", to be submitted to Rev. Mod. Phys.

J. P. Morten, A. Brataas, G. E. W. Bauer, W. Belzig, and Y. Tserkovnyak, "Pure spin flow through a superconductor".

K. Børkje and A. Sudbø, "Effective quantum field theory for fluctuating circulating currents in high-T<sub>c</sub> cuprates", to be submitted to Phys Rev Lett.

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