



*The Swedish Research Council for Environment,
Agricultural Sciences and Spatial Planning*



Vetenskapsrådet

MID-TERM EVALUATION REPORT OF THE 2006 LINNÆUS ENVIRONMENTS AND DOCTORAL PROGRAMMES

**MID-TERM EVALUATION REPORT OF
THE 2006 LINNÆUS ENVIRONMENTS
AND DOCTORAL PROGRAMMES**

Commissioned by the Swedish Research Council and Formas

MID-TERM EVALUATION REPORT OF THE 2006 LINNAEUS ENVIRONMENTS AND DOCTORAL PROGRAMMES

SWEDISH RESEARCH COUNCIL

VETENSKAPSRÅDET

Box 1035

101 38 Stockholm, SWEDEN

© Swedish Research Council

ISBN 978-91-7307-207-6

PREFACE

The Linnaeus Grant is an initiative of the Swedish Research Council and the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas) to support strong research centres at Swedish universities. This report presents the result of the midterm evaluation of the 20 Linnaeus Environments and eight Doctoral Programmes approved in 2006. The international evaluation panels give in the report a number of recommendations for further development and financial support.

On behalf of the Swedish Research Council and Formas we hereby would like to express our deepest gratitude to the panels for their thorough work, devoting their time and expertise.

Stockholm June 2012

Mille Millnert
Swedish Research Council
Director General

Rolf Annerberg
Formas
Director General

CONTENTS

SAMMANFATTNING	7
EXECUTIVE SUMMARY	9
1. INTRODUCTION	11
2. EVALUATION CRITERIA AND INDICATORS	14
2.1 Criteria and indicators for the Linnaeus Environments	14
2.2 Criteria and indicators for the Linnaeus Doctoral Programmes	15
3. OVERALL ASSESSMENT OF THE ENVIRONMENTS AND DOCTORAL PROGRAMMES	16
4. ASSESSMENT OF EACH ENVIRONMENT	18
4.1 Engineering	18
4.1.1 ACCESS Linnaeus Center – Autonomic Complex Communication nEtworks, Signals, and Systems (KTH)	18
4.1.2 ACCESS Doctoral Programme	21
4.1.3 Linné FLOW Centre. A Blueprint for Future Flow Research (KTH)	22
4.1.4 Linköping Linnaeus Initiative for Novel Functional Materials (LiLi-NFM)	25
4.1.5 Linnaeus Centre of Engineered Quantum Systems (LINNEQS)(Chalmers/Gothenburg)	28
4.1.6 LINNEQS Doctoral Programme	31
4.1.7 Nanoscience and Quantum Engineering at Lund University (NanoQE)	33
4.1.8 NanoQE Doctoral Programme	35
4.2 Humanities, Social Sciences and Educational Sciences	37
4.2.1 Stockholm University Linnaeus Center for Integration Studies (SULCIS)	37
4.2.2 Ageing and Living Conditions (ALC) at Umeå University	40
4.2.3 ALC Doctoral Programme	43
4.2.4 Learning, Interaction, and Mediated Communication in Contemporary Society (LinCS) (University of Gothenburg)	45
4.2.5 Centre for Economic Demography (CED) at Lund University	49
4.2.6 CED Doctoral Programme	53
4.2.7 Innovation, Entrepreneurship and Knowledge Creation: Dynamics in Globalising Learning Economies – Linnaeus Research at LUCIE (Lund University)	55
4.3 Medicine	60
4.3.1 Developmental Biology for Regenerative Medicine (DBRM) (Karolinska Institutet)	60
4.3.2 DBRM Doctoral Programme	63
4.3.3 TARGET – A Cancer Research Network (Karolinska Institutet)	65
4.3.4 The Neuronano Research Center (NRC) at Lund University	68
4.3.5 Hemato-Linné at Lund University	72
4.3.6 Hemato-Linné Doctoral Programme	75
4.3.7 Lund University Diabetes Centre (LUDC)	77
4.4 Natural Sciences	82
4.4.1 The Bert Bolin Centre for Climate Research (BBCC) (Stockholm University)	82
4.4.2 BBCC Doctoral Programme “Climate Research School”	85
4.4.3 Uppsala RNA Research Center (URRC)	86
4.4.4 Insect Chemical Ecology, Ethology and Evolution (IC-E3) (Swedish University of Agricultural Sciences, Alnarp)	89

4.4.5 Organizing Molecular Matter (OMM) (Lund University).....	93
4.4.6 Exploring and Controlling the States of Matter with Light – Multidisciplinary Laser Spectroscopy within the Lund Laser Centre (LLC) (Lund University).....	95
5. MAIN CONCLUSIONS AND RECOMMENDATIONS.....	99
5.1 The General Expert Panel’s Conclusions and Recommendations on the Level of the Support.....	99
5.2 Recommendations to the funding agencies.....	102
APPENDIX 1: SCHEDULE PANEL WEEKS	
APPENDIX 2: INSTRUCTIONS SITE VISITS	
APPENDIX 3: SELF EVALUATION REPORT INSTRUCTIONS LINNAEUS ENVIRONMENTS	
APPENDIX 4: SELF EVALUATION REPORT INSTRUCTIONS LINNAEUS DOCTORAL PROGRAMMES	
APPENDIX 5: LIST OF PANEL MEMBERS	
APPENDIX 6: LIST OF ACRONYMS	

SAMMANFATTNING

(Översättning av Executive Summary)

Denna rapport är resultatet av halvtidsutvärderingen av Vetenskapsrådets och Formas Linnébidrag. Bidraget syftar till att utveckla strategiska och internationellt konkurrenskraftiga forskningsgrupper vid svenska universitet. Tjugo Linnémiljöer och åtta forskarskolor beviljades 2006 finansiering för en tioårsperiod.

Utvärderingsprocessen bestod av flera steg, där det i varje steg prioriterades att få processen så transparent och effektiv som möjligt. Alla miljöer och forskarskolor ombads skicka in en självvärderingsrapport som strukturerats utifrån ett antal förutbestämda kriterier. Självvärderingsrapporten granskades av internationella experter som gjorde en preliminär bedömning. Vid ett flertal telefonkonferenser förtydligade och operationaliserade de internationella experterna bedömningskriterierna och planerade platsbesöken. I februari 2012 besöktes alla Linnémiljöer under en hel dag av respektive expertpanel. Under platsbesöket intervjuades miljöns ledning, representanter för de forskargrupper som ingår i miljön, en grupp med doktorander som ingår i eller är knutna till miljön, samt universitetsledningen.

Fem expertpaneler bildades för att utvärdera Linnémiljöerna och forskarskolorna: fyra ämnesorienterade paneler som bestod av fyra till fem medlemmar vardera för Linnémiljöer inom teknikvetenskap, humaniora, samhälls- och utbildningsvetenskap, medicin och naturvetenskap. Dessutom bildades en generalistpanel som bestod av ordförandena för de ämnesorienterade panelerna samt ytterligare fyra experter. De ämnesorienterade expertpanelerna ansvarade för utvärderingsrapporterna för varje enskild Linnémiljö inom sitt område, medan generalistpanelen hade ett övergripande ansvar för rapporten och rekommendationerna till Vetenskapsrådet och Formas.

Huvudkriterierna för utvärderingen av Linnémiljöerna var vetenskaplig kvalitet, mervärde, dynamiska effekter, framtida potential, organisation och ledarskap, nationella och internationella samarbeten, genusaspekter, metoder för spridning av forskningsresultat och kommunikationsstrategier. Forskarskolorna bedömdes utifrån organisation och ledning, rekryteringsformer, genomslagskraft, programinnehåll, framtida potential och hur de utexaminerade doktorernas karriärer hade gestaltat sig.

Panelerna var mycket imponerade av den genomgående höga kvalitet och internationella konkurrenskraft som präglar forskningen som bedrivs inom ramen för Linnémiljöerna. Vissa miljöer har tveklöst uppnått världsklass. Panelerna är övertygade om att Linnébidragen är värdefulla i flera avseenden. De skapar möjligheter till långsiktig strategisk forskning som i hög utsträckning ligger i yttersta framkant inom respektive ämnesområde, och som ibland är innovativ och risktagande, vilket gör hög pay-off mycket trolig. Detta kan inte uppnås inom ramen för kortsiktig finansiering. Vidare har Linnébidraget haft en hävstångseffekt; det har attraherat ytterligare bidrag och finansiering från tredjepart, som ofta vida överstiger Linnébidraget. Slutligen har arbetsformen med interdisciplinära grupper höjt effektiviteten i forskningen. På ett övergripande plan har Linnéstödet bidragit till att ytterligare höja såväl miljöernas som värduniversitetens anseende, och därigenom gjort dem attraktiva för toppforskare från hela världen.

En annan central strategisk nytta med Linnébidragen är, vilket i synnerhet gäller forskarskolorna som är knutna till åtta av miljöerna, att de effektivt underlättar processen att rekrytera, stödja och utveckla unga forskare. De flesta Linnémiljöer är framgångsrika i att fostra en framtida generation av forskare i världsklass och många har lyckats förbättra könsbalansen avsevärt.

Panelerna har emellertid också hittat vissa svagheter. Alla miljöer borde uppmanas att omnämna Linnébidraget i sina publikationer och på sina webbplatser. Vissa miljöer uppvisar bristfälligt ledarskap och saknar en strategisk vision. Större miljöer tenderar att klara sig bättre om de har en person som administrerar bidraget och annan finansiering från tredjepart, som handleder skrivandet av nya ansökningar och ansvarar för spridningen av information och forskningsresultat till allmänheten. Därtill bör Linnémiljöerna uppmuntras att rekrytera nationellt och internationellt på alla nivåer och för alla anställningar för att stimulera ökad rörlighet bland forskningspersonal och doktorander.

Vad gäller rekommendationerna kring framtida bidragsnivåer bör det framhållas att ökningarna endast har rekommenderats i fall då generalistpanelen sett specifika möjligheter som skulle kunna förverkligas i en miljö genom ökat stöd under den återstående bidragsperioden. Det finns också ett litet antal Linnémiljöer där bidraget inte har resulterat i en förväntad forskningskvalitet, eller där det funnits en avsaknad av engagemang för Linnéinitiativets mål. Sammantaget har panelen rekommenderat ökade bidrag för fyra miljöer och minskade bidrag för lika många. Bidragen för de övriga 12 miljöerna rekommenderas förbli oförändrade. Samtliga forskarskolor bedömdes som utmärkta och panelen rekommenderar att den nuvarande bidragsnivån behålls.

Samtliga panelmedlemmar var eniga om att Linnéinitiativet är ett enastående sätt att finansiera forskning i Sverige och att det bör fortgå även efter 2016.

EXECUTIVE SUMMARY

(Barbara M. Kehm, Chair General Expert Panel)

The following report is the result of the mid-term evaluation (after five years) of the Linnaeus Grants. These grants are part of an initiative of the Swedish Research Council and the Swedish Council for Environment, Agricultural Sciences and Spatial Planning (Formas) to support already strong research environments in Swedish Universities with the expectation to develop into strategic and internationally competitive research groups. Funding was granted to 20 Linnaeus Environments and eight doctoral programmes in 2006 for a duration of altogether ten years.

The evaluation procedure consisted of several steps and every effort was made to keep it as transparent and effective as possible. All environments and doctoral programmes were requested to submit a self-evaluation report structured along a set of pre-determined criteria. The self-evaluation reports were studied by international experts for a preliminary assessment. In the framework of several telephone conferences the international experts clarified and operationalized the assessment criteria and organised the site visits. In February 2012 all Linnaeus Environments and doctoral programmes were visited for a whole day by international expert groups. During the site visits interviews were conducted with the steering group of each environment, representatives of the research groups which form part of the environment, a group of doctoral students being part of or associated with the environment, and the leadership of the university at which the environment was housed. The report is the result of the self-evaluation reports, the experts' pre-assessment notes, and the site visits.

Altogether five expert panels were formed to evaluate the Linnaeus Environments and doctoral programmes: four subject-oriented panels each consisting of four to five members for Linnaeus Environments in Engineering, Humanities, Social, and Educational Sciences, Medicine and Natural Sciences and a General Expert Panel consisting of the Chairs of the subject-specific panels and four independent experts. The subject-specific expert panels were responsible for the evaluation reports of each individual Linnaeus Environment in their field, while the General Expert Panel was responsible for the overall report and the recommendations to the funding councils.

The main criteria for the evaluation of the Linnaeus Environments were scientific quality, added value, dynamics created, future potential, organization and leadership, national and international collaborations, gender aspects, dissemination methods, and communication strategies. Doctoral programmes were assessed according to their organization and management, their forms of recruitment, their impacts, their composition and degree of internationalisation, the content of the programme, their future potential, and the careers of their doctoral students after degree completion.

The panels were very impressed by the overall high quality and international competitiveness of the research carried out in the framework of the Linnaeus Environments. Some environments have clearly achieved a status of being world-class. The panels strongly believe that the Linnaeus Grants are valuable in several respects. They provide an opportunity for long-term strategic research mostly at the cutting edge in the respective fields, sometimes highly innovative and risky, making high pay-off very likely. This cannot be achieved in the framework of short-term funding. Furthermore, the grants provided the necessary leverage to attract additional grants and third-party funding, often far surpassing the Linnaeus Grant. Finally, the interdisciplinary group modus has raised the efficiency in the research work. Overall the Linnaeus Grants have contributed to produce additional reputational value making the environments as well as the universities which house them very attractive for high level researchers from around the world.

Another key strategic benefit of the Linnaeus Grants and especially of the doctoral programmes attached to eight of the environments is that they are effective for recruiting, nurturing, and developing junior faculty in a stable environment. Most Linnaeus Environments are successful in nurturing a future generation of world-class researchers and many have managed to considerably improve the gender balance.

However, the panels also identified some weaknesses. All Linnaeus Environments should be reminded to acknowledge the grant in all publications and on their websites. Some environments showed weak management capacities and lack of strategic vision. Larger environments tend to fare better if they have a person to administer the grant and other third-party funding, support for writing new applications and for the dissemination of information and research results to the public at large. Furthermore, the Linnaeus Environments should be encouraged to recruit nationally and internationally for all levels and positions and to stimulate more mobility among research staff and doctoral students.

With regard to the recommendations about the future funding levels of the environments, it should be noted that increases have only been recommended where the General Expert Panel believed that there are specific opportunities which can be realised through additional funding in the remaining period of the grant. There are also a small number of Linnaeus Environments where the grants have not supported the anticipated quality of research or where there is a lack of commitment to the goals of the Linnaeus initiative. Altogether the Panel made recommendations to increase the funding in four environments and to decrease the funding in four environments. For the remaining 12 environments a recommendation was made to maintain the current level of funding. All doctoral programmes were regarded as exemplary and the Panel recommends maintaining the current level of funding for the remaining grant period.

All panellists were unanimous in their view that the Linnaeus initiative is an outstanding way to fund science in Sweden and that it should be continued beyond 2016.

1. INTRODUCTION

Linnaeus Grants are part of an initiative of the Swedish Research Council and the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas) to support strong research environments in Swedish universities with the expectation to develop strategic and internationally competitive research groups. This report presents the results of the mid-term evaluation of 20 Linnaeus Environments and eight Doctoral Programmes which were awarded funding in the first round of Linnaeus calls and started in 2006.

The Universities which had successfully acquired Linnaeus Grants were expected to prioritize the respective research fields having won a Linnaeus Grant and allocate matching funds at the level of at least 50 per cent of the grant. The Linnaeus Grants range between MSEK 5 and 10 per year for a ten-year period for each environment. Eight of the Linnaeus Environments have doctoral programmes attached to them, which are also supported with Linnaeus Grants ranging from MSEK 0.9 to 2 per year for a ten-year period. Of the 20 Linnaeus Environments granted in 2006 five each were supported in the fields of Engineering (E), Humanities, Social Sciences and Educational Sciences (HSE), Medicine (M), and Natural Sciences (N). Linnaeus-funded doctoral programmes were attached to three Linnaeus Environments in Engineering, two Linnaeus Environments in the field of Humanities, Social Sciences, Education Sciences, two Linnaeus Environments in Medicine, and one Linnaeus Environment in the Natural Sciences.

Applications for the Linnaeus Grants had to have official support by the respective university's leadership and were required to include a research programme, an organizational plan, and a leadership/strategy plan. Criteria used to assess the applications were:

- Scientific quality of both previous and proposed research
- Scientific renewal in terms of potential synergy effects
- Commitment of the applicant university.

After one and a half years, five years, and at the end of the grant period all Linnaeus Environments have to undergo an evaluation carried out by international experts and supported by the Swedish Research Council and Formas. The first evaluation focused on organization, cooperation, and leadership in relation to the application. For the Linnaeus Environments being evaluated here this was done in 2008. The mid-term evaluation after five years, the results of which are presented in this report, focused on scientific quality, added value, dynamics created, the potential for further successful research in the remaining grant period, gender balance, and communication aspects. Criteria and indicators for these issues will be presented in the next chapter. The experts carrying out the evaluation were also asked to make recommendations for each environment whether to maintain the level of the grant or whether to increase or decrease it. However, any increase or decrease of the grant level could not be more than 20 per cent of the grant and had to remain within the overall total budget for the Linnaeus Grants.

The evaluation procedure consisted of a number of steps. First, all environments and doctoral programmes were required to submit a self-evaluation report structured along a set of pre-determined criteria and providing a number of appendices with data and figures. Second, the self-evaluation reports were then forwarded to the international experts who were going to carry out the evaluation for a preliminary assessment. Third, the General Expert Panel discussed criteria and indicators for the evaluation in the framework of several telephone conferences. Fourth, further clarification of the evaluation process and the criteria was then organized in the framework of telephone conferences of the members of the subject-oriented expert panels. Fifth, between 6 February and 13 February, 2012 site visits were carried out to all 20 Linnaeus Environments and – where applicable – their doctoral programmes. Sixth, the draft report was submitted on 16 February 2012. Further steps will be a feedback opportunity for the Linnaeus Environments on the draft report of their environment to correct factual errors and provide a reply. The final report will be presented to the boards of the Swedish Research Council and Formas who will decide on the level of support for each environment for the remaining period. After this decision has been taken the final report will be released (May/June 2012).

The actual site visits lasted one day each and consisted of four discussion sessions with differently composed groups of people involved in the respective Linnaeus Environment. First there was a session with the Linnaeus Coordinator, other members of the Steering Committee or Board, where applicable the Director of the Doctoral Programme, and possibly representatives of the research groups working under the umbrella of the Linnaeus Environment. After a presentation of the Coordinator about the Linnaeus Environment as a whole and its development since the beginning of the grant, the main topics in this session were leadership, organization, added value, dynamics created and anticipation of the future of the work. The second session typically consisted of a number (4 to 5) of short presentations of selected projects within the environment and a discussion on scientific quality and future directions. The third session was reserved for a discussion with a group of doctoral candidates (10 to 12) doing their research in the framework of the Linnaeus Environment. This meeting was held in all environments, regardless whether the respective environment had a Linnaeus-funded doctoral programme or not. The fourth session was with the Vice-Chancellor of the University discussing the role of the Linnaeus Environment for the overall research strategy and commitment of the University to the Linnaeus Environment.

In order to have the necessary expertise for evaluating the Linnaeus Environments altogether five expert panels were formed: one General Expert Panel consisting of eight members (the chairs of the four subject-specific expert panels and four independent experts) and four subject-oriented experts panels, one each for the Linnaeus Environments in Engineering, in Humanities, Social Sciences, and Education Sciences, in Medicine, and in Natural Sciences. Each subject-specific Expert Panel consisted of four or five members, at least one of which had particular expertise in the research field of the respective Linnaeus Environment. During the site visits the subject-oriented expert panels were accompanied by one independent expert of the General Expert Panel.

In the following the members of the various expert panels will be introduced. Where appropriate their specific function is indicated as well.

General Expert Panel (GE Panel):

- Prof. Dr. Barbara M. Kehm, University of Kassel, Germany (Chair)
- Prof. Dr. Leif Andersson¹, Haartman Institutet, University of Helsinki, Finland
- Dr. Neil Geddes, Science and Technology Facilities Council, United Kingdom
- Prof. (em.) Dr. Ian R. Swingland, Herons Hall, United Kingdom
- Prof. Dr. Ronald G. Gill, University of Colorado, Denver, USA (Chair M-Panel)
- Dr. Sylvie Joussaume, National Institute of Sciences of the Universe, France (Chair N-Panel)
- Prof. Dr. Huub W. M. Salemink, Delft University of Technology, The Netherlands (Chair E-Panel)
- Dr. Stephanie Shipp, IDA Science and Technology Policy Institute, Washington, USA (Chair HSE-Panel).

Engineering Sciences Expert Panel (E Panel)

- Prof. Dr. Huub W. M. Salemink, Delft University of Technology, The Netherlands (Chair)
- Prof. Dr. Samuel D. Bader, Argonne National Laboratory, USA
- Prof. Dr. Tamer Başar, University of Illinois, USA
- Prof. Dr. Mervyn Miles, University of Bristol, United Kingdom.
- Prof. Dr.-Ing. Nikolaus A. Adams², Institute of Aerodynamics and Fluid Mechanics, Technical University of Munich, Germany.

¹ Due to a late cancellation of one member of the Medicine Expert Panel, Professor Leif Andersson had two roles at the two Linnaeus Environments in the cancer research field, as a generalist and as an expert in medicine.

² Professor Nikolaus A. Adams participated in the evaluation of the KTH FLOW environment only, due to a late cancellation of one member of the Engineering Expert Panel.

Humanities, Social Sciences, and Educational Sciences Expert Panel (HSE Panel)

- Dr. Stephanie Shipp, IDA Science and Technology Policy Institute, Washington DC, USA (Chair)
- Prof. Dr. Amelie F. Constant, Economic Research Institute, Washington DC, USA
- Prof. Dr. Antoinette Fauve-Chamoux, Centre de Recherches Historiques, CNRS, Ecole des Hautes Etudes en Sciences Sociales/EHESS, Paris, France
- Prof. Dr. Sven-Eric Hansén, Åbo Akademi University, Turku, Finland
- Prof. Dr. Leo J. G. van Wissen, University of Groningen, The Netherlands.

Medicine Expert Panel (M Panel)

- Prof. Dr. Ronald G. Gill, University of Colorado, Denver, USA (Chair)
- Prof. Dr. Clemens A. van Blitterswijk, University of Twente, The Netherlands
- Prof. Dr. Ana Cumano, Institut Pasteur, Paris, France
- Prof. Dr. Vivian Mushahwar, University of Alberta, Canada.

Natural Sciences Expert Panel (N Panel)

- Dr. Sylvie Joussaume, National Institute of Sciences of the Universe, Paris, France (Chair)
- Prof. Dr. Martha J. Fedor, The Scripps Research Institute, USA
- Prof. Dr. Szymon Suckewer, Princeton University, USA
- Prof. Dr. Richard G. Vogt, University of South Carolina, USA
- Prof. Dr. Thomas Zemb, Institute for Separation Chemistry of Marcoule (ICSM), France.

2. EVALUATION CRITERIA AND INDICATORS

The General Expert Panel took great care to operationalize the criteria for the evaluation into a number of indicators. These were intended to give the subject-oriented expert panels an orientation what to look out for during the site visits and keep the procedure as fair and equal as possible. The following list of indicators for the various evaluation criteria was not meant to be used as a definitive checklist but provided an orientation for the discussions during the site visits and the production of the reports. Two groups of indicators were developed; one group for the Linnaeus Environments, the second group for the Linnaeus Doctoral Programmes.

2.1 Criteria and indicators for the Linnaeus Environments

- (a) *Scientific quality*: Peer-reviewed journal articles, invited conference presentations to speak on project topic, national and international collaborations, personal research grants (e.g. ERC (European Research Council) grants), breakthroughs, patents and licenses, prizes, awards, distinctions of research staff, valorization, novelty, potential impact, utilization.
- (b) *Added value*: Outputs that would not have occurred without the Linnaeus Grant, additional research income, new research projects, consultancies, industrial collaborations, additional institutional investments, prizes, distinctions, awards of the Linnaeus Environment as a whole, new technologies and/or research infrastructure.
- (c) *Dynamics created*: Assessment of overall productivity, new initiatives as outcome of the research, evidence of risk taking, cross disciplinary developments and/or collaborations, establishment of start-ups.
- (d) *Future potential*: Anticipated changes in the disciplinary knowledge base, anticipated changes in terms of economic/societal relevance, 10-year aspirations (trajectory of the research group, prospects for future success), leadership roles, national and/or international collaborations, integration of junior staff and new appointments, start-ups, spin-offs.
- (e) *Organization and leadership*: General management structure, defined leadership that contributes to the advancement of the Linnaeus Environment, organizational structure of the environment, decision-making procedures to prioritize resources, procedures for resource allocation to benefit the environment, accountability of decision-makers to other members of the group and to the institution, existence of an external advisory board.
- (f) *National and international collaborations*: Collaboration with other national/international research groups and/or individuals, participation in EU-funded projects and networks, role of the environment in national/international networks and size of these networks, national/international visitors and speakers, international research staff in the environment, role in international journals (reviews, editorial board membership), membership in national/international expert panels, role in EU and other international assessments of research grant applications and awards of prizes.
- (g) *Gender aspects*: Composition of team by gender (compared to the time before the Linnaeus Grant), gender composition of leadership and principal investigators, particular efforts to address gender imbalances, effects of research output on women.
- (h) *Dissemination methods*: Dissemination methods used, quality of website and frequency of updates, publications in languages other than Swedish, publications with relevance to a general audience, efforts towards public outreach, media/press releases, interviews given to newspapers, radio, television, flyers, brochures, general PR, organization of national/international symposia, conferences, workshops.
- (i) *Communication strategies*: Meetings of the Linnaeus Environment as a whole, meetings with institutional leadership, types of reporting, sharing of outputs and findings, institutionalization of (regular) seminars and workshops, interaction with other research groups and/or Linnaeus Environments within the institution, organization of conferences, symposia, workshops at home university.

2.2 Criteria and indicators for the Linnaeus Doctoral Programmes

- (a) *Organization and management*: Integration of the doctoral programme into the Linnaeus Environment, links between the Director of the Doctoral Programme and Linnaeus Coordinator/Board/Steering Committee, links between the Director of the programme and the doctoral thesis supervisors, co-determination structures for doctoral candidates, complaints and conflict-resolution procedures.
- (b) *Recruitment*: Forms of advertising (national/international), selection procedures and criteria, quality of candidates applying, origin of doctoral candidates applying, gender balance among doctoral candidates.
- (c) *Impacts*: Model function for other doctoral programmes within the institution, within the country, outcomes in terms of research, impact of doctoral programme on Linnaeus Environment, cross disciplinary collaborations, forms of knowledge exchange.
- (d) *Composition and degree of internationalization*: Size of the doctoral programme, composition in terms of gender and international candidates, proportion of international speakers and experts that have been invited.
- (e) *Content of programme*: courses, colloquia, workshops offered (including frequency), proportion of obligatory and voluntary participation, type of research training offered (research methods, transferable skills, etcetera), opportunities offered to participate in national/international conferences.
- (f) *Future potential and careers*: Career development of candidates after degree completion (inside and outside academia), prizes or awards for doctoral candidates.

3. OVERALL ASSESSMENT OF THE ENVIRONMENTS AND DOCTORAL PROGRAMMES

This chapter will assess the overall strengths, weaknesses, and opportunities of the Linnaeus Environments and the Linnaeus Doctoral Programmes. The first part will indicate the strengths of the Linnaeus Environments and point out the opportunities created by the grant. The second part will discuss some of the weaknesses encountered.

The GE Panel strongly believes that the ten-year duration of the Linnaeus Grant is very valuable in several respects. It provides an opportunity not only for long-term strategic research planning but also for carrying out innovative research that is challenging to achieve through conventional grant mechanisms. In particular the latter opportunity has been taken up by some of the environments making high pay-off very likely. Furthermore, the duration of the grant fosters cross disciplinary and interdisciplinary collaboration (at institutional, national, and international level). Such collaboration needs time to develop and to create a common understanding and language. For most of the environments the Linnaeus Grant has provided the necessary leverage to attract additional grants and third-party funding, often to an extent that far surpasses the Linnaeus Grant. Thus, the Linnaeus Award has proven to be of additional reputational value, making the environments attractive for high level researchers from around the world and as national and international partners and often leaders in large-scale collaborative undertakings to further push the cutting edge of the respective research domain. In addition, the interdisciplinary group modus raises the level of efficiency in the research work. In this context the Linnaeus Grants have directly contributed to an impressive level of excellent research. However, capturing the benefits from the intellectual properties in patents and licenses for the future benefit of the Linnaeus Environments is important.

Another key strategic benefit of the Linnaeus Grant is that it is effective for recruiting, nurturing, and developing junior faculty in a stable environment. Most of the environments have made successful efforts at creating the future generation of world-class researchers and many have managed to considerably improve or even balance the gender distribution. In a number of traditionally male-dominated research groups young female scientists have been or are being groomed to move into senior positions and become future leaders. The doctoral programs have been a particularly effective tool to develop future researchers due to their systematic training and their contribution to the coherence of the environments. Furthermore, the new courses which have been developed in the framework of the doctoral programme are of benefit to the institution as a whole.

Many Linnaeus Environments have strategically invested part of the grant money into up-to-dating infrastructure, instrumentation, software and databases and associated staff with technical training. The Panel believes this is a tangible and essential means of providing added value to the research environments. In this respect funding from the Wallenberg Foundation has greatly contributed to enhancing the effect of the Linnaeus Grants.

Being able to do research with the most modern technology has also made the universities themselves more competitive on a global scale. In quite a number of cases the Linnaeus Grant had a further important effect on the universities hosting the respective groups or centres. The inter-, cross-, and multidisciplinary nature of the research organization within the Linnaeus Environments is being used as a model in several universities to restructure the university-wide organization of research emphasizing collaboration in larger groups and across departments and disciplinary boundaries.

However, the Panel also noted some weaknesses in a sizeable number of environments which should be pointed out here. All Linnaeus Environments should be reminded to acknowledge the Linnaeus Grant in their publications and on their websites. Possibly a logo should be developed to better brand the Linnaeus initiative in general. Furthermore, a small number of Linnaeus Environments showed weak management capacities and a further few a lack of strategic vision. This is closely connected to the fact that the added value of the Linnaeus Grant is strongly related to the style of organization and

leadership within the Linnaeus Environments. Weaknesses in management and strategic vision were particularly obvious when there was no succession planning for coordinators due to retire sometime soon and when there were no ideas about how to sustain the environment after the end of the grant period.

Some environments have shown a clear upward trajectory by having expanded considerably and integrated new and promising research topics. Larger environments tend to fare better when there is a person to take care of the following needs:

- The administration of grants and other third-party funding
- Support for writing new applications (especially for younger researchers)
- Dissemination of information and research results to the wider public and the media.

The degree of coalescence of the environments but also their creativity and innovative capacity is strongly dependent on at least two further conditions: (a) The physical proximity and at the same time openness of offices, labs and social spaces for the group as a whole and (b) the possibility of arranging informal meetings for brainstorming, gathering of new ideas, mutual exchanges (joint coffee rooms, spontaneously formed action groups, periodical retreats).

Many Linnaeus Environments tend to recruit predominantly from within their own departments or institutions, which can hamper creativity and innovative capacity. Linnaeus Environments should be strongly encouraged to recruit nationally and internationally for all levels and positions, and stimulate mobility, including doctoral students.

Apart from rare exceptions most of the Linnaeus Environments do not track where and in which fields their doctoral students end up once they have successfully completed their degree. It can be a measure of success to accumulate better knowledge about this and possibly even start building up an alumni network.

Finally, the Linnaeus Environment but also the university leadership should get clearer instructions from the research councils on what kind of information the financial report should contain. The GE Panel proposes at least three categories:

- Amount of Linnaeus Grant (per year and overall)
- Amount of matching resources from the University (separately reported as funds and as in-kind support) for the Linnaeus Environment
- Additional income for the Linnaeus Environment from other grants and third-party funding (for individual researchers as well as for the Linnaeus Environment as a whole).

This would help the universities, the Swedish Research Council, Formas and the evaluation panels to better evaluate the Linnaeus Grants.

4. ASSESSMENT OF EACH ENVIRONMENT

In their assessments of Linnaeus Environments and Linnaeus Doctoral Programmes the subject-oriented expert panels made **no attempt** to create a hierarchy of descriptors (e.g. between excellent and outstanding) across all assessments or within the assessments of a given Expert Panel.

4.1 Engineering

4.1.1 ACCESS Linnaeus Center – Autonomic Complex Communication nEtworks, Signals, and Systems (KTH)

Introduction

ACCESS is a Linnaeus Environment housed in KTH and focused on complex communication networks, signals and systems. It is composed of about 35 faculty members and 15 postdocs, and the related doctoral programme has about 100 Ph.D. candidates. The Center draws its faculty and students from electrical engineering, computer science and mathematics, and is organized into four thematic research areas: sensing and actuation; transmission and radio; architecture and concepts; and computation and algorithms. The Linnaeus Grant, which started in 2006, is at the level of MSEK 10 per year.

Scientific Quality and Major Results

The Center has shown impressive, unprecedented growth in the activities since its inception. These have enhanced the international visibility of the scientists and engineers involved, and have made a major impact locally in the KTH environment. Growth and visibility have surpassed the expectations five plus years ago (at the time the Center received the Linnaeus status and grant).

The research outcome amounts to more than 300 journal articles and conference papers per year. Some of these publications have been in high-visibility, high-impact journals, such as the *IEEE* (Institute of Electrical and Electronics Engineers) *Transactions on Information Theory*, *IEEE Transactions on Automatic Control*, *Automatica*, and *Proceedings of the National Academy of Sciences*. ACCESS researchers have also edited special issues of journals and books. They have made innovative fundamental contributions to the understanding of:

- spectral estimation and system identification,
- sensor and actuation networks,
- control and optimization of networked systems,
- network management, and
- multiple antenna wireless communications.

These contributions have been recognized internationally through prestigious awards to some of the center faculty, such as the 2011 IEEE Signal Processing Society Technical Achievement Award and 2009 SIAM W.T. and Idalia Reid Prize (SIAM – Society for Industrial and Applied Mathematics). Other recognitions include the IEEE Signal Processing Young Author Best Paper Award, and several conference paper prizes.

Examples of valorization and utilization of the new knowledge generated by the Center can be found in several applications, such as water management in Barcelona (as part of a European project), MIMO (Multiple Input Multiple Output) antenna designs (in partnership with Ericsson), and intelligent transportation (platooning of trucks on highways).

Organisation and Leadership

Most of the original Center leaders have since stepped down or moved to other positions (after serving for a couple of years in the indicated positions). But the turnover has been swift and seamless, with the new leadership taking over stewardship of the Center and administering its various activities very ably. The Center has experienced an unprecedented growth (over a relatively short period of time) in terms of both the numbers faculty and Ph.D. students directly embedded in it and the numbers of women in both categories. The proportions of women to men in leading positions within the Center as well as on its external advisory board are above the average one sees in comparable centers not only in Sweden but in other countries as well (such as the USA).

ACCESS is governed by a board, consisting of eight members, with representation from KTH as well as industry. The *ACCESS Board* is advised by a *Scientific Advisory Board*, with five members, including three women. The *Management* team of five is comprised of the Center Director, Vice-Director, Graduate School Director, PR Officer, and an Administrator. This team, together with the *four Thematic Area Leaders*, constitutes the *Executive Committee*, which reports to the *ACCESS Board*. The *Graduate School Steering Committee* completes the ACCESS organization.

In addition to the thematic area research program, which is long term, the Center has also instituted shorter-duration, competitive collaborative seed projects, which are funded for 2 years. The Executive Committee selects these projects based on proposals received in response to an open call. There are 8 such projects funded at any point in time. In addition to these, there are application projects, which are funded by industry or a third party (such as EU, VINNOVA, and SSF).

ACCESS has also enjoyed impressive international collaboration in both intensity and quality. It has hosted international experts as distinguished lecturers, and has them also contribute to research activities and teaching, depending on the length of their stays.

Level of Commitment of the University

The University seems to place ACCESS high in its list of priorities for allocation of resources (in terms of both faculty lines and direct infusion of funds). The Center has in return delivered excellence in research, directly contributing to the visibility of the university, and has shown impressive growth in the Ph.D. programme, which again has created added value for the University above initial expectations.

ACCESS is active in three of the newly introduced five strategic and cross disciplinary research platforms at KTH. The platforms also play an important role with regard to future investments. ACCESS is helping in particular to shape the future of KTH's research program in ICT (Information and Communication Technology).

Furthermore, ACCESS spans three of KTH's ten Schools. Collaborations in both research and education have improved considerably in these three Schools.

Added Value

ACCESS has served as a catalyst for attracting funding for a multitude of new projects by its faculty, including: EU projects (23 of them); distinguished individual grants (such as ERC, KAW (Knut and Alice Wallenberg Foundation), SSF, and VR); and major industrial collaborative VINNOVA projects in diverse areas such as intelligent transportation, smart energy, and wireless process control. One-third of the total VR funding in signals and systems has been received by ACCESS, and so has one-fourth of national SSF ICT funding in the 2010 call. All of these successes can be attributed in no small way to the acquisition of the Linnaeus Grant in 2006, on which ACCESS faculty have built a strong, expansive research programme.

Since its inception, ACCESS has also seen a rapid increase in collaborations with national and international constituencies, including SRA TNG (Strategic Research Area The Next Generation), EIT ICT Labs (EIT – European institute of innovation and technology), industry (such as Ericsson, ABB, Scania, Cisco, and Microsoft), and selected universities in the USA, China and Korea.

Dynamics Created

ACCESS faculty constitute a young and dynamic group of researchers, who closely follow the trends in the topical areas covered by the Center, and occasionally create them. Their research is readily adaptable to changes in the knowledge base, and the developments in research entities in other parts of the world.

ACCESS consists of faculty and researchers representing different subfields of networks, and signals and systems—groups that normally would not interact. The Linnaeus Environment, however, has facilitated productive and creative interactions that are essential for interdisciplinary research. This has led to cross-fertilization of ideas, collaboration of researchers from different disciplines, with jointly co-authored papers, and an overall positive impact on the research landscape within and outside the University. Impressive evidence of faculty engaging in collaborative research that crosses disciplinary boundaries is the closely knit, dense connectivity diagram in Figure 2 on page 13 of their 5-year report.

The E Panel has not seen much risk-taking on the part of the ACCESS management team. One of the items included in the list of recommendations for the future is that the Center should make some investment in high-risk, high-payoff research.

Future Potential

ACCESS is on a path of innovative, cutting-edge research, which will take it through the end point of the Linnaeus Grant. Its faculty is already well experienced in successfully competing in large-scale grants. This should make it possible for them to continue ACCESS activities (along with the Linnaeus Doctoral Programme) beyond 2016 at least at the same level as today. Current data look very promising for placement of doctoral students after graduation. The ACCESS doctoral programme should continue to attract high calibre recruits, with attention paid to diversity.

National and International Collaborations

ACCESS has extensive collaborations within KTH, with other Swedish universities, with international universities, and with industry. It is the largest and leading research center in its field in Europe, being able to generate world-class research and being highly attractive for international recruitments and exchanges. One measure of its impact is through citations.

As stated earlier, ACCESS has several EU projects, and has enjoyed a steady inflow of prominent international visitors, who have given distinguished lectures (55 so far, with live streaming), and some of whom have also participated in research as well as teaching. ACCESS faculty members have also organized several academic workshops and conferences, including the ACM/IEEE CPSWEEK 2010 (in Stockholm), with over 500 participants.

Gender Aspects

Recruitment of women has increased from an all-male start in 2006 to three female ACCESS faculty members in 2011. One of these women is serving as Vice-Director since January 2012. In the near future one of the thematic area leaders will also be a woman. The Scientific Advisory Board includes three women. The Executive Committee has two female members since the beginning of 2012, and the number of women participating in the distinguished lecture series has increased. There is an initiative to increase the recruitment of female postdocs by the University, doubling the funding for female candidates. Special support for junior faculty taking parental leaves has been introduced, thus creating a woman- and family-friendly environment at the University.

Dissemination Methods

Communication of research output has been in the form of papers presented at leading conferences and published in their proceedings, plenary talks given by senior faculty at major conferences, and papers published in journals with high impact and visibility. All papers by researchers indicated the affiliation with ACCESS as a Linnaeus Environment and acknowledged the Linnaeus support. The Center has a well-structured website, which also provides outreach and dissemination of Center activities (including research) to the broader international community.

ACCESS hired a PR officer in 2008, and has an effective communication strategy. There have been several appearances in the national media promoting ACCESS and its research output. There has also been media training for faculty and doctoral students.

Communication Strategies

Within the Linnaeus Environment, as well as within KTH, communication is via the standard channels of internal seminars, email exchanges, and impromptu as well as scheduled conversations. Doctoral students meet with their advisors on a bi-weekly basis. Collaborators on particular projects have regular face-to-face meetings and scientific discussions.

Additional Issues

The 2008 Evaluation Report was generally very positive, and any minor issues that were identified have since been resolved. The Self-Evaluation Report was comprehensive and well written, and any parts of it that were unclear were clarified during the site visit. The E Panel was satisfied with all the responses to questions raised during the site visit.

The Panel's Conclusions and Recommendations for Improvements

The E Panel was impressed with the progress ACCESS has made since its inception in 2006. ACCESS has excelled in its research agenda, in the development of the Doctoral Programme, and in the overall collaborative environment it has created for science and engineering to blossom. It has healthy connections, nationally and internationally to academia and industry. Its leadership and research faculty are young and dynamic. Its Doctoral Programme is populated with high-caliber, motivated students who have promising job prospects (in both academia and industry, as shown by the data of the last couple of years). The Center projects a bright picture into the future (even beyond the end date of the Linnaeus Grant). The existence of ACCESS has enhanced the visibility of its faculty internationally, and it appears also to have made major impact locally within the KTH environment. Hence, overall the E Panel finds the performance of ACCESS outstanding.

Two recommendations the E Panel makes for the next five years of ACCESS are:

- To develop mechanisms for accommodating high-risk, high-payoff research within the general topical framework of the Center.
- Given that *security* is emerging as a growth area in networking research, the Center should start a new research activity in *system security*.

4.1.2 ACCESS Doctoral Programme

Organisation and Management

The Doctoral Programme started with the Linnaeus Grant, with a level of support of MSEK 1.15 per year. It experienced a rapid growth over the last 5 years, reaching a level in terms of sheer number of doctoral courses and the breadth of the programme not seen in many European universities. The Programme is administered by a Graduate Steering Committee, which is responsible for introduction (creation) of new courses, partly in response to the needs of the students. The Ph.D. programme itself is the responsibility of individual departments, but ACCESS is instrumental in enriching the pool of courses to be taken by doctoral students mainly in electrical engineering, computer science and mathematics. Students from other departments/schools can also take these courses created by the ACCESS faculty (and in fact do so).

Forms of Recruitment

Students are recruited by individual departments and have to meet the admission standards by those departments. But the presence of ACCESS plays an important role in attracting high quality Ph.D. students to these departments, who after joining the programme sign up with a research advisor from ACCESS.

Integration into Linnaeus Environment

The courses offered as part of the Doctoral Programme have been organized in three levels (roughly, introductory, intermediary, and advanced), and look balanced both within each level and across the three levels. The number of courses has continually grown over the course of the Center, resulting in a comprehensive, broad-based programme, which is also forward-looking in terms of addressing topics that will be at the heart of research in networks, communication, control and signal processing for years to come. The growth of the instructional part of the doctoral programme is very much aligned with the growth of the research part of the programme both in terms of the number of students recruited and the breadth of the topics their Ph.D. research addresses.

Impacts

The Doctoral Programme seems to have a high impact on the Linnaeus Environment, with research carried out by doctoral students constituting a major component of the Center, contributing directly to its visibility. Several papers published by Center faculty have doctoral students as co-authors. The number of students in the doctoral programme has grown to 100.

Furthermore, the doctoral programme (through its rich pool of courses) administered by ACCESS is highly visible within the University and represents a success story. The courses are open also to students outside the Linnaeus Environment.

Composition in Terms of Gender and Extent of Internationalisation

About half of the students are from Sweden and half are international. Female students constitute about 10–12% of the student body, which both the University administration and individual departments are making concerted efforts to increase.

Content of Programme

The Doctoral Programme courses are comprehensive in the topical areas covered by ACCESS. Students are strongly encouraged to write papers and submit them to conferences and journals. Attending conferences to present papers is encouraged, with support provided through different sources.

Future Potential, Career Opportunities

Students who have graduated during the last 4 years have been well placed, in industry and academia (as postdocs in leading universities). Prospects for the future continue to look promising.

The Panel's Conclusions and Recommendations for Improvements

The Doctoral Programme has witnessed an impressive growth in the number of students, who also have high credentials. The programme is also credited with having attracted outstanding women students. The Doctoral Programme supports and complements the Linnaeus Research Programme. The E Panel also sees great value in the student foreign visit program. The overall strategy adopted by the Center is working quite effectively.

As a specific recommendation for the future, the E Panel would like to see the number of student foreign visits increased from its current relatively low level of only about 7 per year.

4.1.3 Linné FLOW Centre. A Blueprint for Future Flow Research (KTH)

Introduction

The FLOW Linnaeus Environment at KTH deals mainly with fundamental research in fluid mechanics, with incipient utilization of research in several application areas. The total number of researchers currently involves 44 Ph.D. candidates, about 10 postdocs and junior researchers, and 29 senior researchers (professors at different levels). The Linnaeus Grant, which started in 2006, is at the level of MSEK 5 per year.

Scientific Quality and Major Results

There are six main research areas, each at a different stage of development and connection to application areas:

- Flow stability and transitions.
This is one of the two core areas out of which FLOW emerged. It is, therefore, well developed and the main reason for FLOW's international recognition. Spectacular results in terms of unprecedented direct numerical simulations (DNS) have been obtained for increasingly complex, generic configurations, resulting in highly regarded publications. Some of the findings are touching the application level, and have resulted, for example, in a research project on laminar wing modeling with Airbus.
- Flow control and optimization.
This area is closely connected to the previous one. It naturally emerges out of the fundamental findings about mechanisms of transition-to-turbulence by incorporating classical control and optimization strategies. Here also there is industrial interest in the results (with joint projects with Airbus and with Scania). Another outcome has been the awarding of an ERC starting grant (AFRODITE) on drag reduction.
- High Reynolds number turbulence
In addition to flow transition and turbulence, this is the second core area for FLOW. Important contributions to the theory of turbulence structure at very large Reynolds numbers were made possible mainly with the input from their experimental research, and more recently also with DNS. FLOW is also studying different aspects of geophysical and atmospheric turbulence in a newly initiated activity by taking into account the effects of stratification and rotation. Collaborations have been established with national and international research centers, including the Illinois Institute of Technology, the University of Melbourne, Princeton, Cal Tech, and Nagoya University.
- Microflows and complex flows.
This is an emerging area of research with two important simulation-based contributions on two-phase flows. The two contributions are the instability of a co-flowing liquid sheet, and drop splashing on a liquid surface. Both generic flows are significant for process engineering and biomedical applications.
- Low-Mach-number aeroacoustics.
This is also an emerging activity characterized by experimental and numerical efforts, centred mainly on transport and propulsion related research (noise generation and propagation in exhaust and cooling systems).
- E-Science in fluid mechanics.
The existence of FLOW also was instrumental in establishing the more general E-Science activity at KTH, resulting in this new area to FLOW.

The publication performance of the key people in FLOW is high for the subject. Key publications are in high-ranking journals and represent the core research areas as well as emerging areas.

Breakthroughs have been accomplished in terms of very-large-scale, high-quality DNS and subsequent data analysis of transitional and turbulent flows. FLOW has pioneered the notion of "optimal disturbance" as a criterion for the likely path to turbulence, not knowing the exact disturbance environment to which the laminar flow is exposed. Furthermore, FLOW has contributed unprecedented DNS of simple turbulent shear flows for clarifying intricate details of near-wall turbulence structure.

FLOW patents were not mentioned, but patents are not usually generated in such a rather fundamentally oriented initiative. An ERC starting grant was awarded to a FLOW researcher. FLOW researchers received the prize for best video at a 2010 American Physical Society meeting for their visualization of a jet stream in cross-flow bifurcation. D. Henningson received a von Humboldt Research Award. FLOW contributed two of the five finalists to the da Vinci Ph.D. thesis award competition.

Organisation and Leadership

The FLOW organisation has followed the well-established format of centres at KTH. The Board of FLOW presently consists of a Chairman representing KTH management, four KTH-external members

and five Principal Investigators (PIs) from the Center. There is also a Management Group consisting of young research leaders. Four out of ten members of the board of FLOW are female, and two out of eight members of the management group are female. Furthermore, an International Advisory Panel of leading international experts was established to support the Steering Board in making strategic decisions. The Advisory Panel has delivered a written report in preparation of the 2011 review. The Management Group is in charge of the new Doctoral Programme.

Level of Commitment of the University

The total 5-year funding of MSEK 25 was supplemented by MSEK 5 of basic funding through KTH, partially spent in staff/faculty salaries and Ph.D. and postdoc fellowships. The university is committed to continue funding at the same level.

Added Value

FLOW underpins several KTH applied research environments dealing with combustion engines and wind power. The Linnaeus Grant has generated additional funding of MSEK 46 in 2011 alone. MSEK 25 has been invested into a new computer for very-large-scale simulations in order to provide computational support to FLOW and other computation-intensive activities. FLOW has also been successful in securing large amounts of computing time through the European high-performance computing environment PRACE (Partnership for Advanced Computing in Europe).

Dynamics Created

The FLOW Center has been instrumental in establishing the E-Science funding at KTH, emphasizing the significance of methodological advances and numerical simulation in several topical areas. Strategic networks were established between FLOW and the Wallenberg Wood Science Center, and in the fields of biotechnology, wind power, and combustion engines. FLOW is also part of the newly created Center for Experimental Mechanics at KTH. Scientific outreach to industry is less characterized by direct industry funding, than by participation in industry-led consortia. This indicates that the gap is closing between fundamental research at FLOW and applications. The evolution from purely basic to include applied outcomes is noticeable when comparing the simple modeling in the original core-research program to their more recent, complex, applications-driven efforts, and the movement toward emerging areas.

Future Potential

The future potential of FLOW lies in the scientific excellence of the PIs and in their ability to attract excellent graduate students to create a pool of young researchers that have the potential of becoming future research leaders. The long-term prospects of FLOW also depend, however, on the ability of the PIs to identify, support and exploit emerging new fields.

National and International Collaborations

FLOW collaborates with the KTH Center for Gas Exchange, which deals with different problems of time-dependent gas flows, in particular, as related to internal combustion engines. Problems of cellulose processing are addressed by FLOW with the KTH/Chalmers Center for Wood Science. On a national level, FLOW collaborates with the E-Science activity involving also Stockholm University, the Karolinska Institutet, and Linköping University. FLOW cooperates with Stockholm University through the BBC Centre on the subject of climate research. FLOW and groups from Chalmers and Lund University created CeCOST, which is focused on combustion. Several high-Reynolds-number-related cooperative research activities have been established around FLOW involving U.S. and European institutions.

Gender Aspects

The percentage (about 20%) of female graduate students is what is generally found in engineering across Europe. The senior faculty is 18% female, and the young investigators are 33% female. The FLOW

Steering Board is 40% female and the Management Board is 25%. Efforts are underway to improve these percentages and enhance the research environment.

Dissemination Methods

FLOW's dissemination methods to the scientific community are by standard means of scientific publications and conference presentations. There is also an impressive website. FLOW visualizations are also featured within the image gallery of the Division of Fluid Dynamics of the American Physical Society.

Outreach and publicity to external stakeholders and the public are the responsibility of a Board member. A written communication strategy exists. Outreach includes videos available on *YouTube*.

Communication Strategies

Internal and institutional communication strategies follow standard and well-established patterns with a dedicated website, seminars, colloquia, etcetera

Additional Issues

The evaluation report from 2008 was positive with no unresolved action items.

The Panel's Conclusions and Recommendations for Improvements

The FLOW Center has achieved a remarkable level of international visibility by building upon excellent research output from within its core area of numerical and experimental simulation and analysis of transitional and turbulent flows. It has been able to maintain and even extend the already impressive research output over the reporting period. For the final funding period the challenge will be to reach out to new and emerging fields in modeling of complex flows, and to further strengthen links with application areas in order to create a solid foundation for transitioning into a self sustaining state after 2016.

The E Panel feels positively about the scientific environment created by FLOW. The Center should have a bright future if the recommendations detailed below are implemented in a timely fashion:

- Exploit the existence of advanced numerical models by utilizing expertise in numerical mathematics to create new application codes.
- Foster the creation of innovative ideas via sponsorship of project-oriented internal workshops that include doctoral students.
- Stimulate high-risk/high-payoff projects through appropriate allocation of funds.

4.1.4 Linköping Linnaeus Initiative for Novel Functional Materials (LiLi-NFM)

Introduction

LiLi-NFM is the Linnaeus Environment housed in Linköping University, focused on *Novel Functional Materials*. It is composed of about 150 researchers, including 30 professors, 10 postdocs and 67 Ph.D. students. The Center draws its faculty and students from the University's Department of Physics, Chemistry and Biology. The Center is organized into eight divisions:

1. Thin Film Physics
2. Theory and Modeling
3. Surface and Semiconductor Physics
4. Nanostructured Materials
5. Functional Electronic Materials
6. Semiconductor Materials
7. Surface Physics and Chemistry
8. Plasma and Coating Physics.

The purpose of the Linnaeus Environment is "to enhance support for research of the highest quality that can compete internationally." The objective is to do "basic research to fundamentally understand the atomistic nature of materials properties and behavior and learn how to make materials perform better at acceptable cost through new methods of synthesis and processing."

The Linnaeus Grant support, which started in 2006, is at the level of MSEK 8 per year.

Scientific Quality and Major Results

The research outcome was summarized to the E Panel by listing 20 selected papers published since 2006. These papers are of outstanding quality. Included are those in high impact journals, such as *Physical Review Letters*, *Physical Review B*, *Applied Physics Letters*, *Advanced Materials*, *Nature Nanotechnology*, *Nature Materials*, *Science*, *Journal of the American Chemical Society*, and *Nano Letters*.

Invited talks were not collected into a single list in either the self-evaluation report or the site visit overview presentation by the Director. Evidence of invited talks, however, appear in the individual CVs of selected principal investigators (PIs).

The breakthrough research, as presented during the site visit included:

- Theoretical work and simulations to understand the phase diagram of nanostructured alloys for hard coatings (TiN, AlN, CrN alloy phase stability).
- Experimental demonstration of room temperature spin filtering via defect engineering of a non-magnetic semiconductor.
- Chloride-based CVD growth of high quality SiC, including identifying the electronic structural issues associated with the defect levels whose spin-orbit and crystal field splittings are of comparable energy.
- Thermal decomposition of SiC to create graphene, whose electronic structural response in photoemission and QHE (Quantum Hall Effect) resistance indicates unusually high quality compared to exfoliated material.

There have been 10 patent applications by PIs since 2008. Awards received by the faculty include the following:

- W. Salaneck was appointed honorary professor at Nanjing University, China.
- A. I. Abrikosov was awarded the Göran Gustafsson Prize in 2007.
- L. Hultman was elected to the Royal Swedish Academy of Engineering Sciences in 2008, and to the Royal Swedish Academy of Sciences in 2009.

Examples of valorization and utilization of the new knowledge generated by the Center can be found in 10 patent applications, and in new startup companies, including

- Cyclops, a SiC CVD toolmaker that utilizes the LiLi-NFM chloride-based methodology.
- Graphensic, to make graphene utilizing the LiLi-NFM SiC decomposition methodology.
- Norstel, to make SiC substrates and epitaxial films. (Norstel formed 5 years ago, but located itself in proximity to the Linköping University due to the synergy with the LiLi-NFM.)

Organisation and Leadership

LiLi-NFM is governed by a four-member Directorate that includes the Director and Vice Director, and the Scientific and Administrative Secretaries. The Directorate reports to the Vice-Chancellor. There is also a Steering Committee, Chaired by the Director, that has representation from the eight Divisions. There is no formal External Advisory Board.

The allocation of resources is determined by the Director on a need basis. The criteria for allocations are outlined in a five-point guideline:

1. Grants are given exclusively to fundamental research for excellence, renewal, and synergy (twinning projects), following the original application and new opportunities.
2. Consolidate and develop the Environment's research program and infrastructure.
3. Provide for tenure-track-like positions and support newly recruited professors.
4. Promote sabbaticals and visiting researcher plans (in and out of Linköping).

5. Establish critical mass; this implies a smaller number of budget posts, but with long-term commitment. Leveraging of grants (with respect to faculty and external agencies).

Level of Commitment of the University

The University is strongly engaged in the success of the LiLi-NFM and places it high in its priorities for allocation of resources. The Center has in return delivered excellence in research results.

The University contributes MSEK 2 per year to the LiLi-NFM and has expressed commitment even beyond the remaining five-year life span of the Linnaeus support. The University also makes direct contributions to ten LiLi-NFM PIs at the level of MSEK 2/year/PI.

Added Value

The external funding is about MSEK 60/year, and of this amount, about MSEK 40/year is traceable to being seeded by the existence of the Linnaeus Grant. Thus, the Linnaeus "seed" grant is a powerful catalyst for external funding that is presently five times the Linnaeus Grant level.

Dynamics Created

The PIs seem to be highly productive. New initiatives include:

- 2011–2013 Swedish Research Council – "Free-charge carrier properties and doping mechanisms of advanced semiconductor materials for high speed and THz electronics", MSEK 2.5.
- 2011–2013 Part in the European Initiative Flagship Graphene, EU, kSEK 300/year.

The ability to swiftly seed the new graphene work is laudable.

The E Panel did not see much evidence of culture-changing cross and/or interdisciplinarity in the research carried out at the LiLi-NFM.

The evidence of high-risk/high-payoff research was visible in the graphene program. Otherwise risk taking was not apparent, as most attention goes to continuing existing research lines.

Future Potential

The LiLi-NFM pursues innovative, cutting-edge research that will be sustained through the end of the Linnaeus Grant period. The mentoring of junior staff/new hires seems to be effective. For example, the hiring of Johanna Rosen is laudable. She has received a prestigious ERC starting grant. The Ph.D. candidates are being well trained to take up academic and industrial positions. The number of patents and start-ups bodes well for the future potential of the LiLi-NFM beyond the Linnaeus Grant period.

National and International Collaborations

Strong international ties exist, such as collaborative research with Emeritus Prof. J. E. Greene of the University of Illinois, Urbana-Champaign. Strong national ties also exist, such as to Chalmers University of Technology.

Gender Aspects

One new female faculty member was hired, and six were promoted. This represents movement in the right direction.

Dissemination Methods

Communication of research output is in the form of papers presented at conferences and published in their proceedings, plenary talks given by senior faculty at major conferences, and papers published in journals with high impact and visibility. Most papers written by faculty and students do not show affiliation with LiLi-NFM, and do not acknowledge the Linnaeus Grant support.

A website exists that includes progress reports.

Communication Strategies

Within the LiLi-NFM communication is better achieved within Divisions or clusters of Divisions rather than across the Environment. General announcements also occur via e-mailings, including to doctoral students. Communication channels between the Director and the Vice-Chancellor appear to be excellent. The website is not utilized optimally, although there are lists and a few reports posted there.

Additional Issues

The 2008 Evaluation Report was positive, and identified no action items that required a response.

Items that emerged at the site visit and that were also apparent from a reading of the self-evaluation report include the following:

- There appears to be a lack of infusion of Linnaeus Environment culture within LiLi-NFM. The model is more of a traditional university department structure.
- There was no acknowledgement of Linnaeus funding in most of the 20 selected publications, nor in the Ph.D. theses made available to the E Panel.
- There is no External Advisory Panel.
- Neither the organizational chart nor the website reflects a focused (novel functional) materials mission for LiLi-NFM.
- There is scant evidence of cross-fertilization beyond the boundaries of their discipline.
- The doctoral students do not have the benefit of a synergistic Linnaeus Environment beyond their own research cluster.

The Panel's Conclusions and Recommendations for Improvements

The E Panel was impressed with the scientific and applications-oriented achievements and the emphasis placed on scientific and technical excellence. The E Panel was surprisingly disappointed with the lack of Linnaeus branding and the lack of interest in its importance as a culture-changer that is in the best interests of the participants and to the future of LiLi-NFM beyond the Linnaeus funding period.

4.1.5 Linnaeus Centre of Engineered Quantum Systems (LINNEQS) (Chalmers/Gothenburg)

Introduction

LINNEQS is a Linnaeus Environment in Chalmers University of Technology on Engineered Quantum Systems with an associated Doctoral Programme. It is led by the Director Per Delsing and is based primarily in the Department of Microtechnology and Nanoscience, which itself is interdisciplinary. The researchers in this environment consist of ten principal investigators (PIs), 23 postdocs, and 31 current Ph.D. students with 13 already graduated. It was organized initially under the three themes of Quantum Information, Quantum Transport, and Enabling Technologies. Subsequently, the additional theme of Graphene was added. LINNEQS Linnaeus support is MSEK 9/year with a further MSEK 1/year for the Doctoral Programme.

Scientific Quality and Major Results

The scientific quality of the centre is world leading. In addition to the important results described in the self-assessment document, new and unpublished results were showcased in presentations during the site visit. This is an indication of the pace of advancement as well as the risk-taking culture facilitated by the Linnaeus Environment. Breakthroughs include:

- Experimental confirmation of the Dynamical Casimir Effect (DCE).
DCE is a quantum field theory prediction that a rapidly moving mirror will produce pairs of real photons from the vacuum. For experiments involving massive mirrors oscillating at the maximum achievable rates and amplitudes, theory predicts only one event in 30 years. However, in a series of

breakthrough theoretical and experimental papers generated within the Centre, the use of a superconducting cavity resonator, originally intended for qubit coupling, enabled the first experimental realization of the dynamical Casimir effect. A broadband spectrum of photons was finally produced from the vacuum 40 years after its prediction. Furthermore, in a series of equally impressive experiments, a classical interpretation of the result was ruled out. This opens up a whole new field of investigation into the quantum world.

- Large Area Epitaxial Graphene – a new potential resistance standard
Graphene has been produced in collaboration with the Linnaeus Environment LiLi-NFM at the University of Linköping using the sublimation of Si from a SiC surface to leave C in the form of relatively large graphene areas. Microfabrication of ohmic contacts to the graphene enabled the measurement of record mobilities in these samples, and the measurements of the quantum Hall effect with extremely high precision (10^{-10}) indicated a new metrological resistance standard, which is being pursued in collaboration with the National Physical Laboratory in the U.K.
- Surface acoustic waves – detection of single phonons
Surface acoustic waves are the cooperative displacement of surface atoms and their charge. These quantized waves, also known as phonons, can be detected by a single-electron transistor with high spatial and temporal resolution. A record-setting displacement sensitivity was demonstrated (30 atto-metres RMS/ $\sqrt{\text{Hz}}$) that is below the proton size. This should enable the detection of single phonons, thus opening a whole new class of single shot phonon studies.
- Interface studies of lanthanum aluminium oxide/strontium titanate (LAO/STO)
This is an early example (published in 2007) of the formation of a metallic interface between two insulators. The optical, electrical, and microstructural properties of these novel hetero-interfaces were studied as a function of deposition conditions. Cathode and photoluminescence experiments showed that stable oxygen vacancies are formed in the STO substrate during the growth of the LAO films. This results in high electrical conductivity characteristic of a metallic phase. The importance of this work is that it enables nanoscale interface engineering of technologically important complex oxides.

Since its inception, LINNEQS has published over 190 papers in refereed journals including 6 in Nature journals, 16 in *Physical Review Letters*, and 8 in *Nano Letters*. The PIs have given over 100 invited talks at international conferences during the review period.

Members of the Environment during this period have received many awards and recognitions, and these are listed on page 26 of the self-assessment report. Two examples of note are Eva Olsson's election to the Royal Academy of Sciences and Per Delsing's ERC Advanced Award.

In the areas of valorization and utilization, it can be said that much of this research will underpin the quantum engineering technology of the future. However, there is an immediate application in new metrology standards of electrical resistance of importance to all of commerce. Patent applications are included in the CVs of the self-evaluation report.

Organisation and Leadership

Per Delsing is Director of the Environment, and, since 2009, has been supported by a Coordinator, Göran Johansson. The three original research areas have been expanded to four with the addition of graphene. These areas are:

- Quantum Information
- Quantum Transport
- Enabling Technologies
- Graphene

A Steering Group consisting of the Director, the Coordinator, research area leaders, and the Doctoral Programme Coordinator manages the Environment.

Decisions on allocation of resources are made within the Steering Group. The project themes are interdependent by their nature, making the members inherently and naturally accountable to each other.

The E Panel was impressed with the decision of the leadership to close down a programme (“electrons on helium”) that was too experimentally challenging at this time, and to redirect the funding to the new graphene research effort. The project on quantum digital logic was terminated when its leader moved to the USA.

The LINNEQS environment also has an external International Advisory Group comprised of leading international experts.

This group oversaw a thorough internal evaluation in 2011 in preparation for this site visit, and gave sound advice. All members of this group recommended reinforcing existing directions rather than expanding into new bio areas.

Level of Commitment of the University

In discussions with the President and CEO (Chief executive officer) of the University, it was clear to the E Panel that the University highly values the activities of the LINNEQS Environment. In direct financial terms, in cash the University is contributing kSEK 750/year.

Added Value

The total sum of additional external funding acquired is MSEK 145 compared to the MSEK 45 of the Linnaeus Grant during the five-year period. The Linnaeus Grant established a Linnaeus culture of cross-pollination with the setting up of joint external colloquia from leading international researchers, and the ‘coffee’ seminars at which everyone meets including postdocs and Ph.D. students. The Linnaeus Environment was also instrumental in the choice of *Areas of Advance* themes of Nanoscience & Nanotechnology and of Materials Sciences. The Linnaeus Grant was also key in obtaining the Strategic Research Area funding for Nanotechnology.

All of the research activities, especially the SiC graphene work, have enabled Chalmers to play the coordinating role in the EU Graphene FET Pilot Flagship Project.

Dynamics Created

There is an excellent synergistic partnership between theoretical and experimental research as illustrated in the breakthrough measurements of the dynamical Casimir effect. Another example is the close collaboration between quantum condensed matter physicists and the materials characterisation team, which provides high quality, quantitative information that can be correlated with theoretical insights and experimental data. The highest quality materials preparation and characterisation is leading to the outstanding new physics.

Future Potential

There is a high potential to remain a world leader in their original fields and to become a world leader in new fields. Their basic research has the potential for realizing graphene and quantum computing electronics.

National and International Collaborations

At the national level, LINNEQS has a collaboration on superconducting nanowires with NanoQE, a Linnaeus Environment at Lund University. There is also a collaboration with the LiLi-NFM Linnaeus Environment at Linköping University on the generation of high-quality graphene. At the European level, LINNEQS researchers have been successful in attracting funding for a total of 18 projects.

Gender Aspects

Chalmers University has a gender equal opportunity policy. However, in the fields of physics and engineering, the female fraction of undergraduate students is only about 20% and even lower in senior academic positions. In LINNEQS, three out of ten PIs are female. Female PIs act as role models, attracting young female researcher to their groups. However, overall the percentage of female Ph.D. candidates and postdocs is only about 16%.

Dissemination Methods

The method of dissemination of results to the scientific community is via refereed journals. LINNEQS state that they have adopted a policy of aiming particularly at high-impact journals. The other route of dissemination is presentations at scientific conferences.

Several of their results have been picked up by the general media, following press releases from Chalmers, and featured in both the broadcast and popular print media.

Students from pre-university schools have been invited into the laboratory and cleanroom. Some of the senior academics have given public lectures at Gothenburg's annual Science Festival (Vetenskapsfestivalen). Per Delsing was a member of the advisory board of National Science Discovery Centre, which is involved with Nanoconnect Scandinavia, promoting the value of nanoscience research.

Communication Strategies

Within the Linnaeus Environment effective communication channels exist. Bi-weekly internal seminars ensure an awareness of research activity across the centre, and these are organized by two of the doctoral students. Doctoral students regularly meet with their advisors. The students enjoyed the 'open-door' policy of the PIs. The PIs have regular, face-to-face meetings and scientific discussions.

Additional Issues

The evaluation report from 2008 was positive with no action items identified. There are no additional issues arising from the site visit.

The Panel's Conclusions and Recommendations for Improvements

The E Panel was impressed with the outstanding quality of research and the degree of risk taking that make the Environment a world leader. The research areas are interconnected, with strong synergy between theory and experiment. The E-Panel does not recommend a further broadening of the research areas to incorporate other disciplines.

There should be efforts to improve the gender balance. The E Panel encourages seeking young, outstanding female PIs, and expansion of the International Advisory Group with world-leading female researchers. Similarly, selection of outstanding female speakers for the LINNEQS Colloquium Series would be a valuable addition.

Graduate students who are experiencing external mentoring (e.g., from industry) find it of value. The E Panel suggests broadening this experience to include more students, as well as introducing more external industrial seminars.

The E Panel finds the LINNEQS environment to be outstanding in its research and to have established a broad and dynamic Linnaeus culture.

4.1.6 LINNEQS Doctoral Programme

Organisation and Management

The Doctoral Programme began at the same time as the Linnaeus Grant, with a funding level of MSEK 1/year. To date, there have been 44 Ph.D. candidates of which 13 have already graduated. Mikael Fogelström is the Coordinator of the Doctoral Programme. There is no formal steering group but rather the Programme is guided through a collegial format involving academic staff and students.

Each student has a primary supervisor and possibly one other, as well as an examiner who monitors his/her progress. The student discusses and plans the courses to be taken in consultation with the supervisor(s) and examiner. Regular discussions on what training and knowledge are needed by the students allow the creation and delivery of relevant special courses.

The Doctoral Programme has no formal feedback process, but the students that the E Panel interviewed were satisfied by the response of the Programme to their needs and raised no complaints.

Forms of Recruitment

The Doctoral Programme has instigated no separate enrolment procedure as the departments already provide good enrolment and follow-up processes.

The courses given by the Linnaeus Environment academic staff provide a showcase of the research activity of the Environment and aid in the recruitment of high-quality Ph.D. candidates.

Integration into Linnaeus Environment

In the E Panel's discussion with the students, it was evident that the Doctoral Programme is seamlessly integrated into the LINNEQS Environment. The Linnaeus Coffee Seminars are a good example of this. The Doctoral Programme has enabled Chalmers to offer graduate courses and to invite world-leading researchers as lecturers.

Two examples of courses created and offered by the Linnaeus Environment are:

- "Quantum Optics and Quantum Information for Solid-State Physicists" was held during the fall 2009 and given by Enrique Solano from Departamento de Química Física (Universidad del País Vasco, Bilbao) together with Göran Johansson (LINNEQS, Chalmers).
- "Microscopes to probe the quantum world" was given in the autumn of 2009 by several lecturers, Vladimir Popok (Gothenburg University), Øystein Fischer (Geneva) and Eva Olsson (LINNEQS, Chalmers).

Impacts

The LINNEQS Doctoral Programme is a driving force in the research Environment and has created new doctoral courses and organised Summer Schools. These activities have led to cross-pollination within the Environment and the University. It has also facilitated contacts with other nanoscience centres in Sweden, such as NanoQE, the Linnaeus Environment at Lund University.

Composition in Terms of Gender and Extent of Internationalisation

About half of the students are from Sweden and half are international. Female students constitute about 10–15% of the student body, which both the University administration and individual departments are making concerted efforts to increase.

Content of Programme

The creation of new courses, in response to the needs of the students, has been made possible by the Linnaeus support. A list of courses is given on page one of the Doctoral Programme self-evaluation form. If a particular course cannot be offered locally, then the Linnaeus Doctoral Programme will sponsor the student to take it at another university. Students attend conferences and make presentations. They are strongly encouraged to write papers and submit them to journals and conference proceedings. The Doctoral Programme has organised annual off-site summer schools as well as topical seminar series. Visits by students to international institutes to pursue research have been facilitated.

Future Potential, Career Opportunities

Recent graduates have been well placed in industry and academia (as postdocs in leading universities). Prospects for the future continue to look promising.

The Panel's Conclusions and Recommendations for Improvements

The Doctoral Programme offers a set of fundamental courses plus topical courses that change each year. The Programme is working well and is appreciated by the students interviewed by the E Panel. The off-site summer schools are valuable; holding these jointly with Lund University broadens the experience of the students. The summer school programme should be continued.

External mentoring by industrial researchers is a positive experience for the students. The E Panel recommends broadening this programme.

Extended research visits to other institutes, particularly outside Sweden, are valuable: the E Panel recommends increased external visits.

4.1.7 Nanoscience and Quantum Engineering at Lund University (NanoQE)

Introduction

NanoQE (Nanoscience and Quantum Engineering) is a Linnaeus Environment housed within the Physics Department of Lund University, whose primary mission is to build a bridge between high technologies on the nanoscale, and advances in fundamental quantum physics. It provides an integrated platform for experimental and theoretical research with a focus on quantum transport and nanophotonics, the development of controllable quantum systems, and life science research conducted at the single molecular level.

The Environment is currently composed of 22 faculty members and 33 postdocs and researchers, and the related doctoral program has 36 Ph.D. candidates. It draws its faculty and students from mathematical physics, solid state physics, atomic physics, synchrotron radiation, polymer and materials chemistry, and electrical and information technology. Current research at NanoQE is conducted in six areas, with synergy between them. These six areas are: materials chemistry; nanobiophysics; nano-electronics; QuEMS (extreme nano-devices, nanostructured growth, physics for energy applications); coherent phenomena in optics and transport; and many-body physics in small quantum systems.

The Linnaeus Grant, which started in 2006, is at the level of MSEK 7.5 per year.

Scientific Quality and Major Results

NanoQE leadership likens the structure of the environment to that of a tree, whose root system and trunk are formed by their infrastructure resources, consisting of advanced materials synthesis, world-leading facilities for nano- and micro-fabrication, as well as a wide array of tools for characterization by transport, optical methods and microscopy. This is complemented with a strong competence in theory, developed in the last decade, building on their foundations in basic physics. Scientific activities are built on this foundation, within the framework of their core-competence areas of materials physics and quantum engineering. During the last five years, NanoQE researchers have made substantial contributions to both theory and applications, with the following identifiable breakthroughs:

- Novel semiconductor nanowire heterojunctions; World-class results in wrap-around-gated transistors;
- “AeroTaxy”, a unique, substrate-free, rapid nanowire growth technique; and
- GaN nanowire growth (on Si) for LED (Light Emitting Diode) and photovoltaic engineering.

NanoQE researchers have maintained an excellent track record in publications in high-impact journals (such as *Science*, *PRL*, *APL*, *Nano Letters*, *Nature Materials*) as documented by more than three hundred publications and at least one hundred invited talks during the last five years. Members of the team have received, amongst others, the prestigious ERC starting grant, professorships at well-known universities, including the Chinese Academy of Sciences, membership in the Swedish Royal Academy of Sciences and Fellow of the American Physical Society (APS).

Several members of the NanoQE are involved with a number of start-up companies, which have been built around 40 previously acquired patents.

Organisation and Leadership

The management team of NanoQE actively drives the continuous renewal of the research in the center, to ensure continuity and identification of future opportunities. The Centre consists of a *Steering Committee*, a *Scientific Board*, as well as an *International Advisory Board*, as described in detail in the 2011 self-evaluation report, as well as in the 2008 evaluation report. Currently, Stephanie Reimann and Lars Samuelson act as Co-coordinators. Heiner Linke was recruited from the University of Oregon, USA, to Lund University as a new professor in Nanophysics, who is being groomed as a future coordinator of NanoQE. The Steering Committee of NanoQE is comprised of the two Coordinators, Heiner Linke, Director of the Linnaeus Doctoral Programme Sven Åberg and Anneli Löfgren as administrative coordinator. The center also has an excellent International Advisory Board, comprised of world-reknowned scientists.

Level of Commitment of the University

The Linnaeus Grant NanoQE provides basic funding supporting all activities within the Environment. The Center receives MSEK 1 per year as cash contribution of Lund University, which will continue during the next 5 years at the same level. The University expresses a strong support for the Linnaeus Centre – as is also visible in the internal review 2008, and in support from the Strategic Research Funding. Several University facilities exist, supporting the research activities of NanoQE.

Added Value

The total external funding acquired by members of NanoQE was MSEK 408.7 over the course of the Linnaeus Grant. In addition the Environment works with four companies that were previously spun off from prior efforts of its PIs. The Environment works in an area that is of major current interest to the semiconductor electronics industry.

Dynamics Created

NanoQE has high productivity. It has worked with Lund University on the initiative of the Strategic Research Area Nano. In 2009 consortium nmC@LU received the Strategic Research Area funding and used it for the following two strategic directions:

- (a) broadening of the scope with a strong focus on the application areas for nano-devices, ICT and energy, and
- (b) starting new initiatives via strengthened interactions with NeuroNano, biophysics and nanosafety.

This demonstrates flexibility. The reorientation exemplifies risk-taking with the potential of high reward in the future. Their success record inherently demonstrates a smart, risk-taking attitude and at the site visit the E Panel identified two impressive examples involving GaN LEDs and aerotaxy.

Future Potential

The appointments of nine new faculty in different ranks (including 3 females) is a positive development for the future of the Center. The Ph.D. candidates are well positioned to receive their degree within a five-year timeframe and are well mentored. They are also aware of and exposed to cross disciplinary aspects of the Center. The grooming at the higher management level is laudable. It is expected that the Centre will retain its high quality and relevance in the basic fields, and that it will be able to continue to impact new fields.

National and International Collaborations

NanoQE participates in numerous EU funded projects and has led the large EU NODE. There are excellent colloquium speakers who are world-class scientists. These speakers also are tapped as advisors, as conference participants, and as visiting scientists. There are plans to cooperate with the Lund Linnaeus Environment on organic materials (OMM), in addition to the already established collaborations with the Neuronano Research Center (NRC) and Lund Laser Center (LLC).

Gender Aspects

Lund University has a gender equality program in place. NanoQE is actively pursuing this goal and has achieved marked results. Three females are in the nine new PI hires. 26% of the graduate students are female. For comparison, 21% of physics Ph.D. students are female, and only 6% of physics professors are female. In engineering, only 14% of Ph.D.s are female. Moreover, the Centre supports a special visiting professorship that serves as a female role model, and strives to maintain a balance also in leadership positions.

Dissemination Methods

The main channels used for dissemination of scientific results are high-impact journals (Physical Review Letters, NM, AM, NLet, APL) and important conferences. Further dissemination is via summer schools and workshops (such as with Chalmers Linnaeus LinneQS). Also the additional affili-

ations of researchers to other organisational units contribute to the broadening of the Linnaeus Environment.

Topics of interest to the general public are presented via other channels by the staff, such as radio and TV and dedicated presentations for special audiences, including students in primary and secondary schools. The Centre maintains a clear and informative website that prominently identifies the Linnaeus Environment.

Communication Strategies

There are effective communication strategies within the Environment made possible via colloquia, coffee-seminars, e-mail exchanges, and meetings of students with their advisors on a regular basis. Also communication exists between NanoQE and other Lund Linnaeus Environments, notably with OMM (on organic materials) and NRC (on neuro-nanoscience research). Some PIs hold positions in adjoining departments, such as in the Department of Electrical Engineering and Information Technology and the Department of Chemistry. Communication with the Lund University Board is visible. NanoQE fulfils a role-model function for Lund University.

Additional Issues

The 2008 evaluation report notes the importance of the Linnaeus Grant for stabilizing long-term research and taking on high-risk projects. The E Panel shares the opinion that NanoQE has achieved this goal as evidenced by the quality of its work, its branching out into other fields, attracting external funding, and excellence of its students. Although efforts are underway to nurture new management, the future success of the Centre beyond 2016 remains uncertain, due to the planned retirement of the coordinator Lars Samuelson.

The Panel's Conclusions and Recommendations for Improvements

NanoQE is a world leader due to its excellent scientific results. Both the faculty and students identify with the Linnaeus Environment. In addition it has shown leadership in branching into new research fields, some with high risk, but high value. NanoQE is grooming a next generation of leaders to continue its success into the future.

4.1.8 NanoQE Doctoral Programme

Organisation and Management

The NanoQE-associated Doctoral Programme began in 2006 at the same time as the Environment and had its first review in 2008. The information presented in the self-assessment document is concerned with the period 2008–2011. Since 2006, 26 students have graduated with Ph.D.s, one with a licentiate degree, and 37 are currently pursuing their Ph.D.s. The Doctoral Programme has received MSEK 1.1 per year.

The Management Board consists of the Director of the Doctoral Programme, Sven Åberg, the Environment Coordinators Stephanie Reimann and Lars Samuelson, Heiner Linke, Anneli Löfgren, Knut Deppert, and two student representatives. The Board meets once a month.

Meetings are organised by the students to discuss on-going research and future employment opportunities. When appropriate, an external speaker is invited. The students meet once a year with the Director of the Doctoral Programme to discuss future courses and any matter of concern to be taken to the Board.

Forms of Recruitment

Recruitment is from students with relevant research projects in Lund University. The Management Board selects candidates based on relevant experience and quality.

Integration into Linnaeus Environment

The Doctoral Programme is well integrated with the NanoQE Environment. Courses are given by the PIs. Training on equipment used in the Environment is incorporated in the courses.

Impacts

The student's in their Ph.D. research at NanoQE benefit from the courses offered, as well as other Ph.D. programmes at Lund University.

Composition in Terms of Gender and Extent of Internationalisation

About a third of the students are from Sweden. Female students currently constitute 25% of the student body.

Content of Programme

The Doctoral Programme offers a broad spectrum of courses covering experimental as well as theoretical techniques unique for the research environment. Current courses are:

- High resolution electron microscopy
- Solid state theory
- Quantum mechanics advanced course II
- Nanomaterials: Thermodynamics and kinetics
- Nanoelectronics

New courses:

- Oral communication
- Optics in nanostructures
- Optoelectronics
- The electronic structure of solids
- Didactical and pedagogical training
- How to write applications
- Experimental techniques within nanoscience in Lund
- Many-body physics

Two summer schools were organized jointly by the Lund and Chalmers Directors for the two Linnaeus Doctoral Programmes. When possible, international experts are invited to Lund to give concentrated topical courses.

Since 2006 the Lund Linnaeus doctoral programme has had fruitful collaboration with the Chalmers Linnaeus Programme, and in particular its Doctoral Programme. Two summer schools have been arranged in collaboration between the two Programmes, in 2007 and in 2009.

Research groups in Lund, Gothenburg, Halmstad and Copenhagen (Copenhagen University and Danish Technical University) are the partners of the Interreg IV project "Nano Connect Scandinavia". Two nano-workshops were arranged in which students from the Lund Linnaeus Doctoral Programme participated. The workshop included lectures from leading researchers, student presentations of their own work, and innovation sessions with companies.

The creation of new courses, in response to the needs of the students, has been made possible by the Linnaeus support. Students are strongly encouraged to write papers to be submitted to journals and conference proceedings. The Doctoral Programme has organised annual off-site summer schools as well as topical seminar series. Visits by students to international institutes outside Sweden have been facilitated.

Future Potential, Career Opportunities

Recent graduates have been well placed in industry and academia (as postdocs in leading universities). Prospects for the future continue to look promising.

The Panel's Conclusions and Recommendations for Improvements

The Doctoral Programme offers a set of fundamental courses plus topical courses that change each year. The Programme is working well and is appreciated by the students interviewed by the E Panel. The off-site summer schools are valuable; holding these jointly with Chalmers broadens the experience of the students. The summer school programme should be continued. External mentoring by industrial researchers is a positive experience for the students. The E Panel recommends broadening this programme. Extended research visits to other institutes, particularly outside Sweden, are valuable: the E Panel recommends increased external visits.

4.2 Humanities, Social Sciences and Educational Sciences

4.2.1 Stockholm University Linnaeus Center for Integration Studies (SULCIS)

Short Description

The Stockholm University Linnaeus Center for Integration Studies (SULCIS) at Stockholm University is located at the Swedish Institute for Social Research (SOFI).³

Introduction

The listed personnel affiliated with SULCIS includes 9 Senior Researchers/Professors, 13 Ph.D. students, 8 Guest/Visiting Researchers, 7 Junior Researchers, 13 Postdocs, and 2 Technical and Administrative Staff.

The Linnaeus Grant is MSEK 7.525 per year. Co-financing by the university is approximately 37% of the award plus support of Ph.D. students. In addition the university closed down another centre and transferred the resources to SULCIS, including a position for a professor of integration and international migration.

Scientific Quality and Results

SULCIS was created with the awarding of the Linnaeus Grant and deals with integration studies, specifically immigrant issues in Sweden. Sweden has a long tradition of migration and receives a considerable number of immigrants from western and non-western countries. The existence of this Center is important. It serves the community by examining the relevant issues for Sweden, and can directly influence policymaking. Research at SULCIS takes the form of research projects in five broad thematic fields: the Causes and Consequences of Migration Flows; Integration Policy; Residential and Labor Market Segregation and Mobility; Schooling, Social Capital and the Transition to Work; and Unequal Opportunities.

Since 2006, SULCIS has produced a good number of scientific outputs in terms of refereed journal publications, book chapters, reports, and other policy briefs. The ranking of publication outlets is good. SULCIS has generated a database with 4 datasets. In addition, SULCIS has continued good contacts with policy-makers. The projects that SULCIS analyses are of value for Sweden. The SULCIS projects can also be important for international comparative analyses such as for comparisons of immigrant integration in Europe. Questions about discrimination in the labour market or in the financial loans, using rather experimental means, are also useful for Sweden. There is a lot of collaboration and co-authorship among the members of the core group. There are also different disciplines involved, which gives the center a multidisciplinary flair.

However, regarding breakthroughs, important collaborations, and international impact of SULCIS research the HSE Panel's overall assessment is reserved. Research at SULCIS is purely project oriented without an overarching theoretical binding and stays at a descriptive level of analysis. It appears that SULCIS does not take advantage of the theories that their strong Scientific Advisory Board has

³ SOFI was founded in 1972 and incorporated into the Stockholm University in 1981, therefore providing a strong heritage and springboard for SULCIS. SULCIS aims to advance its visibility and standing and above all to expand the scope of its research.

formulated. Moreover, the questions studied by SULCIS are not new, but have been analysed by many other researchers in several other countries, and neither are they taken in a new direction or to a higher level. Collaboration in papers remains among the members of the core group and has not expanded to include other internationally known scholars within Sweden or outside Sweden. As the projects are specifically and solely related to intrinsic questions in Sweden, they may not be of value to researchers outside Sweden. The output produced does not make any international comparisons per se.

Research also seems to be, or to stay along the lines, of replication of other studies. Often, due to better data, replication studies bring something new to the table, providing new insights to old questions, the result of which are of interest to an international audience. SULCIS research examines questions that have been studied by other researchers for a long time. While this is important for the country, it may not constitute what the Linnaeus Environments programme defines as scientific excellence or path-breaking research of international relevance. SULCIS research is more about answering the same questions for the country of study, Sweden, rather than addressing more pressing issues in the field such as immigrants in green jobs, immigrants' contributions to technological change and innovation in Sweden, or immigrants' labour market standing during and/or after the global economic crisis, just to name a few. Even if replication of results is important and can often lead to improved methods and findings, the students' dissertations seem to follow the same style of research. Examples of the dissertation topics are: job discrimination, income inequality and health, immigration history in Sweden, and immigration and crime. Researchers at Linnaeus Environments should be trendsetters and dictate the new questions for the decade rather than waiting for others to produce new questions

The HSE Panel also is concerned about the apparent depth of thinking of SULCIS research, the at times unclear structure of the Center and what appears to be the peripheral involvement of the Scientific Advisory Board. The productivity of the SULCIS team is good but not exceptional. On average, the outlets for publications are good field journals with wide readership but are not in what are considered top economic journals (with a few exceptions). The Panel noted that in many publications there is no mention or acknowledgment of the Linnaeus Grant.

Productivity varies among the researchers some with high productivity and some, at the reader and full professorship level, with surprisingly few publications since 2006. Since 2006, publication productivity is quite low for many of the 15 researchers listed in the self-evaluation report. The number of publications per researcher ranges from 3 to over 30. Six researchers, including some senior researchers, had fewer than 10 journal or book articles. This is a low level for high-quality research in this field. In addition, some conference paper presentations are listed as peer reviewed when in fact they are not, for example, presentations at ESPE (European Society for Population Economics) or AMERB (Annual Meeting on the Economics of Risky Behaviors).

Added Value

The added value is the new collaborative initiatives with other Stockholm University departments such as social anthropology, CEIFO (although this department has now closed down), criminology, and human geography. SULCIS is also collaborating (or has collaborated in the past) with the Department of Political Science, SPaDE, and CHESS (Centre for Health Equity Studies). The latter two are contributing to the financing of the "Level of Living Survey of the Foreign Born and their Children" (LNU-UFB). SULCIS gives other examples of collaborators among universities in Sweden, such as REMESO (the Institute for Research on Migration, Ethnicity, and Society at Linköping University) and Lund University's CED. Regarding international collaborators, SULCIS has been engaged with Nordic countries, Poland, and Canada. Future plans for the next 5 years are strongly based on data. However, after 5 years of the Grant, the data are not at the level of completeness the HSE Panel would expect. The added value of SULCIS in their own assessment is that they act as infrastructure among the social sciences.

Dynamics Created

This research is possible due to the SULCIS work to collect, create, or enhance databases from four sources (1) Level of Living Survey of Foreign Born and Their Children (LNU-UFB); (2) the develop-

ment of a register (administrative) database STATIV with demographic characteristics and migration information; (3) the creation of a dataset for the financial sector with information about loan applications of individuals and the country of origin of the individuals and their parents, which will be used to study discrimination; (4) interviews with young school-aged immigrants and natives who are tracked in the register data, and who will be interviewed several years later to learn about the role of networks in the labour market and other outcomes.

SULCIS addressed the 2008 evaluation critique and developed a more accessible framework for the research carried out. It received a professorship from the Center for Research in International Migration and Ethnic Relations (CEIFO) (the Center closed), and added another member to their Scientific Advisory Board. They also added collaboration within the university involving criminology and social anthropology; initial collaborations were only between economics and sociology.

The HSE Panel would like to see more comparative work and recommends that SULCIS researchers apply to European Union programmes that support this type of research.

National and International Collaborations

Most of the contacts are through personal connections, and it is not clear what the degree of collaboration is. There are no formal memoranda of understanding that can include exchange of students, for example.

Future Potential

SULCIS is related to SOFI, an established research institute, and it is not clear how SULCIS has made its own path beyond the paved road of SOFI. There is an overlap of researchers in both places. For example, SOFI is known to the government and policy-makers, who may contact SOFI to find out more about new results. The distinction between SOFI and SULCIS is not always clear. The projects that SULCIS is planning for the next 5 or 7 years appear to be “more of the same”. The HSE Panel would like to see the SULCIS director and team setting a more innovative and aggressive research agenda for the next 5–7 years. The talented students that the Panel met do not appear motivated to consider a career outside SULCIS. The HSE Panel noticed that the undergraduate students become doctoral students, become Ph.D.’s, postdocs, assistant professors, associate professors, etcetera within the same unit.

Organization and Leadership

SULCIS draws on six departments: economics, sociology, human geography, criminology, social anthropology and SOFI. It conducts research on and offers courses in immigration and integration and is an integral part of one of the university’s leading research areas in social sciences. SULCIS is run by a Director (Coordinator), supported by a Deputy Director. SULCIS is governed by a six-member Managing Group (MG) appointed by the university. This group has two members from each of the departments of economics, sociology, and SOFI, and meets twice a month. SULCIS also has a five-member international Scientific Advisory Board (SAB) that meets once a year at SULCIS for 2–3 days. Regular meetings are held with all affiliated personnel to discuss SULCIS related matters.

SULCIS organization has remained unchanged since the 2008 evaluation. The HSE Panel is concerned with the lack of strategic ambition of the leadership at SULCIS and is even more concerned about the leadership gap that is expected after the Coordinator’s retirement. The Coordinator is a known researcher in the field, and in Sweden, with many connections. The current Deputy Director is listed as an administrative assistant (on the website) as well as a Deputy Director and reader, but her duties are not clear. The deputy position often involves some administrative duties, but this should not include maintaining the website.

Gender Aspects

The SULCIS gender balance is at present 47 percent females and 53 percent males. The Ph.D. group is very small and the selected sample of students the HSE Panel met was female dominated.

Level of Commitment of the University

The Vice-Chancellor stated that SULCIS has indeed brought added value to Stockholm University and that the university will support SULCIS in the future. He said that SULCIS is one of the leading research units in Stockholm University, works in a leading research area and that the university has received many more grants (from elsewhere) because of SULCIS. The contribution of the University appears to be entirely through in kind support. From the interview with the Vice-Chancellor, the leit-motif appeared to be a lack of clear vision, of a burning aspiration to revamp the Center and to make it one of the top integration centres in Europe that attracts scientist and researchers from all over the world.

The University closed down a related center (CEIFO) and transferred resources to SULCIS, which has resulted in the addition of a new position, a professor in integration and international migration. The University is paying for this position.

External Communication

SULCIS communicates its output and results to the community. For example, it has its own discussion paper series, and uploads information on its website, both in Swedish and English. SULCIS did not mention other international outlets that have wide presence and prestige internationally in which they also disseminate their results such as the German Institute of the Study of Labor (IZA)'s discussion paper series or the Centre for Economics Policy Research (CEPR) discussion paper series. The researchers appeared unaware of other media of dissemination and/or networks with high visibility from which SULCIS can benefit. For example, SULCIS could use H-NET, Humanities and Social Sciences online networks and scholarly edited "lists", as H-ETHNIC, H-MIGRATION and others. SULCIS researchers did not know about IMISCOE research network (International Migration, Integration, and Social Cohesion) and have little collaboration with universities in Europe.

The HSE Panel thinks that, while it is a good idea that the researchers from SULCIS can be responsible for content, there should probably be a professional in charge of the website; someone who is almost daily updating the website, corrects mistakes, and makes sure that all links are "working".

SULCIS dissemination, contacts with the policy-makers and report writing for the government, is positive but it is also a treacherous slope, as researchers might easily end up doing only consultancy.

The Panel's Conclusions and Recommendations for Improvements

Linnaeus Grants are meant to enhance support for research of the highest quality that can compete internationally. SULCIS was awarded and received the Grant in 2006. The HSE Panel finds that the overall quality of research is not up to the standard expected in a Linnaeus Environment. The publication record is not exceptional and for some of the senior professors it is below average.

It is unclear what the difference is between SULCIS and SOFI and how SULCIS has differentiated itself (almost all personnel are affiliated with both units).

National and international contacts exist but are not fully used to formulate collaborations.

The HSE Evaluation Panel makes the following recommendations:

- Include theoretical foundations of research.
- Increase comparative nature of work. Apply for European Union funding available to do this.
- Increase visibility in the national and international arena.
- Recruit outstanding senior scholars outside the SULCIS environment and develop a succession plan.
- Continue active outreach of results to establish a competitive edge.
- Increase publication productivity among researchers.

4.2.2 Ageing and Living Conditions (ALC) at Umeå University

Short Description

The Ageing and Living Conditions Linnaeus Environment at Umeå University (ALC) intends to understand the interactions of ageing population, participation of the elderly in work and society, and

successful ageing of individuals. It coordinates use of national and international databases and involves researchers and organizations from multiple social science, humanities, and medical backgrounds. The long-term goal of ALC is to establish a world-class centre for the study of the ageing population.

Introduction

The Coordinator of ALC is Anders Brändström, full professor in historical demography at Umeå University. The staff participating in the Linnaeus Environment includes 19 senior researchers, 12 junior researchers, 9 postdocs and 23 Ph.D. students.

The Linnaeus Grant is MSEK 8 per year + MSEK 1.4 per year for the Doctoral Programme. Co-financing from the university is approximately 65%.

Scientific Quality and Results

ALC is already considered among the international academic community as a pilot center, not only for its strong research structure and longitudinal multigenerational database, which is unique in the world, but for the scientific quality of its academic results, interdisciplinary approach to research and peer-reviewed publications which have introduced a life-course perspective on ageing. Essential to interdisciplinary research in the ALC is the combination of quantitative and qualitative research and the meeting of research traditions from the humanities, medical, social and cognitive sciences.

The Linnaeus database created by ALC contains high-quality data, combining register data with surveys, allowing research to develop within a coherent framework. New research is implemented from a common basis, taking advantage of life course issues and socio-economic structures. Methodological capabilities and new methods such as brain imaging are developed, providing a good example of interdisciplinary research, since medicine is included in this environment. Brain imaging results are linked to the population database, leading to new measures of population heterogeneity in maintenance or decline of cognitive abilities over a 25-year period. Among other achievements, it was noted that the intervention programme was very effective and helped close the income gap in lowering the risks of cardiovascular diseases.

Members of the ALC have high productivity: senior and junior researchers from different disciplines produced more than 350 publications since 2006 (to which 45 titles are to be added since October 2011). This is high-productivity research, given the fact that the database has only been available in full since 2009.

Added Value

The ALC Linnaeus Environment and the *Doctoral Programme in Population Dynamics and Public Policies* linked to it constitute one of the University's strategic research initiatives, bringing tangible added value. The Umeå University is committed to ALC and placed it among the top three research priority areas of the University, and the only one in the HSE field. The Linnaeus Grant has allowed the team to work together in a true interdisciplinary environment. Their results have very important consequences for ageing policies. The *Västerbotten Intervention Programme* (VIP) is a good example of ground-breaking results arising from an interdisciplinary effort: the VIP effects in lowering mortality were analysed in different socioeconomic groups.

Dynamics Created

High-productivity of research was mentioned above, particularly at the European level. It is noticeable that ALC became a member of a unique European research infrastructure since the *Survey of Health, Ageing and Retirement in Europe* (SHARE) has become a major pillar of the European Research Area. SHARE is one of the first projects to be implemented from the *European Strategy Forum on Research Infrastructures* (ESFRI) Roadmap (2008). In March 2011, the core of SHARE was even given a new legal status as the first ever *European Research Infrastructure Consortium* (SHARE-ERIC).

SHARE helps understand the impact of population ageing on European societies enabling policy-makers to make decisions on health, social and economic policy. Thanks to the Linnaeus Grant supporting ALC, Sweden was able to join a large international project called SHARELIFE, which focuses

on people's life histories. Individual micro data are linked with institutional macro data on the welfare state. It thereby allows assessing the full effect of welfare state interventions on the life of the individual. Changes in institutional settings that influence individual decisions appear to be of specific interest to evaluate policies throughout Europe.

A two-year cycle of review by Advisory Board members has produced coherence in the research programme and provided a dynamic framework for collaboration and further development of the programme. The Advisory Board is therefore an integral and active element of the organisation.

National and International Collaboration

At the national level, scientific collaboration exists with Stockholm University, Lund University and other Linnaeus Environments. At the international level important collaborations exist with the American *National Institute on Aging* (NIA), for example with grants initiative taken by ALC. Contacts have been established with Heidelberg University (Institute of Public Health and Network of Ageing Research) in particular with the new *Ageing and Climate Change* international project (The Arctic, Europe, Africa: research and intervention), in order to study the specific vulnerability of ageing people facing cold and heat waves. Even if ALC has financed a 2-year post-doc in Sami research, the HSE Panel expressed the opinion that Sami research could be much stronger within the ALC.

Regular exchange of researchers and collaborations also occur with the Max Planck Institute in Berlin. In Finland, ALC works with Gerda Botnia, Lapland University and its Network for Gender Studies. There are other contacts in Africa and Asia that are not formal, and participation of ALC researchers in EU-funded projects have been sporadic (for example the *Servant Project* resulting in recommendations to policymakers concerning care-giving in old age). International researchers regularly take part in the ALC Environment.

Permanent national and international contacts, research cooperation with other groups, frequent presentations in international conferences (by senior professors and younger scholars) have supported improved methodologies and findings leading to competitive high-quality and trustable results that may be used by policymakers.

ALC should further develop several of these relationships, formalising longer-term forms of collaboration with international partners.

Future Potential

Among their ten-year aspirations, ALC lists becoming a key player on the international stage. This is highly plausible given their unique database. ALC fits well within the *Centre for Population Studies*. It should not be separated, despite the complex relationship between both, and the HSE Panel advises also, if possible, to keep the Sami indigenous population research as an integral part of ALC. Recruitment of young staff is an excellent approach for securing the long-term viability of ALC.

The University strategy of having ALC among the top 3 priority research areas is of vital importance for achieving the long term goals of this Centre: to be a well-established and sustainable *Centre for the Study of Aging*, and to become increasingly international.

An explicit strategy is required to make the database accessible to the wider scientific group, while preserving the confidentiality of the data.

Organization and Leadership

The complexity of the organizational structure is not felt by ALC to be a problem. On the contrary, the structure is flexible and works well according to the coordinator and the two members of the Advisory Board present at the site visit. The Advisory Board seems to work actively and forms an integral part of the decision-making and implementation of the Linnaeus Environment at Umeå University.

ALC explicitly supports young scientists, which is also the university policy. This explains the apparently high turnover noted among PIs since 2006.

Currently the courses of the Doctoral Programme do not give added value to the research topics of ALC. The Doctoral Programme does not appear to be yet fully integrated with ALC, even if major efforts in this direction have been noticed.

Gender Aspects

A good gender balance in researchers and other staff has been achieved. The ratio is at present 40% males and 60% females.

Level of Commitment of the University

As evidence of commitment, the University and its Board have supported new initiatives for the ALC through funding for international work, support for postdocs and infrastructure, salary support for a researcher in health economics, a tenure track program with four positions, and a professorship in ageing research. ALC is one of the top three priority areas for Umeå University.

External Communication

The scientific dissemination (395 publications) is good, including the proportion of peer-reviewed publications in well-known quality journals.

The ALC has a permanent Communication Officer. The general public is the main target of the external communication. More efforts need to reach the wider community, such as the elderly, even though ALC already collaborates with the Active Seniors Association in Umeå.

The website looks good (in Swedish and English) and is up to date. The communication strategy of ALC includes scientific reports, annual reports, announcements, press releases, media contacts, a quarterly newsletter, an external mailing list, public presentations, and learning lunches. However, a more pro-active approach is required to informing policymakers.

The Panel's Conclusions and Recommendations for Improvements

ALC addressed the recommendations from the 2008 evaluation and have worked to increase the inter-disciplinarity of the research and to better integrate the Doctoral Programme.

The HSE Panel's recommendations are:

- Increase and formalise international exchanges and collaborations
- Increase the level of interaction with policy-makers and health care professionals
- Improve visibility of findings outside the normal scientific community
- Improve the visibility of the topic *Ageing and Living Conditions* on the national and international level
- Invest in developing an alumni network.

4.2.3 ALC Doctoral Programme

The Ageing and Living Conditions Linnaeus Environment at Umeå University has been very valuable for the Doctoral Programme called Doctoral Programme in Population Dynamics and Public Policy.

Organization and Management

The organization of the Linnaeus Doctoral Programme is good. It can fit about 23 Ph.D.s (the present size) but not more. The planning of future courses is done through collaboration with the Director and the department representatives across the Programme that are presented to the Board for approval, an Information Office was appointed that has improved communications between the programme and the ALC, and the transition to the new Director occurred with the previous Director available for consultation. In addition, the setup of the Board, with an Executive Committee and Admittance Committee, deals with on-going issues in between board meetings. The Director is a member of the Admissions Committee, administrative staff, and Steering Committee, which gives him comprehensive perspective on all facets of the ALC Programme. The Director and the Chair of the Board (the Vice-Chancellor) meet regularly between Board meetings.

Integration into Linnaeus Environment

Factors that contribute to the integration of the ALC and the programme are (1) the mentors and supervisors are researchers from the participating departments, (2) the integration of the Programme's

and ALC's seminar series, and (3) the Board, which has approved adding four tenure-track positions and a professorship in ageing research. But the programme is still not yet fully integrated into ALC. There are possibilities, as they expressed themselves, to link the Doctoral Programme and ALC more closely. One obvious route would be to include ageing courses in the curriculum. This could be done by inviting international academics, for instance.

Recruitment

The Doctoral Programme should be more present at the international level. On the one hand it is clear that a substantial share of the Linnaeus Grant should go to Swedish students, but on the other hand a mix of international students will enhance the quality of the Programme.

The Programme would therefore to a higher extent benefit from international recruitment of its student and research staff. But this would imply looking for extra financing due to the fact that the present doctoral program has not the financial means to pay for doctoral positions.

Impact

The Ph.D.s are engaged in front-level scientific research in ALC, and are co-authors in many publications. The programme is an important resource for researchers within ALC, and also provides an interdisciplinary platform for scientific discussions and collaborations.

A positive added value of ALC into the Doctoral Programme was identified for the following points: supervisors are available, the Doctoral Programme is partly financed, students are trained in paper writing and editing, the Linnaeus database is easily accessible (according to ethical rules), the selection of research topics is attractive, the environment is interdisciplinary, rich competence is permanently available, seminars, workshops and lectures offer frequent both national and international openings and debates fields.

The topics chosen by the environment are at the frontiers of scientific progress in the field of ageing, e.g. aging and identity, ageing and climate change, ageing and well-being.

Composition and degree of Internationalization

The composition of the student population shows signals of internationalization, but the HSE Panel notices, as shown above, that the potential is not fully used. The availability of a unique database and the interdisciplinary character of ALC should be able to attract students from many universities in many countries.

The Programme promotes mobility to its doctoral students after their Ph.D. In fact, only one Ph.D. was recruited in ALC. This is a good policy, which needs to be enhanced in all doctoral programmes.

The network of the Doctoral Programme with other universities seems to be based largely on personal contacts. However, some of these contacts could be developed into formal agreements, for instance in the form of exchange programmes at the ALC and/or university levels. Other possibilities are for instance developing a Memorandum of Understanding with other Ph.D. programmes, such as the Pardee graduate school of RAND in California, which focuses on ageing and health as well.

The Doctoral Programme should pursue their idea to become involved in European Marie Curie initiatives, which is a good way of stimulating the internationalization of its students.

Content of Doctoral Programme

Students take one part of their required courses in their respective departments, and one part within the doctoral Programme.

The courses in the Doctoral Programme are focused on methodology, but many of them are of a quite general and basic level (e.g. SPSS) and could be given by any faculty. The HSE Panel misses interdisciplinary courses on ageing in line with ALC. The inclusion of such courses would also strengthen the coherence between the Doctoral Programme and ALC. The more focus put on the specific themes of ALC in the programme, the more successful the joint output of ALC and the Doctoral Programme will be.

A special quality of the Programme is the training of general academic competences, such as proposal writing.

There should be more systematic evaluation of the quality of courses.

Future Potential and Career Opportunities

Up to now, twelve Ph.D.s have finished their degree. One Ph.D. entered the ALC as a researcher. A more targeted strategy should be developed to send doctoral students abroad to work with other research groups in the same field. Future careers could be developed thanks to lively Swedish networks and scientific exchanges. Currently, common courses are regularly arranged with the Doctoral Programme linked with the Centre for Economic Demography (CED) at Lund University.

The Panel's Conclusions and Recommendations for Improvements

The HSE Evaluation Panel makes the following recommendations:

- Recruit international students
- Invest in developing an alumni network.
- Offer interdisciplinary courses focused on ageing and health.
- Rename the programme which currently appears as a *Doctoral Programme in Population Dynamics and Public Policies* to reflect the topic of ageing and living conditions.
- Develop and implement strategy to send doctoral students to work nationally and internationally with other research groups in the same field.
- Systematically evaluate the quality of the courses.

4.2.4 Learning, Interaction, and Mediated Communication in Contemporary Society (LinCS) (University of Gothenburg)

Short Description

The name of the Linnaeus Environment is Learning, Interaction and Mediated Communication in Contemporary Society (LinCS). The University of Gothenburg administrates the centre. There are 32 Ph.D. students, 7 guest/visiting researchers, 8 Junior Researchers, 13 Postdocs, 16 Senior Researchers, and 2 Technical and Administrative Staff.

The Linnaeus Grant is MSEK 5 per year. Co-financing by the university is approximately 76% of the grant.

LinCS is a large research group for the education sciences (in total 50-55 researchers, 20-25 Ph.D. candidates, technical and administrative staff). Major research results have been achieved in four fields: (1) digital media and learning environments in school, (2) digital media in higher education and professional learning, (3) learning, everyday activities and identity in contemporary society, (4) video in research on learning: methodological and theoretical opportunities. On each field a large set of detailed results is described. In accordance with the ambition of the Linnaeus Grants, the research findings reported provide new ways of understanding how technologies are integrated into teaching and learning in school. Between 2006 and 2011 a number of grants were presented during the site visit in the presentation, funded by different national and international funding agencies, mostly the Swedish Research Council. Other important sources of funding have been Knut & Alice Wallenberg Foundation, Knowledge Foundation KK-stiftelsen and Gothenburg University.

Scientific Quality and Results

Technology is leading to the production of massive amounts of data, implying a move from human to automated analysis and production of information. At the same time, a dramatic shift is noticeable in how society stores and accesses digital information. LinCS studies this shift. The primary research interest concerns the role of digital media for transformation of learning practices inside and outside educational institutions. More specifically, it focuses on research in the field of learning, interaction, and mediated communication with a special emphasis on the effects of ICT on learning and knowing.

The results from the research confirm, at a general level, that technologies per se do not have any uniform effects on teaching, learning or performance. However, it is shown that a critical matter is the instructional approaches used and how the technology is integrated into learning practices. For

example, using games can enhance children's competency in mathematics. Another example is how technology can change the approach from 'seeking the right answer', to more open-ended questions that allow for exploration and knowledge seeking, which technology makes easier to do.

A second area of results is related to digital media in higher education and professional learning. The studies in this area take local practices and circumstances as points of departure, like IT-helpdesk teams, professions involving a complex mix of manual, visual, technological and discursive skills and more generic tools in professional education. The findings reveal that theories of media richness and media choice explain little of the actual choice of technologies in everyday work. Instead the results suggest a practice-oriented perspective on how to understand the choice of mediating technology.

The third research area is about learning, everyday activities and identity. Learning technologies are explored in everyday settings, for instance in gaming and on a more general level children's engagement in online practices.

The fourth area relates to video in research on learning. Video documentation has changed research in learning sciences by providing editing and analytical tools contributing to knowledge production. LinCS has also developed a lab facility (LinCS lab) serving as a platform for theoretical and methodological inquiry and development. The laboratory provides guidance for the scholars to secure the quality of the design, analysis and communication. The ambition has been to develop and maintain an infrastructure for generating, analysing, sharing etcetera video documented interaction. A number of promising outcomes of work in the studio are reported. This has generated more publications, as well as grants.

Productivity is an important expression of scientific quality. 400 publications, including 88 peer-reviewed articles, several books and book chapters, are reported for the period 2006–2011. Citation practices vary between scholarly disciplines and in the area of education it is still difficult to get a clear standard for estimating impact factors of educational research conducted in Europe. However, the number of citations in journals can, regardless of the lack of comparable standards, be considered substantial. Moreover, at the national level a large record of Swedish publications is listed, particularly text books for university students, as well as popular scientific contributions. Publishing textbooks in Swedish facilitates good outreach to teacher education and schools.

Added Value

Investments in a University of Gothenburg Learning and Media technology (LETStudio), with an annual funding of MSEK 5 made possible through the Linnaeus Grant, put the group in a leading position regarding educational research with new media. LETStudio is described as an extension of the research perspectives of LinCS and several of the environment's scholars participate in LETStudio work. It has been successful in attracting additional external funding, e.g. winning a national competition for research funding from the Wallenberg Foundation.

Yet another characteristic feature of the research performed is a well-framed theoretical platform which, together with targeted research questions, contributes to maintaining an integrated and holistic character, despite a large number of different sub-projects. However, the fact that LinCS continuously generates new projects remains a challenge for retaining future coherence and consistency. Researchers seemed to be quite aware of the situation and paid attention to the risks.

Dynamics Created

The dynamics created by LinCS is illustrated in several new initiatives and research projects, additional research funding, multi- and interdisciplinary developments and the hosting of the LETStudio. The influence of LinCS is strong on teaching in higher education in Sweden. Being recognized as a center of excellence makes the environment an attractive partner in collaborations. Some LinCS scholars are leaders in national and international research and advisory groups, particularly on a Nordic arena. Institutionalized agreements based long-term international collaborations seem, though, to be limited to a few partners.

The Grant is considered by all interviewed at the site visit, and is expressed in the self-evaluation report to have been important for developing the research group and for engaging in new projects.

There is no formal Linnaeus Doctoral Programme attached to LinCS but doctoral training plays an important role. So far there have been 29 dissertations, six of which were produced in the framework of LinCS, with the others supervised by LinCS researchers. In fact LinCS runs a doctoral programme (Ph.D. courses) funded by the Swedish research Council (LinCS-DSES) in which doctoral students from Sweden and other parts of the world participate. Currently the number of Ph.D. students is 22, which is consistent with the Programme and the availability of supervisors. Depending on their topic and discipline, Ph.D. candidates experience different relationships to LinCS. The Linnaeus Environment has opened doors for collaborations with other research communities, and the Environment itself was labelled as an example of quality by the candidates. The general picture among the candidates was that LinCS offers a fruitful and dynamic environment with easy access to adequate and wide competence which contributes to the quality of their research. By involving candidates in applications for grants they get, at an early stage, good training in writing research proposals.

Future Potential

Plans for future research are ambitious. Several projects are on-going and new projects are continuously launched, such as design-based studies into issues involving institutionalized forms of learning through adoption of digital media in school and other educational settings. The scope of the results presented is already remarkably wide, but a more holistic view of structured patterns has not yet been made visible. During the remaining project years the leadership, therefore, has to pay attention to maintaining consistency and a clear focus on the general and specific aims stated for the whole project.

The prognosis for the status of this research in ten years' time is encouraging. This is underpinned by strategies aimed at intensifying collaborations with scholars and practitioners that are affected by the current changes in media ecologies where interaction with technologies will be increasingly important. The LETStudio is anticipated to become the most prominent element in this development, as an arena for in-depth collaboration on problems concerning learning and visual technologies.

Organization and Leadership

The general management structure reflects the manifold nature of the Linnaeus Environment. LinCS is organized as a multi-institutional collaboration between scholars and research groups at the University of Gothenburg, Chalmers University of Technology, and the Swedish School of Library and Information Science of the University College at Borås. It is led by a Board with seven members, representing participating units and various stakeholder groups (seniors, juniors, Ph.D. students and one administrator). There is one Director and four Co-directors. Care is taken to develop talented junior researchers for future leadership positions.

The 2008 evaluation report criticized LinCS for its overly complex governance structure. The large number of groups was criticised as possibly not being conducive to synergy and coherence and leading to difficulties in maintaining consistency and striking power. Several groups with overlapping research interests, skills and competencies were working in parallel and with diverse foci. The self-evaluation report acknowledges the observations made by the expert group in 2008, and action has been taken since then to remedy the situation. This has resulted in a better focus of the actual research (i.e. exclusion of policy-oriented research) and in a simpler governance structure. Four Collegia are now integrated in one. The project-driven eight-working-group structure seems to have disappeared but it was not clear to the HSE Panel what kind of structure has replaced this.

Gender Aspects

Attention is paid to gender balance: 5 men and 6 women have served in the Steering Group. The University has a clear policy for equal treatment and LinCS follows its rules. The overall balance within LinCS is 40% men and 60% women. At the senior level there are more men (13 male, 8 female), while women dominate at the postdoc and junior researcher level (5 men, 11 women) and at the level of Ph.D. candidates (5 men, 15 women). The Steering Group currently consists of 3 men and 4 women. Recruitment also takes gender balance into account.

Level of Commitment of the University

The grant is considered important for the University, and in its strategy the University Board has selected “Learning” as one of a few interdisciplinary priority areas and established the LETStudio.

This has expanded the collaborations within the University emphasizing the synergies between LinCS scholars and different departments, for instance scholars and practitioners of the Sahlgrenska Academy, Gothenburg Centre for Person-Centred Care, and several departments within Humanities, Sociology and Teacher research. As a consequence of the synergies created in these new activities, significant additional funding from external sources has been generated.

External Communication

Research results have been communicated to the scientific community via a large number of publications.

LinCS members have teaching responsibilities in their respective faculties, especially in teacher education. As Gothenburg has one of the largest teacher training programmes in Sweden, this is an important arena for the dissemination of results. LinCS members are also involved in in-service teacher training at all levels of the education system. A large number of popular science articles have been produced, which have appeared in newspapers, teacher press, popular journals in the area of libraries and librarianship, and popular media journals.

LinCS members also participate in public events and in developmental work (e.g. video-based training in dentistry, virtual microscopes in medical education, wikis in higher education) and there is a frequently updated website (www.lincs.gu.se). In addition LinCS has formed collaborations with industry and policymakers. For example, one of the LinCS researchers participated in R&D work with the Mobile Life Centre, a VINNExcellence Centre funded by VINNOVA operating in collaboration with industrial partners (Ericsson and Microsoft Research).

The policy of the Centre to prevail in a bilingual language environment corresponds appropriately to national and international needs. LinCS shows a strong commitment of serving teacher education by research and teaching, which requires a well-established scientific national language. On the other hand the communication and dissemination of research is linked to the language requirements of the international scientific community.

The Panel’s Conclusions and Recommendations for Improvements

The LinCS has contributed to a remarkable expansion of multidisciplinary collaboration within the university and between the University and participating external institutions. Overall LinCS is successful, dynamic and productive, and a high quality centre with a strong research environment providing excellent working conditions for researchers and doctoral candidates.

The results already presented in the mid-term evaluation and on the site-visit are very promising and have produced added value to our understanding of the role of communication technologies in various learning practices. The standing of the research conducted is impressive in relation to publishing policy, attracting external funding, funding for postdocs and invitations to join several collaborative research activities and participate in national and international communities.

The HSE Evaluation Panel makes the following recommendations:

- Develop long-term collaborations based on more formal agreements to further increase their international impact.
- As LinCS continues to generate new projects, systematically evaluate them to encourage and support consistency and coherence in the entire Linnaeus Environment,
- Plan a study of investments in infrastructure for a wider range of stakeholders, such as parents or professional associations.
- Maintain control over the ICT infrastructure, given the large reliance of LinCS on digital media and databases.

4.2.5 Centre for Economic Demography (CED) at Lund University

Short Description

CED has substantially grown since 2006, particularly in the number of Ph.D.s: from 14 to 39 Ph.D. students. Currently there are 25 senior researchers participating in the centre, 7 post-docs and 4 junior researchers. There is a large overrepresentation (more than 80%) of males among these groups. Technical and administrative staff amount to 16 persons.

The total grant from VR is MSEK 5 per year. Co-financing of the University is 87% (MSEK 22) of the Linnaeus Grant received so far, mostly (MSEK 14) in the form of wages.

Introduction

The Linnaeus Grant given to the Centre for Economic Demography is meant to 'close the gap' in knowledge between the past and the present processes in health and mortality improvements, and the making of the modern Swedish family. This closing the gap is literally filling in the data gap between historical micro data that span the period from 1750 to 1895, and digitized national register data from 1968 onwards. . The opportunity for cross disciplinary research will be much greater now that the data gap has been closed. The Centre will lead to a greater understanding of the demographic changes during the transition from an agrarian to the modern welfare society in Sweden. It will also allow an intergenerational life course approach to demographic change and health. A specific feature of the Centre is the micro-macro link that should give insight into the role of macro developments, such as economic crises or famine, and institutions on micro behaviour. Within this overarching theme the Centre distinguishes between 5 research areas: (1) the demographic transition (from high mortality and fertility to low mortality and fertility); (2) population ageing; (3) fertility, family and gender; (4) immigrant integration; and (5) pathways to health and wellbeing. The focus is on description, but primarily on causes and consequences of demographic change.

In line with the strong Swedish tradition on this point the centre has developed a unique database: the SEDD (Scanian Economic Demographic Database 1646–2011), but also the SLI (the Swedish Longitudinal Immigration Database) and FINSWED (the Finnish-Swedish Longitudinal Immigration Database). In addition, researchers collect their own samples to complement these register data, and to go deeper into the specific causes and consequences of demographic change.

Scientific Quality and Results

The scientific quality of the centre is measured through a number of indicators. First, the scientific output in terms of high quality publications is substantial. The group publishes in the major journals in the demographic, social medicine and economic field, such as *Demography*, *Population and Development Review*, *Social Science and Medicine*, *Labour Economics*, *Economic Journal*, *Economic History*, etcetera. The group also admits that it has not yet reached to the real top level, such as *Nature*, *Science*, or *the Lancet*, but states that they are aiming at this for the future. In total there are 462 publications to be counted by the end of 2011.

Second, CED has been able to create a truly cross disciplinary platform, where researchers from various disciplines interact fruitfully and find new avenues for research that would not have emerged within the traditional confines of the respective departments. Clear examples of such cross disciplinary linkages were given in the presentations of the research group and talks of the Ph.D.s. The five research areas mentioned do not function as separate units or labs, but are focal points of research where various researchers may be engaged. For instance, the migration theme is also relevant in the ageing and health themes. While acknowledging that the cross disciplinary character of CED is an asset, one of its current weaknesses, pointed out in their SWOT analysis, is the limited number of cross disciplinary publications. Given the high productivity of its researchers, solving this issue is not a matter of increasing the level of output, but an organizational matter of bringing the right people together.

A third indicator of the scientific quality of CED is the availability of a unique historical, multigenerational database of demographic and health indicators of the Scania region: SEDD (Scanian

Economic Demographic Database 1646–2011). The biggest advantage of this database is that it enables life course research over a very long time span. This opens up the possibility to answer important research questions, such as early life experiences and later life health and mortality; intergenerational causality in social and health inequality; disentangling age, period, and cohort factors in demographic, health and socio-economic change, etcetera

In the presentations some clear examples of new findings not previously known in the literature were presented. For instance, from analysis of the social gradient in adult mortality in the age group 20–59 over the last 200 years it appears that social differences between the highest and the lowest social classes have been persistent but small until the middle of the 20th century, and have widened substantially since then. Based on this pioneering result from the CED group other researchers in Sweden and abroad have confirmed this result with other data. Another example involves the study of early life factors on later life outcomes in demographic, socio-economic and health outcomes. For instance, exposure to airborne infectious diseases in the first year of life, such as measles, scarlet fever and whooping cough, was found to have a significant effect on social mobility and mortality in later life.

The use of the life course framework in these studies also implies that the role of macro-factors on micro behaviour is taken into account. SEDD, therefore, also contains a module that records macro-indicators of economic change (such as prices), epidemics, etcetera. In various studies macro indicators are linked to micro behaviour using the appropriate multi-level techniques. SEDD is not a nationally representative sample. The Scania region is for various (historical) reasons a particular region in Sweden. The limitations of this restriction are overcome to some extent by advocating cross-country comparative research in international collaborations (see below). Moreover, many demographic and other processes, such as ageing, are universal, and results obtained based on SEDD have some external validity as well for that reason.

Added Value

The Linnaeus Grant has enabled CED to develop from a research group to a Centre with a critical mass to function as an efficient research organization, with an adequate research infrastructure. The long-term nature of the grant made it possible to invest in databases that take a long time, high costs and a lot of effort before becoming operational. This accomplishment has had a positive influence on the quantity and quality of the research output in terms of publications and new results.

The added value of CED at the University level lies also in its priority for register based research, and its linkages with other research groups, i.e. the Pufendorf Institute for Advanced Studies (epigenetics) and KWC (Knut Wicksell Centre of Finance).

The HSE Panel also views the societal relevance of the CED research as a measure of scientific quality. Research results are of direct relevance to public health policies, migration policies and family policies.

Dynamics

According to the CED researchers and Ph.D.s, the Centre functions as a platform where new research initiatives are created as a result of exchange of ideas between different disciplines. The long term character of the grant makes it also possible to make changes to the content of the programme whenever needed, and to invest in high-risk research or research with a long gestation period. It allows also starting new research initiatives very fast, such as FINSWED.

National and International Collaboration

CED collaborates with other centres in Lund University, with other Swedish universities, and internationally. Interactions within Lund University are significant including, among others, SIMSAM (early life research jointly with the medical faculty) and LUCCI (a Linnaeus Environment of Physical Geography and Ecosystems). There are institutional linkages with other Linnaeus Environments in Sweden, such as ALC (Umeå), SPaDE and SULCIS (both at Stockholm). The international dimension of CED is particularly extensive. CED took the initiative in the EurAmerica Project (a follow-up of the

EurAsia project in which 6 countries participated), that involves research institutes in Europe (France, Italy, the Netherlands, Spain, Sweden) and in North America (Canada and the US). Interactions also exist with the US National Institutes of Health (NIH), through a joint project and a jointly organized workshop co-financed by the European Science Foundation (ESF). In addition to the institutionalized forms of collaboration, individual collaborations exist with many universities in Sweden, Europe and elsewhere. As a result of these international interactions, CED is highly visible internationally, and is regarded internationally as one of the key demographic institutes in Europe.

The character of the Doctoral Programme that attracts a high number of international Ph.D. students as well as teachers (see below) adds to the international character of CED.

The strong international dimension of CED is without doubt also an asset for the University, and fits in the LU strategy of internationalization.

Future Potential

CED's goal is to develop from a centre to an institute. This means securing long-term financing not only for the staff, but also for the database, the central research infrastructure around which CED is built. In that respect the future after 2016 is uncertain and much relies on the outcome of the internal evaluation of Lund University in 2014. In addition, new resources have to be found. CED has been successful in this in the past, but these resources are not always of a long-term character. Given the future societal need for research in the CED areas it seems likely that external funding will also be available in the coming years. This favourable outlook is further strengthened by the Lund University strategy to focus on larger research groups with the profile and impact of CED.

No major changes are foreseen in the organization or leadership of CED. Senior researchers within CED are well developed and prepared for the future. At the same time, the Director will retire before 2016 and the Deputy Director has retired but is still active at the centre. (The term of the Deputy Director expires fall 2012). Although this is anticipated, it remains unclear to the HSE Panel how this implied transition is going to take place.

Organisation and Leadership

The organizational structure of CED was carefully planned. In fact, it took over six months and consultations with all participating faculties before the final form was chosen. It appears to work well, a fact confirmed by the Vice-Chancellor. In the 2008 evaluation report no changes were recommended, and the structure has remained largely the same. One recent change is to hire an administrative assistant to streamline the processes for course applications, housing and administration.

CED is an independent unit under the Board of Lund school of Economics and Management (LUSEM). In many respects it looks like a regular department, with the exception that it has no teaching responsibilities itself. The CED Board is composed of 5 persons, the Director, and one member from each of the participating schools/faculties: the School of Economics and Management, the Faculty of Social Science, and the Faculty of Medicine. In addition, there is one doctoral student representative in the board. The board has the legal responsibility for the management plan, research activities and the annual budget and report. The members of the board are appointed for three years by the Dean of the School of Economics and Management, after consulting with the deans of the two faculties. The board appoints an international Advisory Board, consisting of three distinguished scholars. The Advisory Board does not convene regularly, but is consulted by the director on a one-to-one basis. This structure seems to work well under the present Director, with close ties between Director and Advisory board, but it may not be the optimal structure in a future situation with other leadership.

The database has its own Database Committee, in order to protect CED from becoming a full-time data provider. The Committee is advised by an ethical commission about usage of the database. Plans for a release of the database through the Internet are underway, under the restriction that a significant part of the data is not owned by CED but by Statistics Sweden. The HSE Panel recommends investigating the possibility to fund these activities through the VR Council for Research Infrastructures.

It appears to the HSE Panel that the structure of CED is very flat and efficient, with close ties between Director, researchers and Ph.D.'s. The position of the Director is crucial. On one hand this is a strength,

but on the other hand a potential threat when it comes to succession and future leadership at the Director and Deputy-Director level. The HSE Panel is concerned about the future transition to new leadership.

Gender Aspects

CED follows the gender policies of Lund University and has worked actively towards a more equal gender structure at all levels. Among Ph.D.s the balance M/F is 60/40 which may change in the near future due to an active promotion of female inflow. At the higher levels the balance becomes more uneven, and it becomes more difficult to stimulate change, since the recruitment pool is unbalanced as well. Lund University actively stimulates female leadership at the university level, particularly by providing leadership-training programmes that address this issue. The Vice-Chancellor finds that more should be done at all levels at the University to support female leaders also after being appointed.

Level of Commitment of the University

CED is aligned with the vision of the University, which can be characterized by (1) interdisciplinarity; (2) internationalization; (3) focus on strong groups and leadership; and (4) visibility inside and outside the University. In each of these dimensions CED can be seen as a role model for other groups in the University. In respect of the cross disciplinary dimension, the University has created a special board to oversee the Lund University Centres outside of the current faculties. The purpose of this new board is to provide administrative support to Centres, to facilitate communication, to assure that the centers are meeting their mission, allocating their funding productively, and overall being managed efficiently. The Board will provide advice to the Vice-Chancellor about each centre.

In 2014, Lund University will start an internal evaluation. It is unlikely that all Linnaeus Environments within Lund will be financed automatically after 2016. The policy of Lund University is to stimulate the strong environments, and cut the less successful centres.

External Communication

As discussed above, scientific dissemination is at a high level, with a large quantitative and qualitative output in terms of journal articles, prestigious working paper series, and also books, which are mainly in English. Another form of scientific dissemination is the planned availability of a large share of the database on the web. This is especially useful for researchers from abroad who want access to the data. However, not all data are freely accessible: more recent data are owned by Statistics Sweden and cannot be released in this way.

The website is well organized and up to date. The current strategy is aimed at a larger exposure of the website to the general public. The appointment of a special Communication Director at Lund School of Economics and Management (LUSEM) is of great strategic importance in expanding the diffusion of important research findings of CED to policymakers, stakeholders and the larger public.

The societal relevance of many research projects is large. Therefore, CED organizes seminars and workshops for policymakers and stakeholders to address important research results. In addition, researchers figure frequently in newspapers and other media addressing their research. Moreover, since 2007 CED benefits from a communication specialist in producing printed information material and writing press releases.

At the international level CED participates in Population Europe; an international initiative of which CED was one of the founding organisations. Population Europe aims at bringing demographic issues to policy-makers at the national and European level.

The Panel's Conclusions and Recommendations for Improvements

In each of the major research areas of CED clear intentions are expressed about future research directions. Basically they involve deepening of the research strands currently implemented, for instance by linking additional information to the register based database, in order to give the research a clearer causal edge. Given the availability of their unique databases, the continued extensions of the database and the quality of the research group publishing in the top ranked journals seems realistic within the coming five years.

Many demographic issues are germane, and CED research could be of value not only to Europe and other developed countries, but also to countries that will face similar problems as Europe in the not too distant future, such as China. A future focus more on global issues based on its own expertise could be a fruitful direction of work, also from the point of view of extending the resource basis.

The HSE Panel has the following recommendations:

- to stimulate an increased share of cross disciplinary publications
- to plan for succession of leadership in the coming years
- to better formalise the role of the Advisory Board
- to investigate the possibility to fund the creation of an open access database through the VR Council for Research Infrastructures
- to focus on global issues in other regions and countries, such as China.

The HSE Panel's conclusion is that CED is a vital and productive Linnaeus Environment, where the Grant is used well to produce substantial scientific quality and added value. Additional resources could be devoted in the coming period to further investments in the long-term build-up of the database, in order to prepare for the long term viability after completion of the Linnaeus Grant.

4.2.6 CED Doctoral Programme

Organisation and Management

The Doctoral Programme, called *Research School in Economic Demography* is a separate unit within CED and answerable to the CED board. It has a Dean appointed by the Board of CED to handle day-to-day operations. The programme has its own Steering Committee that consists of 5 people in total, including the Dean, appointed by the CED Board. In addition there is an Advisory Committee of 10 researchers from other universities from the Nordic countries.

The goal of the Doctoral Programme is to provide courses to Ph.D.s that are not available elsewhere in the University, and are at the cutting edge of the research frontier of CED. It is therefore a clear example of research-based education, one of the key themes of the University (the so-called Knowledge Triangle).

The policy of CED explicitly advocates an international recruitment strategy to obtain the highest possible quality of its inflow.

During the years 2009/10 and 2010/11 the structure of the programme changed somewhat due to the temporary hosting of the European Doctoral School of Demography (EDSD): a one-year training programme for Ph.D. students in demography in Europe. The EDSD rotates between European demographic research centres on a two-year basis. In total 38 (2x19) students participated in this programme. In order to deal with the increased coordination tasks, the CED research secretary worked with the Programme, and was supported by a Ph.D. candidate dealing with administrative tasks. The EDSD has increased the visibility of Lund and CED within the European demographic field. Two new generations of talented Ph.D. students have become familiar with the environment and form a pool of recruitment for new inflow at the Ph.D. and postdoc level for the coming years. Having said that, this choice also came with a downside. The local Ph.D.s from Lund were given less attention during this period.

Ph.D. students feel that they have easy access to the teachers and researchers of CED. Since the organisation is very flat, communication is easy within the Programme and with CED. In such an environment problems and conflicts are dealt with swiftly (although the Panel is not aware of any concrete examples). The main experience of the Ph.D. students with the Programme and CED was freedom to make the appropriate choices in their research.

Recruitment

There is separate recruitment for each course in the Doctoral Programme (but for the EDSD programme see below). The courses are announced on the website, through the programme's network and

professional organisations at the national and international level. There is also collaboration with the Max Planck Research School in Demography in Rostock, which has its own channels. Student selection is based on how well the course fits into their Ph.D. programme. Gender balance is a latent issue, but if manifest leads to male preference, since the majority of the students is female (55/45% F/M). So far this 'informal' recruitment seems to have worked well, but the HSE Panel recommends a rethinking this procedure for the future, if surplus demand increases, in order to ensure equity.

The selection of EDSD students is a matter of the board of the EDSD, and delegated to a selection committee of which the Dean of the Doctoral Programme was a member, but is otherwise independent of the Doctoral Programme.

Integration into the Linnaeus Environment

The programme provides the advanced courses not given in the respective faculties, which are necessary for the research themes in CED. The programme enhances research based education, as well as the international character of CED: to date it received students from 19 countries and 47 universities, and teachers from 10 countries and 20 universities and research institutes. Ph.D. students have published in peer-reviewed journals. However, the HSE Panel had expected that more students would have based their research on the database, which is more than anything else the comparative advantage of CED. The opportunity for Ph.D. students to use SEDD will be much greater now that the data gap have been closed. The seminars and courses given also provide a meeting platform for students and researchers of the Linnaeus Environment, often also with prominent external researchers who teach a course or give a lecture. The contacts the HSE Panel had with researchers and Ph.D. students showed that these exchanges are successful. The HSE Panel notes that the position of the director is very central for the Ph.D.s. This may make the Programme to some extent vulnerable.

Impact

The Doctoral Programme has influenced a large group of Ph.D. students within Lund, Sweden and abroad. It collaborates closely with some of Europe's most important research training programmes in demography. Through these contacts the network of the programme and CED has increased substantially, and this will lead to fruitful knowledge transfer and cross-fertilization of practices and information. The impact of the European Doctoral School of Demography (EDSD) on European doctoral training is substantial, and the Doctoral Programme has played a substantial role in this development. DEMODOC, another collaborative programme involving a number of European universities and aimed at training Ph.D. students, is a further initiative with the aim to develop a joint Ph.D. programme.

The choice to focus on advanced courses, not complete Ph.D. programmes within the programme itself is also very beneficial for the participating faculties. The courses are presented an *à la carte list* of choices for their Ph.D. students.

Gender Aspects

The majority of the students (55%) are female, as opposed to only 20% of the teachers. CED Research School Steering Committee consists of men only, and the Research School Reference Group of nine men and one woman. Ph.D. students in CED are 40% female and 60% male (which is different from the students participating in the courses).

Composition and Degree of Internationalisation

The degree of internationalization of the Programme is very high. As indicated above, to date it received students from 19 countries and 47 universities, and teachers from 10 countries and 20 universities and research institutes. The playing field for the Programme (as of CED as a whole) is the international arena, not Sweden.

Content of Doctoral Programme

The Doctoral Programme offers advanced courses not given elsewhere in Lund. They are voluntary, with the obligatory training part being left to the curricula of the respective faculties. The courses

are therefore 'tailor-made' and highly appreciated by those who participate. Where appropriate, the Programme joins forces with other demographic research training programmes in Europe to exchange courses and students. Courses offered are to a large extent linked to the CED themes, which leads to a true synergetic effect. Part of the resources is also spent on conferences, courses and workshops elsewhere. (CED has started to organise an alumni program for the EDSD students.)

Future Potential, Career Opportunities

The programme has thought about the continuation of their Programme after the 10-year period of the Linnaeus Grant. It will have to reduce the number of courses given, but will be able to maintain the spirit of the Programme even without the Grant. Collaborations with other doctoral programmes both in Sweden (e.g. SPaDE, SULCIS and ALC) and abroad (DEMODOC) are implemented or planned. Through these networks, in which Lund appears to be close to the centre, the long-term viability of the Programme seems guaranteed, also after the expiration of the Grant.

The career opportunities are difficult to assess for the Programme, which is based on individual courses, rather than a complete programme. So far, CED has recruited two Ph.D. students from the EDSD programme. Graduates from the EDSD programme have generally entered Ph.D. programmes throughout Europe and to a lesser extent elsewhere. The HSE Panel is not aware of any form of alumni programme for those who followed courses in the doctoral programme, although this would be a good idea.

The Panel's Conclusions and Recommendations for Improvements

The Doctoral Programme has produced an impressive record of students and courses, with a high level of internationalization, and based on advanced and cross/disciplinary research, reflecting the research themes of CED. It is a role model for research based education in LU, and has had a significant impact, not only at LU, but also at the European level of demographic training. The decision to host EDSD was a bold move, but has worked out fine.

The HSE Panel recommends some minor adjustments:

- to start an alumni programme of those who have been involved in courses
- to rethink the selection of students for individual courses.

4.2.7 Innovation, Entrepreneurship and Knowledge Creation: Dynamics in Globalising Learning Economies – Linnaeus Research at LUCIE (Lund University)

Short Description

LUCIE (Lund University Centre for Innovation and Entrepreneurship) is one of the interdisciplinary Linnaeus Research Environments at Lund University, with leading researchers in innovation, economic geography, business administration, psychology, economic history and research policy. The centre aims to understand innovation, entrepreneurship and knowledge creation dynamics in globalising learning economies. LUCIE is located in The Centre for Innovation Research and Competence in the Learning Economy (CIRCLE). The Linnaeus Grant is one source of funding for CIRCLE and they identify themselves as CIRCLE. Therefore, this evaluation refers to CIRCLE, not LUCIE.

CIRCLE has substantially grown since 2006, from 12 to about 43 associated staff. Currently there are 24 senior researchers participating in the centre funded from the Linnaeus Grant, 9 junior researchers, 4 postdocs and 4 Ph.D.s. Technical and administrative staff amount to 6 persons. Women make up 38% of this staff.

The Linnaeus grant is MSEK 5 per year. Co-financing by the University is approximately 76% of the grant + MSEK 1 per year provided by Lund University.

Scientific Quality and Results

CIRCLE researchers are productive in publishing findings in journals including peer-reviewed and international journals and other publications. The findings from the research are novel, such as under-

standing how firms use global innovation networks or the development of a new methodology to understand how major technological innovations lead to economic growth. These findings are based on the databases created at CIRCLE. Evidence of their productivity is also based on the citation counts presented in the self-evaluation report. In addition, CIRCLE researchers are invited to speak at many international conferences and researchers at all levels, including Ph.D. level, are able to do so because of availability of funding.

CIRCLE researchers have created novel databases that support their work:

- CIDER (CIRCLE Innovation Databases for Economic Research), funded primarily by VINNOVA, contains firm-level and individual-level data, as well as data on exports and imports and energy consumption.
- SWINNO (Swedish Innovations), funded by VINNOVA, contains over 5000 observations on innovations commercialized by Swedish firms in manufacturing industries over a 30-year time span.
- CRA (Constructing Regional Advantage), sponsored by the European Union, contains detailed information on innovation activities and knowledge networks in regionally clustered firms in eight European countries.
- GLOBINN (referred to as VR and INGENEUS—the Impact of Networks, Globalization, and their Interactions with EU strategies-databases in the 2011 annual report), contains survey data collected in 2008 at the firm-level in three sectors (green biotech, automotive, and ICT) for developing countries and firm level data in three sectors (automotive, ICT, and agro processing) collected through another survey of developed countries.

For the first five years, the research program was organized around 3 platforms (knowledge creation, transforming knowledge into innovations, turning innovation into growth) and 3 perspectives (competence building, innovation systems, governance).

Each platform and perspective conducted research around key research questions at the individual, organizational and societal levels. Each platform and perspective was managed by one senior and one junior researcher from different disciplines. Each platform and perspective organized its own activities (workshops, planning and presenting preliminary results etcetera) and also integrated activities across all three platforms and perspectives (conducting basic research, infrastructural investments, establishing research networks etcetera).

The preliminary results contribute to field of knowledge creation, innovation and growth. The findings contain potential for application by firms.

Platform 1 (Knowledge creation) centers around two themes: universities and academic knowledge creation, specifically focusing on research activities at university, and knowledge creation as an interactive process, with focus on the interplay between actors in different types of creative knowledge environments in knowledge creation.

Platform 2 (Transforming knowledge into innovations) has focused on how different organizations (entrepreneurs, technology-based firms, universities etcetera) interact and how the roles of institutional rules frame the interactions. The GLOBINN database is an outcome of this theme and this has enabled a theoretical and empirical overview of the different forms of global innovation networks. Other findings demonstrate the importance of regional networks, their type, and optimal size for spurring innovation.

Platform 3 (Turning innovation into growth) has centered on the reciprocal relationship between innovation and growth. This platform has a strong quantitative orientation building on the longitudinal databases (CIDER, SWINNO, CRA, GLOBINN). The results have shed light on underlying structures of the Swedish economy.

Perspective 1 (Competence building) focuses on required competencies for knowledge creation and diffusion, entrepreneurship and innovation, including how these competencies are influenced by different institutional rules, norms and standards. Researchers have developed expertise in entrepreneurial research, including experiential approaches to entrepreneurship and commercialization and diffusion of academic knowledge.

Perspective 2 (Innovations system) concentrates on how information systems emerge and develop and what their distinctive features are. Innovations systems are studied in different settings. One of the most important outcomes of this research is publication of the *Handbook of Innovation Systems and Developing Countries* (2009), which adapts the Innovation Systems approach to developing countries both theoretically and empirically.

Perspective 3 (Governance) focuses on how organizations, networks and nations steer and support knowledge creation, furthermore the use of knowledge through entrepreneurship and innovation and growth processes. This perspective permeates all three platforms in viewing governance as an ingredient in learning processes where new knowledge is created and utilized for economic benefits in society and fills a gap in the literature by focusing on innovation-facilitating governance.

Although forming the basis of the research presented during the current review, this original structure did not live up to expectations. Starting in September 2011, the new director created a new structure that, in the opinion of the HSE Panel, is clearer, more efficient, and more transparent. Research and staff are now organized around four overall areas. These areas are innovation and economic growth; globalization and innovation; entrepreneurship and innovation; and national and regional innovation and policy analyses. Each area is managed by a senior researcher who appears to each have their own staff. There is overlap across the four areas, which will encourage collaboration and cross-fertilization of ideas. The senior researchers are quite strong, dynamic, and passionate about their work. Presentations at the site visit were a mix based on the old structure and on the new.

Added Value

The Linnaeus Grant has provided CIRCLE with long-term support, stability, possibilities to combine basic and applied research, and time to consolidate CIRCLE as an independent physically located research unit at Lund. The staff stated that without the Linnaeus Grant, CIRCLE would not have achieved its position and would “have been less impressive today.” CIRCLE views the Linnaeus Grant as an important source of funding, but the Linnaeus Grant branding does not appear important to them.

Dynamics Created

The dynamics created were most apparent in the interviews with the Ph.D.s. They chose CIRCLE because of the interdisciplinary environment and strong qualitative and quantitative methodological approaches with the new databases. They are free to select their projects and take courses they need for their research. The possibility to pursue a post-doc or career at Lund University is important to them. The students were clearly inspired by the cross disciplinary opportunities enabled by CIRCLE.

CIRCLE has obtained new funding from the Swedish Research Council, VINNOVA, and international organizations to pursue new research in the innovation and entrepreneurship sphere.

National and International Collaborations

CIRCLE has collaborations with Lund University departments and faculty outside of CIRCLE. They have collaborations with other Swedish universities and research centres in each of their platform and respective areas of research, such as the Centre for Future Research in Stockholm and Umeå University.

On the international front, they are engaged with several European research programs such as European Union Framework 6 (FP6) programs DIME (Dynamics of Institutions and Markets in Europe) and PRIME (Policies for Research and Innovation in the Move towards the European Research Area) and funding from the EU FP7 to develop databases. They also have grants from the European Science Foundation, Riksbankens Jubileumsfond, Volkswagen foundation and other EU opportunities.

Individual researchers have collaborations on the national and international front. A social network diagram reveals that researchers are collaborating with 50 other universities and 20 organizations in 19 countries. Researchers also collaborate with researchers at firms and science parks. In one presentation, a researcher said he is working with Nordic Energy Research and KIBIOS, Competitive and Innovative Biorefineries (a 2-year grant from the Swedish Energy Agency). Despite an extensive collaboration with many parts within the University there has not been any formal collaboration with other Linnaeus Environments at the University, which the HSE Panel found surprising.

External scholars are invited to present seminars on a monthly basis, thus setting the stage for potential collaborations with CIRCLE researchers.

Future Potential

The future potential appears strong, although CIRCLE's history of under-spending is a concern. CIRCLE is a leading centre for the study of innovation and entrepreneurship in Sweden and Europe. The new organizational structure has positioned them to undertake innovative research in globalization of innovation and sustainable development and innovation. They have identified research plans around the 4 new research areas identified above.

CIRCLE advertised for 3 tenured positions, 3 to 6 postdocs, and 3 Ph.D.s and a new director with an international reputation. The Ph.D.s have been selected and are starting in the Spring Semester of 2012. Their long term strategy is to continue to recruit world-class researchers, to create a centre independent of existing departments, with its own Ph.D. program, and to undertake new areas of innovation research, such as innovation related to sustainable development.

Plans also include expanding interactions with policy-makers through the Knowledge Exchange Forum (KEF) and the creation of a 'demand-oriented front desk' where policy-makers can request information. Their research plans are also focused on the future.

Despite these strong plans, the HSE Panel has concerns about their ability to implement these plans. The current Director appears to have an energetic and strategic vision. The new Director being recruited now should not only have an international scientific reputation but also the organizational skill required to lead CIRCLE forward.

Organization and Leadership

According to the organizational plan, the Vice-Chancellor oversees CIRCLE. Within CIRCLE, the four new research areas are coordinated by the Director and Deputy Director, who both began in September 2011. The new Director was the former Deputy Director.

Until September 2011, the CIRCLE Director wore multiple hats and apparently ran the Centre without input from his researchers. The Deputy Director took over in September and has instituted reorganization and future oriented plan for research and hiring.

The organizational chart of CIRCLE is difficult to sketch. The confusion starts already in the proposal in 2006, where LUCIE was presented both as a research programme connecting 7 different organisations (5 departments, plus RPI, LUIS, and CIRCLE), and a building (LUCIE/MNO) that houses the research programme and more. The 2008 evaluation report noted that CIRCLE and LUCIE had grown into a close symbiotic relationship, which made it difficult to disentangle the respective activities and intellectual products and outputs. Moreover, the 2008 Evaluation Panel missed "any specific linkage between individuals, the funding of their projects and precisely how this fitted in with the three platforms", and noted that it was necessary that such a link should be made, in order to gauge the viability of each platform in view of its inputs and outputs. The HSE Panel observed that the situation has not improved significantly since then. The Linnaeus Grant (LUCIE) was acknowledged to be an important source of funding for CIRCLE during the site visit, but is otherwise not visible or identifiable, not on the website, in the annual report, nor in the mind of most of the researchers. This lack of recognition of LUCIE in itself can be considered to be a minor point, but the lack of transparency in how the money is used is more problematic. For example, it is unclear how funding was allocated over the three platforms. Moreover, it is unclear to the HSE Panel how many researchers are funded by the grant: depending upon the source of the information, this can appear to be anywhere from 12 to 40 people.

The HSE Panel noted that the Linnaeus Grant is significantly underused up to the present. In its original form LUCIE was led by one Coordinator, without a board, and with an external Advisory Board identical to the CIRCLE Advisory Board. As of September 1st 2011 the previous Coordinator retired and was succeeded by the present Director. He has carried out a reorganization; appointing three new people in addition to himself to direct four closely interrelated research platforms: innovation and economic growth; globalization and innovation; entrepreneurship and innovation; and national and regional innovation and policy analysis. They have plans to utilize the built-up reserves.

The previous division in platforms and perspectives is still used for completing current research projects. The new division in four research areas and their talented leaders seems to the Panel a viable structure for the future.

Internationalization of the programme is strong. They stated that 50% of the staff is non-Swedish. None of the 6 researchers and 5 Ph.D. students that the Panel met were from Sweden. The 2011 CIRCLE annual report states that they have 10 Ph.D. students. The Linnaeus Grant has enabled new recruitment at CIRCLE specifically for the Centre.

There appears to be some tension between CIRCLE and the departments resulting in some lack of coordination concerning required classes and format for dissertation.

Gender Aspects

CIRCLE gender balance has improved. Almost two-fifths of the staff (about 38%) are women up from about 10% in 2006, and 2 of the 4 key research areas are led by women. The CIRCLE leadership state that they will continue to monitor the balance and Lund University has recently instituted a new policy that emphasizes the importance of gender equality and leadership. In total, the self-evaluation report identifies 15 females and 24 males.

Level of Commitment of the University

The Vice-Chancellor appears committed to CIRCLE. As former Director General of Vinnova, he clearly feels that it is important that Sweden has a strong research centre focused on understanding innovation and entrepreneurship. He noted that he expects the Centre to play an important role in identifying metrics that effectively measure innovation and impact, an increasingly important area of government interest. He would like the Centre to work with firms in the region to spur innovation and would like CIRCLE to develop metrics that measure University impact on regional innovation and to provide advice to policy-makers. In addition, given that Lund University received 8 of the 20 Linnaeus Grants initiated in 2006, this could be an opportunity to study innovation at the ground level. An analysis using the tools developed by CIRCLE would inform Lund University and contribute to the innovation literature on the role of centres.

The Vice-Chancellor supports CIRCLE's plan to recruit a new Director with an international reputation as well as more professors, postdocs, and Ph.D. students. He continues to support the University contribution of MSEK 1 per year to CIRCLE during the Linnaeus Grant contract period even though he is aware that they have underspent the Linnaeus Grant funding in the first five years. He is creating a new special faculty board to oversee the Lund University Centres with existing centres, such as CIRCLE. The purpose of this new board is to provide administrative support to Centres, to facilitate communication, to assure that the Centres are meeting their mission, allocating their funding productively, and overall are being managed efficiently. The Board will provide advice to the Vice-Chancellor about each centre.

The Deputy Vice-Chancellor noted that CIRCLE and Lund University should improve the visibility of the Linnaeus Grant awards and noted that publications should in general reference their funding source.

External Communication

The CIRCLE Electronic Working Paper series is the initial point of dissemination for most of the early research generated by CIRCLE researchers. Other methods of dissemination are academic conferences, seminars, and "brown bag lunches". Internal seminars alternate between presentation by CIRCLE researchers and Ph.D. students and external scholars invited to present new research ideas. CIRCLE researchers have frequently been invited as keynote speakers at international academic as well as policy-oriented conferences.

CIRCLE also communicates through their website which they update weekly, and an annual report that describes the outputs from their research. They do not appear to identify the source of their funding in their published research, although the Deputy Vice-Chancellor indicated that this will change.

They also have an agreement with VINNOVA to publish research in *Entré*, a journal of the Entrepreneurship and Small Business Research Institute (ESBRI), in Stockholm. Their outreach extends to media interviews (radio, newspapers, and magazines).

A less formal dissemination channel is a weblog that is used for information from seminars, new publications, grants or other news. The CIRCLE annual report contains detailed information about their databases, research outputs, and collaborations. CIRCLE researchers regularly appear in the various media to communicate their research findings and their potential impact on the society.

The Panel's Conclusions and Recommendations for Improvements

The Linnaeus Grant has strengthened CIRCLE in its early years and has provided long-term support and stability. The most visible results have been the hiring of new academic staff, support for the creation of databases, and increased productivity of the research staff. CIRCLE produces important research on innovation and entrepreneurship.

The Centre appears to have relatively few Ph.D. students, although they are working to increase the number. This is still surprising given their surplus of funds. At the site visit, the Deputy Director stated that the Linnaeus Grant funding accounted for about 50% in the first few years and is now less than 25% of their total funding because they have received additional funding from other sources, in part, due to the prestige of the Linnaeus Grant.

Specific recommendations follow:

- Form an internal advisory Board with the CIRCLE Director, Deputy Director, and one representative from each of the faculty departments involved with CIRCLE. This Board can facilitate communications, such as agreeing on Ph.D. requirements for students.
- Identify the International Advisory Board and make it clear what their role is to CIRCLE. The HSE Panel's view is that they should provide input and feedback about CIRCLE's strategy and research outputs. Make the Board be visible on the website, in the annual reports, and in actions.
- Cite the Linnaeus Grant funding in publications, websites, and other activities funded with this money.
- Implement the proposed hiring and recruiting strategy, conduct proposed research, and spend the funds allocated from the Linnaeus Grant on more Ph.D. students. (The recent increase is commendable, but more Ph.D. students could be added.)
- CIRCLE views the Linnaeus Grant as an important source of funding, but the Linnaeus Grant branding does not appear important to them. As a result, they have not responded to the findings from the 2008 evaluation to distinguish the intellectual outputs and products of CIRCLE from those of the actual Linnaeus Environment.
- The HSE Panel's over-riding concern is that the Centre did not achieve the vision set forth in the proposal and instead are pursuing a new strategy in creating an independent institute rather than a collaborative platform across departments and institutes. There is a new Director and a good strategy for going forward but, based on what was proposed and actually implemented for the Linnaeus Award, this is difficult for the HSE Panel to assess.

4.3 Medicine

4.3.1 Developmental Biology for Regenerative Medicine (DBRM) (Karolinska Institutet)

Short Description of the Research Environment

The DBRM – A Strategic Research Center in Developmental Biology for Regenerative Medicine – incorporates a consortium of investigators from the Karolinska Institutet involved primarily in basic research in developmental biology, stem cell biology and regenerative medicine. This group is highly focused on the cellular and molecular mechanisms of neural stem cell development. The group includes 13 original faculty members serving as principal investigators and has as of February 2012 added 8 associate members. This group currently directly mentors approximately 50 doctoral students and 50

postdoctoral fellows. There is a developing involvement in more translational studies that utilize stem cells and pharmacological agents for tissue regeneration. This Linnaeus Environment was established in 2006 and was awarded MSEK 9.72 per year. In the last national call for assistant professor positions from the Swedish Research Council, 6 out of 18 positions awarded nationwide in biomedical sciences were scientists trained by the DBRM.

Scientific Quality and Results

The M Panel considers the DBRM to be exemplary in the field of basic developmental biology, and are considered to be world-leaders in the area of neural stem cell basic research. This group has the potential to make major contributions to the application of stem cell biology to regenerative medicine. The clear strength of the DBRM is in the area of basic research, cell and molecular biology. It is particularly relevant that 3 of the principal investigators within this environment received an ERC senior award and additional three younger principal investigators received ERC starting grants. The M Panel is greatly impressed with the large number (23) of high-impact publications in the best broad-readership journals, in the biomedical field, such as *Nature*, *Science* and *Cell* plus many additional publications in other excellent more specialized journals.

Notable scientific advancements: major advances were made in the differentiation of dopaminergic cells from embryonic stem (ES) cells. Gamma-aminobutyric acid (GABA) was described as a novel pathway to control cell cycle progression, in ES cells. Similar control mechanisms are now being investigated in other types of stem cells. The functional interaction between hypoxia and the Notch signalling pathway derived from a close collaboration between the Linnaeus Environment TARGET (a cancer research network for studies of the diagnostic, prognostic and therapeutic potential of mesenchymal cells of the tumor stroma) and DBRM. It was shown that the epithelial to mesenchymal transition, observed in tumour cells that initiate a metastatic process, is induced by hypoxia and requires a functional Notch signalling pathway. Using the newt model for regeneration it was shown that dopamine has a role in controlling adult neurogenesis by signalling to neural stem cells. Ephrin signalling pathway was shown to be a novel mechanism to control stem cell proliferation in normal and malignant intestinal tissue. The scar tissue formation in the spinal cord, following injury, is initiated by pericytes, a cell type that had not been previously implicated in this process. The thinking regarding the mechanisms of pigmentation was re-shaped by studies showing that melanocytes originate from a different progenitor than usually accepted and that this new progenitor migrates through the skin along the nerve fibers. The ingenious use of ¹⁴C dating to determine cellular 'birth dating' was important in assessing the regeneration potential of human tissues. In a series of ground-breaking studies it was shown that different sets of neurons and cardiomyocytes, initially thought to be post-mitotic, undergo slow renewal, after birth, under physiologic conditions. Many of these contributions shifted paradigms and had a major impact in neurosciences and stem cell biology. The M Panel is very impressed by the innovative character of the research.

This group shows clear evidence of substantial and vibrant collaborations between DBRM faculty members. The interactions are reflected by a large number of peer-reviewed publications involving two or more DBRM principal investigators. It was apparent from the DBRM presentations that there are additional emerging collaborations with several leading international centres.

While translational studies involving regenerative medicine are not considered to be a current strength of this group, the M Panel notes that there is a clear commitment to increasing activity in this area, largely through strategic collaborations with other investigators. Moreover, the Karolinska Institutet received the largest grant for Stem Cell and regenerative medicine given by the government Strategic Research Area initiative where 7 out of 10 scientists are members of the DBRM. Additionally, the members of the DBRM received funding for the Wallenberg Institute for Regenerative Medicine (WIRM) with the mission to focus on hematopoiesis complementing DBRM expertise.

Evidence of this applied aspect of research efforts was seen in the work by one of the associate members involving the use of electrochemical polymers to direct stem cell differentiation. Growing interactions with the TWIN Institute in Tokyo is another example of how this group is extending their existing strength in basic stem cell research to more clinically relevant translational studies.

Organization and Leadership

The DBRM environment is composed of 13 principal investigators and of 8 associate members. The coordinator of this group has created an exceptional environment where outstanding scientists work in conjunction to meet a common goal. The 13 principal investigators receive an equal allocation of the Linnaeus funding. Associate members of the group do not receive directly core funding but profit from the common core facilities and interactions with the DBRM group. The group of principal investigators that meets regularly makes the decisions, and the coordinator steers the consortium to capitalize on opportunities but does not micromanage. The StratRegen (Strategic Research in Stem Cells and Regenerative Medicine) and the WIRM are two recent initiatives, triggered by members of the DBRM dedicated to translational regenerative medicine and to hematopoiesis, that were created through the joint efforts of the members of DBRM. The organization of these two centers relies on three researchers that recently signed on as visiting professors. The gender representation amongst Ph.D. and postdoctoral fellows is approximately 30:70 male/female ratio. The faculty gender representation is however more unbalanced, and they are making efforts to recruit more females.

The M Panel is very impressed by the managing style of the Coordinator that while not heavily micromanaging, created a very well organized, highly interactive and productive environment of top scientific quality. The members of this environment take particular care of nurturing and breeding a new generation of outstanding scientists.

Level of Commitment of the University

The University highly regards the DBRM and is aware of the positive impact that this environment has in the Karolinska Institutet. In fact, the Karolinska Institutet considers the DBRM Linnaeus Environment to be the flagship environment on campus. Less obvious is the actual contribution of the Karolinska Institutet to the environment. Although it is clear that there is an apparent commitment of the University to continuing to support the DBRM but the extent and the nature of this support remains unclear.

The contribution of DBRM to the Karolinska Institutet on the other hand is very clear. DBRM has produced a highly visible, scientifically outstanding group of senior and junior investigators. Collectively, the group has brought additional fame and honour to the Karolinska Institutet. The nourishing environment within the DBRM has provided an exciting avenue for excellent collaborations and high-risk, high-reward research investigations. It also provides the necessary support for individual principal investigators and their laboratories for improving the cutting edge quality of their work, and enhanced the chances of publishing the work in top-tier journals. The environment has also played an important role in enhancing the chances of success of individuals as well as group grants submitted by the group. Moreover, the highly collaborative and well-organized DBRM environment has already resulted in the training of very high quality Ph.D. students and postdoctoral fellows. The commitment of the principal investigators and trainees to the DBRM environment is clearly palpable, and has created many opportunities for interaction that would likely not have been possible without the Linnaeus Grant.

External Communication

The main external communication in this group operates through the conventional channels such as main scientific journals and conferences. Outreach to the general public is basically done by the coordinator through public conferences.

The Panel's Conclusions and Recommendations for Improvements

The DBRM environment is noted for its outstanding scientific productivity and impact in the area of basic neural stem cell biology. The DBRM leadership clearly has fostered a strong atmosphere of collaboration and collegiality. The DBRM is to be congratulated for developing a rare 'culture' of positive interactions blended with world-class scientific excellence. The Linnaeus Award has clearly created significant dynamics to both the DBRM investigators and the Karolinska Institutet. The award has fostered new and more extensive interactions between investigators resulting in very high impact studies. As such, the Linnaeus Award support has clearly increased the national and international stature of the DBRM group. It appears that several DBRM faculty members have advanced to tenured positions

at least in part due to the Environment supported by this Linnaeus Award. There is an important benefit of this award to provide stability of support for collaborative ventures that may not have been supported through conventional funding mechanisms. The Linnaeus Award also helped develop a strong teaching and training environment as indicated by a number of new doctoral level courses and the recruitment of a large number of national and international doctoral students and postdoctoral fellows. Training from the DBRM faculty is generating a strong and diverse range of Ph.D. graduates with an interest in both basic and applied research that should be an invaluable resource to the future development of regenerative medicine. Recommendations for improvements:

1. Engaging bioengineering sciences will be a strategic priority for this group in order to apply their impressive basic science discoveries to actual translational regenerative medicine.
2. Devising a coordinated outreach strategy to inform the public about the excellent work conducted by the DBRM group and the future implications of the result.
3. Engaging more junior faculty members, in addition to the excellent efforts of the Coordinator, in the mentoring of female Ph.D. students in choosing an international postdoctoral fellowship, and in following with these trainees while they are abroad. These efforts will likely enhance the chances of success in securing leading professor positions by the female trainees in the group.

4.3.2 DBRM Doctoral Programme

Short Description of the Doctoral Programme

The Doctoral Programme for Developmental Biology and Regenerative Medicine (DBRM Doctoral Programme) is well timed in view of the scientific progress in this particular field and the under representation of these disciplines in the standard curriculum before at the Karolinska Institutet.

The Doctoral Programme is awarded MSEK 1.15 per year and is strategically well positioned within the Karolinska Institutet and is noteworthy because of its international exposure as exemplified by e.g. joint teaching activities (exchange courses) with the universities of Hong Kong and Toronto.

A remarkable feature of the Doctoral Programme is the high degree of responsibility allotted to the Ph.D. students to take the lead in organizing teaching modules such as seminars. Furthermore, the intentional mingling of biomedical doctoral students with clinical residents (in training) may well provide a strong basis for future reinforcement of translational aspects.

The programme features 37 courses that so far have enrolled 632 students that interacted with 381 tutors, of which, notably, 128 were from other institutions. Both students and staff find the programme extremely useful.

Organization and Management of the Doctoral Programme

The Programme is supervised by the Dean of studies, recipient of the distinguished teaching prizes at both Karolinska Institutet and Uppsala University. Under his responsibility the programme extends from the bachelor to the doctoral phase and also enrolls clinicians (in training). As in the research programme its organization is flat and well integrated. The Department of Cell and Molecular Biology provides support for issues like human resources, IT etcetera.

The dean of studies is further supported by a steering committee composed of the DBRM coordinator, the principal investigators of DBRM, doctoral students and, notably, delegates from the USA and Singapore. This structure ensures solid integration within the Karolinska Institutet and also provides the necessary external input.

Admission to the Programme is obtained through assessment of educational track record, merits, letters of motivation and similar. Like the DBRM research initiative, the Doctoral Programme is well organized. A Steering Committee provides input for the subjects covered by the Programme, while actively searching student input and even having activities fully organized by students as for example an international summer school course. Quality assurance, as described in the self-evaluation report, appears solid and involves proper registration and an archive of course material.

The M Panel notices that the Programme also initiated the development of a stem cell knowledge base and students have launched a Karolinska Institutet community (website) that currently hosts 1100 users.

Recruitment of Doctoral Students

Courses are widely announced among biomedical students as well as clinicians (in training). Inflow, in addition, comes through the established international network (five official international collaboration programmes) and obviously many students enter the programme through their individual departments. It is the view of the M Panel that although the courses in the Programme are highly appreciated, the majority of Ph.D. students find their way into their individual research groups mostly through personal contacts, the reputation of the principal investigators and dissemination of published work through peer-reviewed papers. The M Panel would like to remark that it truly appreciates the efforts made to connect the exceptionally strong research base of the DBRM programme to highly promising translational initiatives like StratRegen, which hosts for instance a reputed surgeon.

Impact of the Doctoral Programme on the Linnaeus Environment

Firstly, the Doctoral Programme "DBRM Research School" has influenced the Linnaeus Environment by offering a wide spectrum of educational courses to students. It should be noted that 90% of course materials has been designed specifically for the DBRM environment. Another aspect is the exposure of students to each other's research disciplines as they frequently jointly participate in programmes. This latter aspect provides an excellent basis for interdisciplinary research and an open attitude to collaboration. Perhaps mostly important to the future development of the Linnaeus Environment is the deliberate attempt to increase the inflow of students with a clinical background. It is foreseen that this, ultimately, will induce a solid connection between the fundamental and translational aspects of regenerative medicine research. This might well be a key element to maintaining this Programme's position at the international forefront.

Impact on the University and Doctoral Training

The overall biomedical research and training environment at the Karolinska Institutet is greatly strengthened by the DBRM Programme since education in the area of regenerative medicine is relevant to many related basic science and clinical disciplines. The M Panel hopes that the openness to other disciplines and the willingness to collaborate may serve as an example to other Karolinska Institutet research groups.

Exchange of Knowledge, Cooperation, and Cross Disciplinary Research Exchange

The M Panel finds the structure and implementation of the DBRM Doctoral Programme exemplary in providing an environment for knowledge sharing and interdisciplinary research training. The M Panel notes, however, that this interdisciplinary aspect focuses largely on the biological, biomedical and clinical collaboration while leaving out most of the engineering sciences. It is to be applauded that the environment now hosts a promising, albeit still limited in size, biomaterials programme. It is hoped that ultimately this will evolve into a strong implementation of the engineering sciences in this programme as it may well shape the future of this field. The principal investigators acknowledged this feature, and the M Panel has high hopes of the accelerating effect that this may have on propelling the Programme even further to the international forefront.

The Panel's Conclusions and Recommendations for Improvements

In sum, the M Panel concludes that the introduction of the DBRM Doctoral Programme has incurred a prominent effect on both student education and the research environment. It is truly remarkable how the introduction of 37 courses has led to a more solid training environment while creating a stimulating effect on interdisciplinary collaborations.

In particular, the role that the DBRM Doctoral Programme plays in securing an integration between the clinical and bio(medical) disciplines is to be complimented. It will form a solid base in assuring

a fully connected research pipeline going from fundamental developmental biology to translational regenerative medicine.

The international aspects of the Programme will not only provide access to a group of well-trained international students but, in addition, warrants an even more prominent position of this Environment in the international research arena.

It is to be noted that the students showed a strong self-confidence and pride in their Linnaeus Environment. Particularly, the degree of self-initiative that was employed by these students is to be commended and may well lead to a further empowerment of Ph.D. student potential.

On a more critical note, the M Panel would like to recommend that the already created interdisciplinary collaboration between fundamental biology and translational regenerative medicine will be further enforced by an increasing involvement of the engineering sciences of which the biomaterials programme might well form the nucleus.

4.3.3 STARGET – A Cancer Research Network (Karolinska Institutet)

Short Description of the Research Environment

The STARGET – a cancer research network for studies of the diagnostic, prognostic and therapeutic potential of mesenchymal cells of the tumor stroma – Environment is composed of three clinical and five basic research laboratories working in a combined effort to characterize novel functions for mesenchymal cells in tumour progression. The major focus of the research in this environment is on the discovery of molecular mediators of non-malignant cells from the stromal compartment (endothelial cells, pericytes and mesenchymal cells) in tumour biology. The research laboratories are physically separated in three different locations within the Karolinska Institutet campus: Department of Cell and Molecular Biology, Department of Medical Biochemistry and Biophysics, and Department of Oncology and Pathology. The environment has approximately 50 young scientists with 25 Ph.D. students and 25 postdoctoral trainees. The environment recently has recruited a new principal investigator at the associate professor level. A portion of the research activity by this group is supported by the current Linnaeus Award in the amount of MSEK 9.72 per year.

Scientific Quality and Results

The STARGET group was founded to pursue the following scientific aims: 1) Characterize novel functions for mesenchymal cells in the tumour microenvironment, 2) Identify soluble mediators in both malignant and non-malignant cells that contribute to tumour progression, and 3) Identify molecular biomarkers in both malignant and non-malignant cells that identify disease status. The group has made significant progress in all three of these research priorities. Overall, the M Panel notes that the STARGET environment is excellent, punctuated with some outstanding investigators. The group has been very productive over the past 5 years of the Linnaeus Award. Since 2008, the group produced more than 15 publications in the highest impact factor journals of general readership such as *Nature* and *Cell*. They have also more than 20 publications in excellent specialized journals (e.g. *Blood*, *JCI*, *EMBO Journal*, *J. Exp. Med.*). Individually, the scientists in STARGET performed remarkably well and received national and international recognition. One investigator received the Del Monte Medal and one an ERC senior award. A junior member received the Young Investigator Award from the Swedish Cancer Society. Three researchers of STARGET received special research support from the Karolinska Institutet Distinguished Professor Award. As a result of the collective STARGET efforts, this group has become internationally recognized for their research excellence, especially in the study of the tumour microenvironment. Importantly, the group integrates both clinical and basic scientists in a clear concerted effort to augment the translational value of the group's research activities.

There are notable specific scientific advances made by the STARGET investigators. During the last few years the Environment made important contributions in understanding the role of the stromal microenvironment in the development of tumours. In a high impact study, pericytes were identified

as major cellular components that regulate the integrity of blood-brain barrier. This discovery can pave the way for using pharmaceutical compounds that interfere with the integrity of the blood-brain barrier, allowing the delivery of chemotherapeutic drugs to the central nervous system (CNS). This has been an ongoing significant problem for the systemic treatment of CNS tumours and therefore has tremendous clinical relevance. Researchers from STARGET also have identified hypoxia as a major factor inducing epigenetic modifications in tumour cells through the induction of histone demethylases. These epigenetic modifications might be responsible for acquisition of stem cell markers by tumour cells, a phenomenon that coincides with tumour progression. New strategies to analyse the transcriptome at the single cell level were developed. This novel technology will be used to define new molecular mediators in freshly isolated tumour cells and biomarkers associated with metastatic tumours. That is, this technology will allow the determination of the gene expression 'signature' of individual cells within the tumour environment. Researchers in STARGET identified particular subsets of stromal cells that develop in the tumour microenvironment and defined the density of PDGF (platelet derived growth factor) receptors, in tumour-associated stromal cells, as a biomarker of poor prognosis, in breast cancer. Overall, molecular tools developed within the STARGET Environment have been successfully used to analyse the transcriptional profiles of primary versus metastatic cancer biopsies.

STARGET investigators are involved in a number of local and national/international collaborations. There are a variety of ongoing significant interactions amongst the STARGET members themselves and with members of the DBRM Center, another Linnaeus Environment at the Karolinska Institutet. Most members of the STARGET participate in numerous cancer related networks, mostly with national participants but also some international networks. One member of STARGET directs the BRECT, a breast cancer theme center financed by the Karolinska Institutet, and several members participate in this network. Two principal investigators participate in an international network to study mechanisms of haemorrhagic stroke. One member of the environment is organizing a new bio-bank/tissue collection enterprise at the Karolinska Institutet. Importantly, STARGET members are providing synergistic effects in a number of these associations. Though not described by the STARGET presentations, there are several international collaborations mentioned in the self-evaluation report from which the M Panel highlights the association with the A*STAR (the Agency for Science, Technology and Research) initiative in Singapore. This association involves the exchange of Ph.D. students between the two institutions and one of the STARGET researchers has a joint position in Singapore. These international activities of STARGET members were generally understated by the groups' presentations.

Organization and Leadership

The organizational and leadership style of the STARGET consortium is highly de-centralized and appears to promote a sort of 'self-assembly' model in which research directions and collaborations emerge largely spontaneously from group interactions. The devotion of the group to this value is clearly evident by the members' consensus decision to re-direct some of their own laboratory Linnaeus Award funds to support the recruitment of an additional junior faculty member. Also, the research success of this group in the form of consistently high-tier peer reviewed publications and other forms of recognition described above provide empirical evidence that this type of group organization has been fruitful during the initial five years since founding the STARGET Environment. The M Panel expresses concern about this organizational style regarding the future direction of the group. On one hand, this pluralistic approach to group activities permits strong input from all STARGET members, which is a significant benefit because this group is comprised of many talented, highly experienced investigators. However, this model also presents the challenge of how to provide clear prioritization and vision for the future direction of STARGET as a group venture. This element of the group's leadership is considered important for effectively capitalizing on this group's considerable current and future potential.

The STARGET group is comprised of a number of very successful, experienced faculty members. However, the M Panel notes concerns regarding two features of the group's composition of investigators. Firstly, there is a predominance of mostly senior investigators within the STARGET faculty; only two members of the group are currently at the rank of assistant or associate professor. For the ongoing

continuity of the group, there is probably a need to incorporate more junior investigators within the group. Also, there is an obvious gender imbalance amongst the core STARGET faculty, with only one female member. There is a clear gender balance amongst the Ph.D. students and postdocs that demonstrated approximately equal representation of male and female trainees.

Level of Commitment of the University

On behalf of the Karolinska Institutet, the Vice-Chancellor expressed pride in the Linnaeus Environments, and commented on the increase in visibility and prestige STARGET has brought to the cancer programme at the Karolinska Institutet. The M Panel identifies a specific Karolinska Institutet commitment to STARGET in the form of the active recruitment of a senior international faculty member who will become part of the STARGET group. Apart from this contribution to the group, the source and specific form of additional institutional support is ambiguous.

The M Panel believes that STARGET has provided considerable added value to the cancer research group itself and to the Karolinska Institutet at large on multiple levels. The STARGET is an excellent consortium that includes some exceptional investigators. This group consistently has been productive, including a number of published studies in very high impact journals. Importantly, there have been a number of distinctive findings generated from this group that have elevated their international visibility and prestige in the cancer research field. This, of course, clearly increases the prestige of the Karolinska Institutet in the field. Furthermore, research productivity from the STARGET group has strong current and potential translational value. That is, some efforts involve clinical trials using therapeutic agents directed towards molecules/pathways studied by this group. Ongoing basic science projects within the group have the potential to identify additional clinically relevant therapeutic targets and/or biomarkers of cancer progression. Regarding basic science projects, this group is developing new and potentially powerful animal models for studying cancer development and other novel technologies, such as single cell genetic/molecular analysis. Taken together, the M Panel is greatly impressed by the quality and impact of novel and creative studies largely related to studying the cancer microenvironment. Thus, for the Karolinska Institutet, the STARGET Linnaeus Environment has provided clear added value by promoting a number of basic and clinical collaborations that quite possibly would not have occurred otherwise. Overall, these interactions permit both greater advancements in this highly significant area of healthcare and have the added benefit of making the Karolinska Institutet even more competitive for securing future research funding.

External Communication

The M Panel notes that the STARGET group's approach to knowledge dissemination was largely through standard mechanisms of peer-reviewed publications and presentations at local, national, and international meetings. No clearly identified strategy for communicating with the general public is noted, with the following exceptions: 1) Substantial efforts by one of the principal investigators, who acts as a primary public spokesperson, in spreading awareness and informing the public about advances in cancer research and, 2) Another principal investigator's substantial involvement in conveying basic science results to clinical audiences (40 educational sessions with oncology audiences to date).

The Panel's Conclusions and Recommendations for Improvements

As mentioned in a section above, the Linnaeus Award has produced considerable added value to this group beyond the simple sum of the individual investigators research activities. STARGET activity has markedly increased the interactions between the members of the group, and enhanced the cohesiveness of the scientific outcomes. More visibly and very importantly, STARGET increased the basic science-clinical science collaborations. This in turn resulted in a strong reinforcement of the translational activities, which are a critical benefit in disease-related research such as cancer. The increased interactions between STARGET group members have taken the form of monthly seminars, several principal investigator meetings each year, and annual retreats. These interactions appear to have further invigorated the principal investigators, many of who express excitement about the new knowledge they had gained from each other. The interactions also allowed for the development of novel animal models

and technologies, and the provision of important human tissue samples for analysis. Importantly, STARGET is successful in leveraging the funds, attracting funds for new group and centre grants, and recruiting additional group members. STARGET also substantially contributes to strengthening the training environment for Ph.D. students and postdoctoral fellows. Finally, the longer term (10 years) funding support provided by the Linnaeus Award has had a clear additional value to the group. This feature of more stable support has permitted the development of either higher risk projects and/or more protracted experimental models that are very challenging to develop in shorter-term project periods. The M Panel considers this element of the Linnaeus Award to contribute, at least in part, to the facilitation of some of the very high profile studies generated by this group. In addition, this funding stability is noted to be invaluable for the more junior members of this group to establish a firm research foundation from which to proceed and increase the likelihood of future success.

The M Panel also notes some challenges for this group. There is a lack of geographical proximity amongst several of the STARGET groups that creates a barrier to optimal ongoing interactions and collaborations. While it is recognized that there have been strong clinical and basic studies, the group is encouraged to become more intentional in enhancing this translational dimension of their collective efforts. The M Panel notes that this group could benefit from an increased engagement of doctoral students and postdocs in STARGET related activities and programmes. The M Panel is also concerned with two areas related to the perceived imbalance of the STARGET faculty composition. Firstly, the large majority of STARGET is comprised of senior investigators, a property that threatens the future continuity of the group. The M Panel encourages the group to increase their efforts to recruit new junior faculty investigators. Secondly, there is an obvious gender imbalance within the core STARGET faculty with only one female principal investigator. The group is encouraged to continue efforts to correct this problem over time. Finally, the M Panel believes that the ongoing success of the STARGET group as a consortium will require greater strategic planning from the entire group. That is, there is a need to increasingly and intentionally coordinate research efforts to unleash the group's additional potential.

4.3.4 The Neuronano Research Center (NRC) at Lund University

Short Description of the Research Environment

The Neuronano Research Center (NRC) is an especially interdisciplinary consortium focused on developing neural interfaces as tools for both advancing basic neuroscience research and for developing potential therapeutic vectors for treating neurological disorders. The group is comprised of more than 40 members, including 17 faculty-level investigators and an equal number of graduate students and postdoctoral trainees. These investigators cross four faculties and represent a broad spectrum of expertise including areas such as basic biology, neuroscience, engineering of nano-scale, thin, flexible electrode technology, high capacity digital communications and wireless technology, neuroinformatics, and ethics. The group therefore represents the critical disciplines needed for technological development and biological testing of neural interfaces, as well as a wealth of neurophysiological expertise for utilizing the technologies in basic investigations of the nervous system. The group has organized its activities in 5 comprehensive and well-interconnected platforms: electrode development, tissue reactivity, neurophysiological investigations, wireless communications and neuroinformatics, and ethical considerations. The group is led by a visionary and inspiring Coordinator. A Steering Committee made of 8 faculty-level members (including the leader and one junior investigator) are responsible for monitoring, guiding and making decisions regarding the NRC's direction. Input from an International Scientific Committee is effectively utilized.

All NRC members (from four faculties) are located within a short walking distance from each other and Ph.D. students from the various disciplines share common office areas. Therefore, the group is very highly interactive at all levels of organization. Moreover, the excitement, synergism and added value are clearly reflected throughout the NRC. Such well-thought-out organization and high interaction

has allowed the NRC to provide a very effective and true amalgamation of multiple varied disciplines, allowing for the formation of an exceptionally well-functioning interdisciplinary unit.

The amount awarded by the Linnaeus Grant is MSEK 7.5 per year.

Scientific Quality and Results

Overall, this group is performing ground-breaking work in the field of neural interfaces, focusing on three main technical challenges (bottlenecks) in the field as identified by the NRC group: 1) Electrodes (the elements in direct contact with the neural tissue), 2) Wireless communication (transmission of neural recordings outside the body through a telemetry connection as opposed to direct wires exiting the skin), and 3) Neuroinformatics (data management and mining of the vast banks of neural recordings that can be obtained on a daily basis). The developed technologies will be used for addressing critical neuroscience-based investigations, and in the future, to treat unresolved medical conditions. From the basic investigations perspective, the group will address questions related to the mechanisms of pain, learning and memory, and control of movement. Future clinical translation will be in the areas of drug-resistant pain, depression, Parkinson's disease and possibly epilepsy.

The group is made up of internationally recognized researchers in systems neuroscience, micro/nanotechnology, and wireless communications as well as rising stars. Historically, ground-breaking investigations have been published by the senior members of the group. An example of this includes the seminal work by the coordinator demonstrating the effects of fetal movements on the shaping of spinal neural networks. As a group, the NRC has made exceptional progress since the initiation of the Linnaeus Grant. Within the short span of 5 years, this group has both developed the concept of a compatible microelectrode with nano-based surface treatments and produced a working prototype that showed excellent results. Compelling *in vivo* recordings have been obtained along with impressive tissue reaction results. *In vivo* recordings for up to 6 weeks have already begun to enable longitudinal studies investigating cortical changes due to pain, memory formation and dyskinesia. Furthermore, biocompatibility studies demonstrated substantial improvement in tissue reactivity towards nano-treated electrodes implanted up to 6 months. The speed of these developments is remarkable, clearly exceeding those achieved by an individual laboratory or a single discipline.

Most of the NRC publications over the past 5 years are in the form of peer-reviewed, multi-page proceedings of the IEEE EMB annual conferences (Institute of Electrical and Electronics Engineers, Engineering in Medicine and Biology conferences). IEEE EMB conferences are the main events for unveiling new technologies in biomedical engineering. They also reflect the developmental nature of the work in electrode technology and provide a valuable, PubMed-cited avenue for disseminating early findings prior to reaching the critical level of full journal article publications. It is anticipated that the next phase of the Linnaeus Award will witness a substantial increase in impactful, full-size peer-reviewed publications.

The new technologies will allow the NRC investigators to address very exciting questions regarding the mechanisms of pain, learning and memory, and control of movements. Therefore, the new technologies will play a critical role in further advancing the group's profile in neuroscience. If successful, the ripple effect of the electrode technologies on the field of systems neuroscience will be extremely palpable, as new questions that have not been answered with conventional technologies can, for the first time, be successfully addressed. The proposed plans for preclinical testing in a large animal model (mini-pigs) will be an important step in evaluating the clinical suitability of the nano-treated micro-electrodes, and demonstrate the NRC's deliberate efforts at utilizing their technologies for clinical use. The inclusion of ethical expertise also adds a very important dimension to their work. The recruitment of a faculty member in ethics to the NRC ensures that critical questions related to the legal, ethical and social aspects of neural interfaces are recognized and addressed in a manner that informs the public, policy makers and recipients of neural interfaces themselves. This not only benefits the NRC, but the neural interface and nanotechnology fields collectively. The NRC is therefore taking a very important lead in setting the stage for future implementations of implantable biotechnologies for treating a wide range of medical conditions.

The NRC's work in wireless communication appears to have been stalled by the common, yet enormous challenges in the field: transmission of very large amounts of data at a very high data rate. The M Panel appreciates the magnitude of this challenge. Therefore, the group's plans to delay the hardware developments and instead focus on computer simulations that would address both data reduction and compression questions were well received. Knowledge gained from the simulations will undoubtedly lead to more effective hardware implementations. Finally, the NRC's focus on neuroinformatics adds an excellent novel dimension to the work in systems neuroscience and neural interfaces. The group's emerging national leadership in this area will very likely position them as international leaders in this field in the near future.

Collectively, the NRC has developed into an excellent, cohesive multi- and interdisciplinary group over the past 5 years of the Linnaeus Award. Over the next 5 years, the NRC has a great potential to become a clearly visible leader in the field of neural interfaces. It is important to emphasize that this is not simply a cross disciplinary group with a given field (such as biology, bioengineering, etcetera), but is a truly interdisciplinary group that brings together investigators from a wide variety of fields that very likely would have limited interactions without the Linnaeus Award funding mechanism.

Organization and Leadership

As mentioned above, the NRC is a highly focused and visionary group, guided by inspired leadership. Despite the extremely broad range of disciplines involved in this consortium, there is a clear definition of the vision leading to the formation of the group, their current accomplishments, and their short and longer-term goals. The M Panel notes that the strong organization and visionary leadership did not suppress the creativity of the group's individual investigators. Instead, creative initiatives are supported such as the inclusion of activities from such diverse subjects as optogenetics and ethics, which collectively have enhanced the effectiveness of the group. Such measures will very likely lead to the establishment of the NRC as a recognized international player in the field of neural interfaces.

The M Panel notes that the NRC has a clear structure for decision-making that includes input from both the internal Steering Committee and the external Scientific Advisory Board. At present the group has largely adhered to the goals and directions outlined in the original proposal. Interactions within the NRC are facilitated through shared co-supervision of many of the trainees by two or more NRC faculty investigators, joint project planning, and on a larger scale through NRC seminars, journal clubs, project meetings, and annual retreats. It is apparent that frequent formal and informal interactions amongst NRC members greatly enriched the interactions within this group. Taken together, it is apparent that there has been an intentional and effective approach to facilitating interactions within this unusually broad, cross disciplinary group. The group is successful in creating a highly cohesive environment, which was clearly exemplified in the manner the group presented their scientific work. The NRC also has a clear and defined research structure to capture intellectual property for potential future commercialization. This not only establishes a path for commercializing the technologies for use by investigators in neuroscience, but also ensures that the technologies will be available for clinical use if the clinical potential is realized. The M Panel congratulates the group for its outstanding organization and leadership.

The M Panel notes a relative gender imbalance at the principal investigator level and within senior leadership (Steering Committee) in the NRC, with the large majority being male. While a roughly equal distribution of male and female postdoctoral fellows is currently part of the NRC, the graduate students are predominantly male. Nevertheless, there is no impression from the M Panel that there is any gender bias, but rather that the gender distribution at this time reflected the demographics of the applicants.

Level of Commitment of the University

The M Panel notes a clear and tangible commitment from Lund University to the NRC Linnaeus Environment. Lund University directly provides MSEK 1 per year to this group. There is additional support from the faculty of medicine towards the salaries of assistant professors for 4 years. In terms of future commitment (past the end date of the Linnaeus Grant in 2016), the University leadership stated that a University-wide research and educational assessment exercise is scheduled for 2014. The outcome of

this exercise will allow the University to identify areas of excellence to be supported. Evaluation of the Linnaeus Environments will be of particular interest to the University to determine whether the effectiveness of this model of funding in advancing the research and educational missions of the University, and in enhancing interdisciplinary interactions. Continued commitment to the NRC from the University past 2016 will be dependent on the outcome of the 2014 evaluation, which the M Panel considers to be a very reasonable approach to determining future University support for this Programme.

The M Panel strongly believes that NRC has provided a clear and visible added value to the University. The NRC is a very novel and dynamic broad multidisciplinary group that simply would not have developed without the financial support of the Linnaeus Award. The level of innovation has been raised by the true and effective interdisciplinary training approach of students in research areas that would not commonly be integrated. The M Panel notes that the establishment of the NRC Environment has resulted in the recruitment of a critical mass of highly motivated students, both from within Sweden and from other countries. Quite impressively, all students, regardless of their home department or faculty, are very clear on the vision and mission of the NRC and fully support them.

It is very apparent that the interdisciplinary nature of this group has actually fostered the enhancement of important but under-represented research areas, such as the study of the biological interface of nano-scale electrodes within neural tissue, and developing equally important bioinformatics platforms for interpreting data. In the first five years of the Linnaeus Award, the NRC has already begun to garner international stature, raising the prestige of Lund University in the nano-technology and neuroscience fields. The M Panel also finds an especially important and essential value related to the long-term (10 year) timeframe of this Linnaeus Award. This award allows the development of a challenging, high-risk project that likely would not have occurred through the conventional grant award mechanisms. This investment allows for breaking new ground in the nano-technology field and the challenging process of gradually integrating highly disparate disciplines (such as engineering and biological sciences) to result in a novel research group.

External Communication

Dissemination of knowledge follows a number of paths. One mode of communication is through the conventional mechanism of peer-reviewed publications and presentations at scientific conferences in the field. Among the scientific conferences is a meeting organized by the NRC in Ystad, Sweden in 2010. This meeting was attended by almost all the recognized leaders in the field of neural interfaces, and attracted attention to the work conducted by the NRC. Another mode of communication is through organized seminar series at various townships targeted towards the general public. It is noted that a substantial proportion of faculty members as well as Ph.D. trainees contribute themselves to this liaison mechanism with the general public. Yet another mode of communication is through media releases organized by faculty and University media officers as well as response of the NRC principal investigators and trainees to requests for interviews from journalists. Finally, the international conference organized by the NRC in 2010 was also accompanied by a special series of talks and interviews with a selection of leading international investigators in the field of neural interfaces, all geared towards the general public.

The Panel's Conclusions and Recommendations for Improvements

The NRC is an excellent, well-functioning centre involving multidisciplinary faculty and trainees, providing true interdisciplinary interactions across a very wide spectrum of expertise. The Centre has outstanding leadership and organization, and has provided a fertile ground for creativity and innovation in research and doctoral training. Even though the NRC is a completely new and novel group, the collective work of its members is already placing it on a rapid increasing trajectory of international status. The NRC's work is deliberately progressing from technology development to the harvesting of new biomedical information in neurosciences. Though the technological developments conducted by the NRC are still considered to be fairly high-risk, they have a great potential payoff. In addition to the potential scientific breakthroughs in systems neuroscience, the NRC has a clear vision towards increasing the translational value of their applications. For example, the NRC plans to progress to more clini-

cally relevant large animal models (e.g. mini-pig model) for testing their nano-treated microelectrodes. The M Panel notes that the trainees are highly engaged, and participate in all activities of the NRC. This includes the NRC's excellent approach to public outreach. Taken together, the M Panel notes the development of the NRC group is an especially effective result of the long-term Linnaeus Award funding mechanism. Recommendations for improvements:

1. The M Panel encourages the students to exercise initiative in increasing the course opportunities offered for Ph.D. trainees. This will expand the course-based training, which is especially important in a highly interdisciplinary environment such as that of the NRC.
2. The M Panel notices that there is no clear contingency plan if the current nano-electrode technology should fail to achieve the targeted research goals. There is also a related concern about potential regulatory obstacles regarding the use of non-degradable nano-structures *in vivo*. Although the group already is aware of both regulatory and ethical issues related to the potential clinical application of these developing technologies, the M Panel recommends increasing the interaction with regulatory agencies to minimize risk of obstacles that may compromise the clinical value of the developed technologies.

4.3.5 Hemato-Linné at Lund University

Short Description of the Research Environment

The Hemato-Linné Environment at Lund University is dedicated to the study of hematopoiesis. The environment is composed of one coordinator and 12 principal investigators. Following recommendations from the advisory board and from a previous evaluation, the environment tried to strengthen the translational dimensions of their work. Two researchers were hired at the assistant professor level focusing on generation of hematopoietic progenitors from induced pluripotent stem (iPS) cells and on epigenetic chromatin status of hematopoietic stem cells. An additional faculty recruit has since taken another position in Australia. One medical doctor and four associated members were additionally integrated in the programme. Four of the principal investigators are visiting professors and dedicate approximately 10% of their research efforts to Hemato-Linné. Recently, a new recruit was hired in the field of molecular hematopoiesis. They maintain scientific collaborations with the Lund based members and co-supervise Ph.D. students. Importantly, this Linnaeus Environment is associated with a Linnaeus Doctoral Programme.

The amount of the Linnaeus grant is MSEK 5 per year.

Scientific Quality and Results

The Hemato-Linné Environment has produced excellent research results in basic hematopoiesis during the first five years of this award. The members of the environment developed studies along four major lines of research: First, they made important contributions to the understanding of the basic mechanisms of maintenance and expansion of hematopoietic stem cells. They found new mediators of the hematopoietic stem and progenitor cell function. They attempted to define the molecular components involved in loss of repopulating capacity and lineage bias in aging hematopoietic stem cells and the factors that determine lineage commitment of developing lymphoid progenitors. In a second line of research the members of the Hemato-Linné initiated a programme to devise protocols of expansion of hematopoietic stem cells. An shRNA screen identified several putative enhancers of stem cell survival or expansion. They also defined culture conditions that allow iPS cell differentiation into multiple hematopoietic lineages and into progenitors that phenotypically resemble hematopoietic stem cells. Thirdly, the Hemato-Linné group developed efforts to increase the understanding of the mechanisms involved in the development of acute leukemias. This was done by dissecting the cooperative action of oncogenic events that leads to leukemia and by identifying the origin of the respective cancer stem cell compartments. In a fourth line of activity they developed mouse models of chronic myeloid leukemia and of Diamond-Blackfan anemia. They developed a protocol for gene therapy in infantile osteopetrosis that might be taken to clinical trial within 3 years.

These research activities were highly successful and generated a large number of publications in high impact, broad readership and specialized journals. The M Panel is impressed by the scientific productivity and by the high quality of the publications. However, the M Panel also notices that some of the highest impact publications were authored by the visiting scientists associated with this group, and so referred to studies that were largely developed within these outside laboratories. In some of these cases, the contribution of the Hemato-Linné environment to such studies is not obvious. Also, in many instances, the Lund affiliation was not mentioned and the Hemato-Linné financial support is not acknowledged in resulting publications. The four visiting professors that receive MSEK 0.3 per year are meant to co-supervise Ph.D. students in conjunction with the Lund members of the Hemato-Linné. However, in the self-evaluation report provided by the group the M Panel finds no Ph.D. or postdoctoral fellows mentored by any of these professors that remain in Lund after 2011. The M Panel also notices that, while there are a substantial number of high impact publications, the overall citation level of some individual members of the Hemato-Linné in Lund is not especially high, indicating that the international visibility of this consortium could be improved. Along this line, while acknowledging the excellent general level of the research done, the M Panel also notices that there are no clearly defined breakthrough achievements. Nevertheless, the members of this environment have very promising lines of research that are often extremely competitive and that in the future, might result in highly impacting findings.

The members of the Hemato-Linné Environment have good internal collaborations between individual members and with the visiting professors. However, other national or international collaborations remain limited or at least are not apparent to the M Panel. There are other inter-institutional collaborative ventures that developed, such as the STEM THERAPY (a Strategic Research Area funding) and the European commission STEM EXPAND (Stem Cell Expansion) projects, but the exact role of this Linnaeus Award in augmenting these larger order collaborations is not clear. In conclusion, the Hemato-Linné environment is derived from those members of the Lund Stem Cell Center working in the field hematopoiesis. The current Hemato-Linné group focuses on fundamental questions in stem cell biology and hematopoiesis and their productivity has been excellent. However, the departure of two principal investigators from the group has left a void in the group that thus far has not been replenished. It is also noted on various occasions that the translational orientation of the research of this environment should be increased. While it is apparent that some progress has been made in that direction, the M Panel recommends that additional translational efforts should be attempted.

Organization and Leadership

The Hemato-Linné group appears as a somewhat loose amalgamation of investigators arranged around a common general interest in hematopoiesis. There is a healthy blend of talented experienced investigators with promising junior investigators. As such, although the group has been clearly productive in overall research activity, it is more similar in its organization to a conventional academic department rather than a mission-oriented, cohesive Linnaeus Environment. It is not apparent that there is clear strategic planning or intentionally coordinated interactions that lead to the prioritization of research activities towards achieving overarching major research goals. That is, while the Hemato-Linné group has successfully produced excellent studies in the field of hematology/hematopoiesis, the group organization and leadership has not resulted in the anticipated synergism supported by a Linnaeus Award. The group coordinator makes most decisions for resource allocation. There has been the strategic addition of a grant manager position that has been a great overall benefit to the group. However, such addition appears to largely advance the individual group members' research activity rather than promote interactive research projects. Again, this group appears to be more similar to a conventional research department rather than a highly coordinated, mission-oriented team.

Regarding gender equality, there is clearly a balanced representation of women at both the graduate student and postdoctoral fellow level. As with many biomedical research groups, there is a strong under-representation of women amongst the faculty level members and leadership, with only one female member within this Linnaeus Environment. The group coordinator noted that serious attention is being paid to this problem. Tangible evidence of this effort to provide opportunity to female

investigators was shown by the hiring of an additional female faculty-level member within the past two years, although this individual has since assumed a post at a different institution. Moreover, the group coordinator indicated that a deliberate effort is put in place (at least in his own laboratory) to encourage female Ph.D. students to pursue international postdoctoral fellowships that increase their chances of advancing to faculty and leadership positions in the future.

Level of Commitment of the University

The University/medical faculty jointly provide MSEK 1 per year directly to the Hemato-Linné group, support assistant professor positions for four years, and have committed to support an additional junior faculty position. There is also quite valuable career training provided by the University for both trainees and faculty. Thus, the combined resources provided by the Linnaeus Award and by Lund University have allowed the increase in both the number of investigators and breadth of research activities by the Hemato-Linné environment. With regards to future support past the conclusion of the Linnaeus Award, it was clearly stated by the Lund University central leadership that a major institutional quality assessment of all research activities will occur in 2014. Additional institutional support for the Hemato-Linné group will be contingent on the result of this evaluation. The M Panel considers this a very reasonable approach for determining future support for the Hemato-Linné beyond the current funding support from the Linnaeus Award.

The Hemato-Linné group has also provided benefit to the University. The increased resources to the group provided by the Linnaeus Award has provided additional faculty members and increased the breadth of expertise in the hematology area and has maintained the research activities of the group. The associated doctoral programme initiated by this group also has a strong benefit to the University by providing novel and important new training courses in experimental techniques available to many students, staff, and faculty members. Many students attending such courses are outside the Linnaeus Environment. Several Hemato-Linné investigators and postdocs directly supervise these courses. Thus, the academic value of the Hemato-Linné group extends well beyond the immediate environment of this group.

External Communication

External communication by the Hemato-Linné group is largely through conventional mechanisms of peer-reviewed publications and presentations at national and international scientific meetings. There is little evidence of any intentional efforts to convey research findings to the general public. It appears that any public dissemination of information occurred on an *ad hoc* basis.

The Panel's Conclusions and Recommendations for Improvements

The M Panel finds that the Hemato-Linné is a strong basic research group that has consistently produced a large number of peer-reviewed studies in both solid to high-tier journals. However, apart from increasing the size and range of expertise of the group that has led to an increased value of the group's research efforts, the Linnaeus Award appears to provide only modest actual added value relative to other conventional academic research groups. From the M Panel's view there is concern regarding the prospect of the continuing development of the Hemato-Linné group as an internationally recognized leader in hematology-oriented research. On one hand, the M Panel recognizes that this is clearly a solid and productive group that would be deemed as an excellent research department at essentially any major University. However, while the M Panel understands the fact that this group did not receive the level of support of some Linnaeus Environments, the Hemato-Linné group nevertheless appears to fall short of achieving the expected stature of a dynamic, major programme supported by a Linnaeus Award in biomedical sciences. That is, the whole of the collective efforts of the group appears to largely equal the sum of the individual parts (members) rather than producing enhanced group synergism in addressing research goals. This concern is amplified by the fact that some of the key original members of the Hemato-Linné group either have relocated and/or have limited current direct involvement with the group. Thus, it is not clear whether or not there is an upward trajectory for this group towards developing into a leading consortium devoted to the study of hematopoiesis.

There are two primary areas identified by the M Panel where the Hemato-Linné group could improve during the final phase of this Linnaeus Award. Firstly, the group is encouraged to develop more effective collaborative efforts. This could be achieved through more intentional investigator meetings and strategic planning resulting in the execution of more interactive projects. These types of group-oriented interactions have the potential to generate projects that tackle major scientific and clinical problems that are less likely to occur through individual research efforts. So, while the Linnaeus Award has maintained a breadth of expertise in the group, there is a need for the coordination of greater collaborative studies to take advantage of the collective potential of the group. The second and related suggestion for the group is to intentionally coordinate and increase the clinically relevant translational efforts of the group. As a group performing hematology-oriented research, there is a clear and direct clinical relevance to their work. While there are currently clinical investigators associated with the Hemato-Linné group, such involvement is largely *ad hoc*, not appearing to result from an intentional integration of group research efforts. These types of interactive efforts are considered vital for the continuing growth and development of this group, especially for the more junior faculty members.

4.3.6 Hemato-Linné Doctoral Programme

Short Description of the Doctoral Programme

The Doctoral Programme of the Hemato-Linné environment at the Lund University – Lund Research School in Stem Cell Biology – receives MSEK 1.15 per year and the Director is assisted by a Steering Committee composed by the Coordinator of the Hemato-Linné Environment, the Administrative Director, two young independent scientists and two representatives of the Ph.D. students. In addition, one professor acts as consultant of this Programme. The Programme recruits students and organizes courses that are also attended by students from the medical faculty and from other doctoral programmes. Overall the Environment organized basic courses on stem cell biology and hands-on practical courses that were attended by over 350 students, in the last 6 years.

Organization and Management of the Doctoral Programme

The M Panel is very impressed by the organization and management of the Doctoral Programme. The excellent quality of the courses organized within the programme attracted many students from Sweden but also from countries all over the world. The Doctoral Programme has presently 60 Ph.D. students and has, in the last 6 years, graduated 24 students.

The Ph.D. Programme, which fosters high quality education and training, has organized several courses that were also attended by postdoctoral fellows, independent scientists and even principal investigators. The courses comprised biostatistics in biomedical research, basic and advanced flow cytometry, leadership courses for principle investigators, coaching courses for Ph.D. students, advanced course in stem cell biology with an international mini-symposium, a career day for Ph.D. students and postdoctoral fellows, a course on scientific communication and grantsmanship, leadership for Ph.D. students and postdoctoral fellows, RNA interference in stem cell research and a workshop in bio-business. These courses were very successful and there were many more applicants than available places.

Although the Programme has attracted a large number of applicants, few Ph.D. students have a medical background. Such students would be particularly valuable in the Hemato-Linné Environment. To fill in this gap the Steering Committee hired one postdoctoral fellow that is charged of recruiting students from the Medical Faculty. This recruitment is done through scientific presentations given periodically to medical students.

Recruitment of Doctoral Students

The excellence of the courses provided attracted many applicants to this Doctoral Programme, which recruits students internationally. The Programme received more than 300 applicants last year alone. Selection was done based on academic track record, motivation letter and through personal interviews

that are handled by young researchers of the Environment. The candidates attend the preparatory programme and the most motivated and engaged students are selected. The Programme has presently 60 students, about 20 of whom are in laboratories from the Hemato-Linné Environment.

In addition to recruitment through the preparatory programme, the Hemato-Linné Doctoral Programme utilizes two other modes of student recruitment. The first is through organized lectures by a postdoctoral fellow to medical students, and the second through lectures by the faculty members of the Hemato-Linné Environment to students in other programmes.

Collectively, the recruitment strategy of the Hemato-Linné Doctoral Programme appears to be well thought out and well organized.

Impact of the Doctoral Programme on the Linnaeus Environment

The Doctoral Programme contributed to 20 Ph.D. students to the Hemato-Linné Environment. The principle investigators of the Environment took the responsibility of 7 courses. Along with the courses, the Programme organized several activities that were primarily attended by the Ph.D. students and the postdoctoral fellows within the Environment. One of these is 'the meet the expert seminar', where experts in different areas come to discuss particular aspects of the experimental work. This activity is run by the students. Students and postdoctoral fellows also organize the retreat that does not have the participation of the principal investigators. The students highly praise this retreat that allows free interactions and the initiation of collaborations. The students and postdoctoral fellows also run a seminar series where they invite the seminar speakers.

Impact on the University and Doctoral Training

The Doctoral Programme from the Hemato-Linné has a very high impact on the University. The courses organized by the Programme had a broad attendance over (350 students). Ph.D. students, postdoctoral fellows and principle investigators attended the courses. Every semester the Steering Committee of the Hemato-Linné Doctoral Programme meets and decides on new courses that should be organized. They are highly responsive to new techniques or subjects that can be important in the constantly changing needs of the stem cell research field.

Exchange of Knowledge, Cooperation, and Cross Disciplinary Research Exchange

The Hemato-Linné has strong partnerships with other doctoral programmes. They established strong contacts with the Doctoral Programmes at the Karolinska Institutet and other doctoral programmes of other Linnaeus Environments. Importantly, the Programme established strong exchange programmes with the Danish Research School on Molecular Mechanisms of Disease and to the Keio University in Tokyo. This partnership led to an interchange of trainees between these two institutions and to the visit of scientists to the partner institution.

The Panel's Conclusions and Recommendations for Improvements

The M Panel is very positive about the Doctoral Programme of the Hemato-Linné Environment. The leadership, excellent coordination of this Doctoral Programme and the constant support for training of world-class scientists are very much appreciated. The M Panel recommendations are to continue the excellent organization of the Programme with the constant search for the highest standard education, the implementation of a Thesis Advisory Committee and to increase contacts between the students and industrial representatives, outside the University environment, that would help to orient the future graduated students in their future career choices. Increased interactions and exposure of the trainees to the clinical world through meetings with clinicians and patients, and through participation in clinical rounds would substantially enhance the clinical relevance of the work, and provide the trainees with first hand understanding of the importance of their work. This would also allow them to identify relevant, unresolved medical issues that could become the guiding path to their own research endeavours in the future.

4.3.7 Lund University Diabetes Centre (LUDC)

Short Description of the Research Environment

The Lund University Diabetes Centre (LUDC) is a consortium of one coordinator and investigators dedicated to the study of both type 1 and type 2 diabetes. The greatest current research efforts of the group centre on the study of genetic and metabolic features of type 2 diabetes. When LUDC was created in 2006 by the Linnaeus Award it was composed of around 100 investigators, built around a core group of investigators that have worked in conjunction since 1997. Today the LUDC includes 34 faculty-level investigators and 280 total faculty, trainee, and staff level members. The funding from the Linnaeus Award, MSEK 10 per year, was used to create infrastructures that comprise of platforms for tissue banking, gene sequencing, proteomics, bioenergetics, flow cytometry, metabolomics, and bioinformatics. In addition to the individual projects the Environment is organized into smaller action groups that assemble investigators, working towards a common objective. Action groups are created and extinguished according to scientific priorities, a system that creates high responsiveness and flexibility.

Scientific Quality and Results

The LUDC is a Linnaeus Environment that was derived from an already large group of excellent investigators that was well recognized for their multi-faceted research efforts in diabetes-related research. The group coordinator presented a clear mission statement for the group that centred on the dissection of the genetic and metabolic complexity of diabetes. The collective research efforts of the group accurately reflect this vision for the group. The LUDC has been remarkably productive, even considering that this is a very large research group (34 faculty investigators and roughly 280 total faculty, trainees, and staff). During the first 5 years of the Linnaeus Award, this group has educated 55 doctoral students and has generated more than 600 peer-reviewed publications in solid to outstanding level journals and these studies have been cited more than 15,000 times over period. This enormous effort clearly reflects the global impact of this team in diabetes-related research. Thus, this Linnaeus Award has further elevated this group to what must be considered as one of the largest and most dynamic diabetes research centres in the world.

This group is outstanding in several aspects of its collective research productivity, scientific impact, and fostering new and ongoing collaborations. Although the LUDC has active research interests in the study of both type 1 diabetes (T1D) and type 2 diabetes (T2D), the most preminent research advances appear to be in the area of T2D-related research. More specifically, this group is world leaders in the genetic analysis of T2D. Much of the current research momentum is based on major, multi-centre genetic studies published in the highest tiered journals (e.g. *Nature*, *Nature Genetics*) that have set the stage for much of the current group activities. These studies were published early in the establishment of the LUDC Environment and were likely not a direct result of the current Linnaeus Award. However, these key findings form much of the foundation of the group's current collective research. A notable, more recent genetic discovery by this group was in the identification of variants of the alpha-2A-adrenergic receptor that correlates with the pathophysiology of T2D. Other research groups and centres have since validated this exciting discovery. There are also very impressive studies from this group in the areas of T2D genetics and in islet biology. The number, breadth, and scientific significance of the research publications generated from the LUDC and their external collaborators have been exemplary. While the T1D-related research has been solid, this area is not considered to be as dynamic as the T2D research activities. It should be noted that although this group already was a very strong environment supporting diabetes-related research, the support of the Linnaeus Award appears to be strengthening and expanding the success of this excellent consortium of investigators. The M Panel notes that while the efforts in T2D research are considered to be quite strong, this level of excellence is not currently advancing in the area of T1D research. While several previous efforts from within this group have been outstanding in this area, the current ongoing efforts in the study of autoimmune T1D are not dramatic. At present, the basic T1D research is not considered to be advancing at a pace likely to have major future international impact relative to past achievements. The number and impact of most

T1D-related studies are considered to be modest and any future development and goals in the study of autoimmunity is unclear both by the self-evaluation report and in the LUDC meeting with the M Panel. Thus, the LUDC group has continued to evolve over several years into an international centre of excellence focusing on T2D research.

There are aspects of this group's activity that must be considered to extend beyond traditional metrics of research productivity. There is a very obvious and strong emphasis on translational studies and ultimately into clinical trials. While the concept of clinical 'translation' can sometimes be simple rhetoric, the LUDC has effectively applied this important value to their programme. This group appears to be performing a number of iterative projects in which clinical observations are used to develop basic science studies and, conversely, attempts to apply basic discovery to clinical analysis. This is considered to be a very rare and valuable feature of the LUDC. As such, one must consider that some of these types of translational studies can be less likely to be published in the highest-tiered journals. However, the actual value of this research strategy for advancing the field may ultimately be greater and has the potential to hasten the development of clinical diagnostic tools and treatment modalities. So, in addition to their very strong track record in published work, the M Panel notes this invaluable and intentional feature of the LUDC. Overall, the greatest strength of the group is considered to be in the arena of clinical translation rather than in primary basic discovery. In addition, there is a general paradigm change occurring in the diabetes field at large that is already well incorporated into this group's mindset. T1D has traditionally been viewed as a disease of insulin insufficiency due to autoimmune injury while T2D has been viewed largely as a metabolic disease of peripheral insulin resistance. However, these distinctions have become blurred regarding this viewpoint. The LUDC already has found genetic features of T2D that appear to be intrinsic to the insulin-producing islet cells themselves. As such, these types of studies reflect a more open-minded view of the diabetes field and positions this group to contribute new and potentially unexpected findings that help shape future thinking about diabetes pathogenesis and treatment.

It is also clear that the Linnaeus Award has aided the LUDC research community to develop or enhance collaborations with both national and international programmes and consortia. For example, the LUDC was a major initiator of the new EXODIAB (Excellence Of Diabetes Research in Sweden) programme (a Strategic Research Area funding) that, in collaboration with investigators in Uppsala, has allowed the invaluable biobank resource for the study of human tissues, such as pancreatic islet, adipose, and muscle. There is also major and unique compilation of tissue samples from a large series of genetically defined family cohorts. Both of these sources of human tissue provide the LUDC and collaborating investigators with essential, and in some cases unique resources of human samples for both genetic and cell/molecular analysis. Another major collaborative venture established since the Linnaeus Award was granted to this group was the EU-supported SUMMIT (surrogate markers for diabetic complications) project that provides MSEK 250 to 10 centres. This is a rare collaborative interaction between academia and pharmaceutical industry aiming to development of new therapies and biomarkers for T2D. LUDC investigators play a major leadership role in these different consortia. Illustrated by these and other new awards obtained by this group, the LUDC has been remarkably effective at leveraging the Linnaeus Award funds to obtain new external grant support that greatly exceeds the level of the original Linnaeus Environment support. Finally, it is noteworthy that the 10-year time frame of the Linnaeus Award has itself provided additional value to this group. The stable funding provided by this grant mechanism has allowed the LUDC to develop both research infrastructure and promising junior faculty and trainees to a degree that promises a very high likelihood of success for many years to come.

Organization and Leadership

The LUDC Linnaeus Environment is very effectively structured in an impressive way, led by an excellent Coordinator and Vice-Coordinator. Firstly, there are layers of investigator interactions that greatly enhance both collaborations and group governance. There is a general Governing Board comprised of all faculty level investigators that meets monthly to both present research results and discuss group directions. There is also a smaller Executive Board comprised of 6 faculty members that meets every

other week to further provide group direction. There is a solid external Scientific Advisory Board that convenes every other year, most recently meeting in October 2011, to provide additional expert input into the direction of the LUDC. As such, the LUDC has very effective and intentional mechanisms of group leadership and coordination. That is, the managing structure is built around a matrix organizational style that provides both vertical and horizontal lines of developing group research priorities. There is also a very interesting and flexible means of organizing research subgroups with the LUDC. There are more stable research 'platforms' that organize groups around major thematic areas, such as genetics, cell biology, disease complications, etcetera. However, this group also organizes spontaneously developing action groups within the LUDC to address emerging areas of interest. While some of these action groups develop into actual research platforms, others can be dissolved. Over the last year, for instance, four of these action groups were terminated while others were initiated. Because scientific themes often expand or contract within a field, this is seen as a fluid and adaptable means of coping with changes in the overall diabetes research landscape. Notably, the action groups very much added to the interdisciplinary nature of the group. For example, the Ph.D. students express their joy about these action groups. Taken together, the M Panel views the LUDC as an exemplary model of effective and flexible long-term group leadership. The physical infrastructure actually reflects the philosophical values of the group. The facilities at the Malmö Campus are excellent for housing several interacting laboratory groups and important multi-user core equipment units. There is a logistic issue that some of the LUDC investigators are housed at the Lund Campus, but this does not appear to form a major hindrance to the overall group interactions.

In addition to an excellent organization structure, the approach to Linnaeus Award resource allocation is considered to be outstanding. Rather than simply distributing funds to individual groups, most resources are allocated to research infrastructure and group/trainee development that benefit the entire LUDC community. Examples of this infrastructure are shown by the development of the bioinformatics computational centre and the diabetes tissue bank. This central approach to dispensing funds reduces costs for individual participating investigators and also forms an access to otherwise scarce means. The M Panel considers this approach to greatly enhance the added value of the Linnaeus Award to both the group and to Lund University. There is one other very notable organization aspect of the group. There is a mechanism of internal competition for LUDC awards, such as for the support of postdoctoral fellows, supported by Linnaeus Award funds. Because there can be some potential concern that a long-term (10-year) award could promote a degree of complacency, this aspect of the LUDC creates a healthy competitive aspect to a long-term award. The M Panel considers the LUDC leadership and organization to be a model of how to effectively utilize the Linnaeus Award grant mechanism.

A final issue relates to gender representation within the LUDC. The M Panel notes that the gender composition of the LUDC is exemplary. Women are very well represented at almost all levels, from Ph.D. students to faculty-level investigators, including most senior leadership. As with many established biomedical research groups, there is an imbalance of male senior professors, but the LUDC is rapidly correcting this problem and show a rapidly increasing proportion of women within their group that appears to be greater than the national average. It is important to note that women are well represented even within the more senior executive committee of the LUDC. These types of leaderships often show the greatest disparity between male and female representation, so the LUDC shows a very clear commitment to providing opportunities for female investigators.

Overall, the M Panel finds that the LUDC Linnaeus Award is very effectively utilized by the group to generate synergistic and not merely additive benefit to the group. There is the general impression that the LUDC could serve as a model of how to organize and implement this type of programme support award.

Level of Commitment of the University

In the discussion with the Vice-Chancellor and Deputy Vice-Chancellor it was confirmed that apart from an annual contribution of MSEK 1 per year to the budget of the Linnaeus Grant of the LUDC an additional MSEK 164 has been invested in this consortium over the last 5 years in the form of infrastructure, personnel etcetera This became evident during a brief tour through the LUDC labs and

offices that made clear that a lot of effort has been successfully directed to developing an environment that invites openness and collaboration, properties so essential to translational programmes. It is also noted that the University Board will, in the coming years, reflect on the future of the financial contribution to the Lund Linnaeus environments based on the quality of the programmes. This contribution, if any, could come directly from the University or through other sources as the University Board tries to convince authorities to make the Linnaeus contribution indefinite. Currently the University Board is initiating greater efforts into an infrastructure programme since other sources of funding for these important institutional facilities (such as through the Wallenberg Foundation) are becoming more scarce. As yet, it is unclear how this will affect the LUDC environment. It was made explicit, however, that such funding would not go to closed-shop operations.

As to the influence of the environment on Lund University the Vice-Chancellor remarked that it serves as a source of inspiration to develop personal talent and strive for scientific excellence, something the University management intends to roll out over Lund University more intensely in the years to come. Furthermore the fact that the facilities of the consortium are open to outside researchers is also seen as an essential contribution to Lund University. Finally it is noted that in the last year alone, already roughly twice the entire Linnaeus LUDC budget was obtained by LUDC through obtaining additional grants. This obviously reflects on the career opportunities of young researchers within the LUDC Environment.

In return, there has been tremendous added value of the LUDC environment to the University. Firstly, the LUDC has elevated the already strong scientific stature and prestige of institution in the diabetes research field. Also, there has been dynamic student recruitment and training and the LUDC has been an exemplary model for developing new groups and promoting junior faculty. There is additional tangible financial benefit through the leverage of existing expertise and resources to obtain additional major grant support greatly exceeding the Linnaeus Award. Finally, the LUDC has created considerable research infrastructure in the form of specialized instrumentation and related expertise that greatly benefits the University at large. As such, the LUDC Linnaeus Award has been a tremendously beneficial investment of funds for both the participating investigators and for Lund University.

There are several ways in which the LUDC has led to additional resources and collaborations that greatly exceed the initial Linnaeus investment. Regarding the impact of the Linnaeus support in fostering collaborative ventures in the LUDC, there is clear evidence that many existing and new groups have flourished. It is noticeable that a wide variety of publications involve more than one LUDC faculty-level investigator, a finding that tangibly demonstrates the collaborative flavour of this large group of investigators. Within the LUDC environment there is a notable and strategic enrichment of research infrastructure to support collaborative research. One key example of an invaluable example of new infrastructure is the development of the Human Tissue Laboratory core programme, or 'platform', that serves the LUDC research community. A wide variety of investigators have benefited from this important source of human tissues – pancreatic islets, RNA/DNA for genomics, GWAS (Genome-Wide Association Studies), etcetera – that are extremely difficult to generate within a single or even several laboratories. As mentioned above, this group also has initiated a bioinformatics platform that has clear added value, both to the group and to the entire University. In addition to physical infrastructure development, the LUDC has developed a number of defined research areas and related action groups that interact to develop/promote strategic research areas. All of these elements of the LUDC supported by the Linnaeus Award serve to promote a larger order benefit to the group and to the University that exceeds simply supporting individual investigator projects.

External Communication

The dissemination strategy of the LUDC consortium is truly diverse. Of course, much of the communication of research communication flows through the conventional mechanisms of peer-reviewed publications and presentations at national and international meetings. As mentioned above, it is noteworthy that some of these papers are cited at extremely high rates, confirming the impact on the scientific community. The LUDC is also very intentional in developing an effective interface with the general public. LUDC maintains an effective website www.diabetesportalen.se that is aiming at

the public at large and according to the coordinator is highly successful and is visited more than any diabetes-oriented website in the country. The M Panel notes that apart from textual material the site also boasts a number of video presentations of quite a few principal investigators, adding to the attractiveness of the site. In addition, many principal investigators as well as students participate in meetings with patient groups on a regular basis and the M Panel is particularly impressed by the hiring of a professional academic journalist specialized in diabetes that now takes responsibility for the public relations strategy. One of these activities encompasses the writing of press releases in case of particular scientific findings that are of interest to the public.

Overall, the M Panel believes that the LUDC Linnaeus Environment takes the dissemination of scientific research in the diabetes area very seriously and has implemented a communication strategy that is highly effective.

The Panel's Conclusions and Recommendations for Improvements

The M Panel's clear consensus opinion is that the LUDC is an outstanding and internationally prestigious group that has been an exemplary model of an effective approach to implementing and managing a Linnaeus Award. This particular Linnaeus Award resulted in very clear added value in many respects. The M Panel is very impressed by the leadership and organizational model that distinctly generated expanded value of this Linnaeus Award in promoting infrastructure, meaningful collaborative efforts, and the development and promotion of both trainees and junior faculty investigators. There is also an excellent translational feature to the group that is often challenging to develop between clinical and basic scientists. It is important to note that these connections between clinical issues and findings with the related basic science projects likely would either not have occurred at all or would have been greatly diminished without this LUDC Linnaeus Environment. The LUDC also was instrumental for developing larger scale collaborations and consortia, both nationally and internationally that greatly exceed the original Linnaeus Award resources. That is, this group very effectively used the Linnaeus Award to leverage substantially greater external funding. There was a strong innovation structure developed through the hiring of an innovation officer position that increases the likelihood that new intellectual property developed by the group can be adequately captured and developed. Finally, the impressive research productivity of the group has elevated the international prestige of both the group and Lund University as a major centre of excellence in T2D research. It should be noted that the long-term (10-year) feature of the Linnaeus Award, in addition to strengthening critical mass, was also vital for the recruitment and careful nurturing of promising junior faculty that has proven to be challenging through many current mechanisms of support. Taken together, it is very clear that the impact of this Linnaeus Award is far greater than the simple sum of its individual parts.

While the T2D-oriented research is very strong, the LUDC T1D research at present is not as dynamic. If the LUCD wishes to maintain a vigorous profile in T1D-related research, they will probably require a greater mass of expertise and investigators in this area. Although they mention the development of a 'meta-immunology' group, it is not at all clear what this group actually does or how it will develop into research areas likely to impact the T1D field. This value and a corresponding plan for continuing the development of T1D research will need to be evaluated by the LUDC collective leadership. Finally, a minor suggestion emerged regarding the consideration of developing a mechanism of Ph.D. student support at the LUDC. Since the group already supports postdoctoral fellowship positions, the Ph.D. students themselves indicate the value of a similar mechanism of Ph.D. student support. Since funding for Ph.D. student trainees can be challenging, especially for junior investigators, this could be a very strategic use of other potential funding sources for attracting top-level students in the future.

4.4 Natural Sciences

4.4.1 The Bert Bolin Centre for Climate Research (BBCC) (Stockholm University)

Short Description of the Research Environment

The Bert Bolin Centre for Climate (BBCC) at Stockholm University scope is on climate evolution and climate-controlling processes on different time scales. BBCC research is based on three main pillars: 1) understand present and past natural climate variability on different time scales, 2) understand key processes of the Earth's climate system dealing with atmosphere, ocean, cryosphere and land and encompassing physical and biogeochemical processes, and 3) develop numerical climate models based on improved knowledge of processes to help understand climate variability and changes.

In order to address these broad challenges, the BBCC gathers researchers from four departments at Stockholm University: the Department of Physical Geography and Quaternary Geology, the Department of Applied Environmental Science, the Department of Geological Sciences and the Department of Meteorology. BBCC includes 47 senior researchers, 36 junior researchers including post-docs and research assistants. During the 5-year period, 77 Ph.D. candidates have been working at BBCC.

The amount of the Linnaeus Grant is MSEK 10 per year. Co-funding from the Stockholm University amounts to MSEK 141 over 5 years, complemented by MSEK 211 of external funding. Total funding is MSEK 412 over the 5 past years.

Scientific Quality and Results

Key Findings and Breakthroughs

Many excellent results have been obtained by BBCC with several breakthroughs. Among those the N Panel can cite: impact of atmospheric circulation on Arctic amplification of global warming, evidence of massive ice-shelf break-up in West Antarctica at the end of the last deglaciation, evidence of seasonally sea ice-free conditions at early Holocene, extensive methane venting to the atmosphere from sediments of the East Siberian Arctic Shelf, origin of brown clouds in South Asia, increase of melt water inflow to the Arctic. Several methodological developments have also been performed among which the development of a new parameterization for the boundary layer that is implemented in a regional model largely used internationally.

The overall activity of the BBCC is very impressive with about 500 papers in 5 years, including 16 publications in the high-impact journals of Nature and Science. Bibliographies joined show a large number of highly cited papers, with 24 above 150 citations and some up to 500 citations, indicating that the international community is being impacted by BBCC activities.

Thanks to the Linnaeus Grant, BBCC has gained a strategic grant on climate modeling supported by the government that complements the Linnaeus Grant and reinforces the transversal theme on climate modeling. This is a very positive impact of the Linnaeus Grant that will play an important cross-cutting role at BBCC: it will help to better interpret observations and will benefit from process studies done at BBCC as can already be shown by some results.

Important Collaborations

Collaboration has been developed with two other departments from the University: in Mathematics on statistical methods and on History on the use of historical archives. Both are very valuable to the research topics of BBCC.

In Sweden, BBCC is a unique centre with such a large expertise on climate. On global and regional climate modelling, its collaboration with SMHI and KTH within the Linnaeus and strategic grants are very important. Collaboration with Lund University focuses on aerosol and greenhouse gases. BBCC expertise has been recognized in the Nordic countries arena with their participation in the Nordic Centre of Excellence DEFROST.

The BBCC has also sustained international collaboration with the USA and in Europe, which has resulted in additional publications. They also participate to a larger number of international projects especially related to field campaigns and modeling. All the core themes seem to be involved in strong international collaboration projects.

Added Value

The added value of the Linnaeus Grant shows very strongly in this environment.

The BBCC has provided an umbrella organization unifying 4 departments, creating the largest research environment on climate in Sweden. This organization has been beneficial to science (see above) and has increased the visibility of climate research at Stockholm University. It paves the ground for a very successful future centre.

In a few years BBCC is now known at international level and has attracted very good international scientists that have been recruited thanks to the Linnaeus and strategic grants as well as thanks to the long-term commitment of the University.

Added value is also seen by the allocation of the strategic grant on climate modelling (>MSEK 90) and the Wallenberg grant for Swerus-3C program (MSEK 46). This shows the important leverage effect of the Linnaeus Grant.

Added value is also shown through the recruitment of 10 permanent positions (from Linnaeus and strategic grant) and the attraction of high profile international scientists that will strengthen BBCC especially in its modelling activities.

Dynamics Created

The Linnaeus Grant has strengthened internal collaborations, in particular through common postdoctoral grants. Co-publishing interactions documents a significant increase in interaction during the course of the Linnaeus project. It is therefore a very good indicator of the positive incentive of the grant on internal collaboration. However, the diagram also shows that groups are working in "islands" whereas BBCC has a potential to further develop work together to find a "global picture" of climate evolution, especially to establish "weight" (role) of considered processes on overall climate change. These interactions are especially expected to further increase in the future with the strengthening of the modeling activities.

Future Potential

The Panel is impressed by the clear strategy of BBCC, especially with regards to choice of profile for the new appointments. BBCC has chosen to strongly increase its modeling capacity seeing modeling as a way to integrate and reinforce the other topics. Up to now, BBCC is lagging on climate modeling compared to other international groups. However, their strong recruitments and willingness should allow them to be at the forefront in coming years.

The future plans for BBCC are convincing and show a strong objective of integration between the different domains. BBCC wants to organize more around questions in the three pillars mentioned above (paleoclimates, process and modeling). This will be the task of the next coordinator (see organization).

BBCC has all the potential to further increase its leadership and should at the end of the Linnaeus Grant period be established as a strong center.

Organization and Leadership

The BBCC Linnaeus Environment has allowed creating the Bert Bolin Centre by gathering four initial departments. Originally (2006) defining 5 areas of focus, the BBCC has now expanded these to 7 areas, splitting one of the original areas of focus and formally establishing modelling as a separate but at the same time unifying theme. BBCC is organised around these 7 core themes, each led by a PI.

The site visit has allowed better assessing the dynamics of BBCC and its role to foster integrations between the Core themes. The N Panel has strongly appreciated the dynamics created by the Linnaeus Grant and the enthusiasms of Core Team Leaders.

Governance of BBCC is straightforward with a Steering Committee gathering the Coordinator and the 7 Core Theme leaders. Money is allocated about equally in support to new permanent positions,

mobile resources, postdoctoral positions and administration and premises. Part of funds is allocated to each Core Theme and mobile funds follow an application procedure. Such funds allow allocating funds to cross-theme activities.

The N Panel has learned at the site visit that the Coordinator of the Linnaeus Grant will leave and be renewed at the end of 2012. The role of the coordination in such a large environment is crucial and the Panel recommends preparing rapidly for this change. The new Coordinator will have to further elaborate plan for next 10 years and increase the visibility of BBCC internally and externally.

Gender issues are dealt with by BBCC, following the Stockholm University policy. Three of the seven core leaders are female and two associate professors have been promoted full professors thanks to earmarked resources for increased research time. About 30% of persons recruited are female. About 54% of Ph.D. students are female. BBCC has a very good record on gender issue.

Level of Commitment of the University

The Stockholm University is clearly very well committed to this program, as is well documented by the comments of Vice-Chancellor Bremer and by his interview.

Stockholm University considers "Climate, Ocean and Environment" an area of strength and that the BBCC is one of its backbones. The University supports staff (total co-funding is MSEK 141). It intends on continuing to support and expand the field of BBCC and strengthen its role in education, which is not a classical topic for education in Universities. The University considers it important to be at the forefront on environment research in order to meet the expectations from students and society.

One very important commitment is the recruitment of permanent positions on non-permanent funding. Thanks to Linnaeus and its spin-off "strategic climate modeling initiative", ten senior positions have been offered as permanent positions with a long-term commitment from the University (from both grants). This commitment has had a strong positive impact on the possibility to attract internationally renowned scientists. It also shows that BBCC is endorsed by the four departments committed in BBCC.

The Stockholm University has also granted the BBCC of two grants for Ph.D. cohorts, each of them including 8 Ph.D. grants. This is a very strong support to the environment.

External Communication

Research staff received basic media training and communicated through various channels and vehicles such as TV, radio, policy-making groups, newspaper debates and important environmental committee of the national parliament.

BBCC visibility is increasing through scientific publications. However, BBCC is still a young structure that would deserve to increase its visibility both internally with regards to the four University departments and outside.

The Panel's Conclusions and Recommendations for Improvements

Through the self-assessment and the site visit, the N Panel considers that the BBCC has very successfully established a single community for climate scientists from the 4 departments of the Stockholm University.

The added value of the Linnaeus Grant is very strong and the Stockholm University strongly committed. BBCC uses the Linnaeus Grant and its spin-off "strategic climate modelling initiative" very efficiently to build a strong Centre which is meant to be sustained in the future thanks to the support of the University.

Since the current coordinator is resigning this year, the N Panel is concerned that the current impetus and coherent direction is maintained. However, the Panel is confident that BBCC is strong enough to make the best choice for its future.

The N Panel acknowledges the steps taken to strengthen internal collaboration and would like to recommend to further increase this direction which will lead to innovative ideas. In particular, the investigators should take advantage of the co-supervisor arrangements for Ph.D. students to promote even more interdisciplinary research.

BBCC creation has been very successful and the N Panel recommends BBCC to put more emphasis on increasing its visibility, internally, nationally and internationally.

4.4.2 BBCC Doctoral Programme “Climate Research School” at Stockholm University

Short Description of the Doctoral Programme

The Climate Doctoral Programme at Stockholm University supports the development of courses for Ph.D.s working in the four departments in that field as well as the Bolin Centre Linnaeus Environment. Its objectives are to create a strong link between the four departments and complement the Bert Bolin Climate Centre Linnaeus Environment.

The Doctoral Programme has been granted MSEK 2 per year.

Organization and Management of the Doctoral Programme

The Doctoral Programme has been used to develop courses that did not exist in the field of climate research for Ph.D. students. Such courses deal with scientific topics such as climate modelling, biogeochemical cycles and glacier dynamics, but also on more general topics to help students on issues such as statistical methods, matlab programming, media training, and writing.

Both attendances to the courses and interviews with students confirm the strong success for the Climate Doctoral Programme. The Programme fills a gap in needs for education in the field of climate research.

The Doctoral Programme is managed by a Director and two part time Directors of Studies. They are helped in their management by a Board including 7 other members: one professor from each department, one Ph.D. student representative and 2 external members. Students contribute to the choices of topics.

Recruitment of Doctoral Students

The Doctoral Programme has not been meant to support Ph.D. grants. However, two cohorts of 8 students each have been granted by the University to the Linnaeus Environment. Recruitment has been achieved through international advertising.

The courses have been followed by the students of the cohorts but also more largely by Ph.D. students of the four departments. Some students from outside the Stockholm University have also benefited from the courses on their demand.

The Doctoral Programme also supports summer schools on the Arctic at every two years with very strong international participation.

Impact of the Doctoral Programme on the Linnaeus Environment

The Doctoral Programme has been developed in a way to strengthen the links between the four departments, reinforcing the integration of the BBCC and therefore the Linnaeus Grant. Topics of courses are fully integrated in the overall objectives of the research environment with topics such as historical perspectives and a summer school on the Arctic climate. The other courses are meant to provide methodology/tool skills to Ph.D. students and help them in their Ph.D. work (writing and presentation techniques, statistics, numerical modelling with matlab, media training). They are all particularly relevant to BBCC.

The Doctoral Programme is so attractive that BBCC will continue it after the end of the Linnaeus Grant.

Impact on the University and Doctoral Training

The Doctoral Programme has influenced the strategic priorities of Stockholm University by creating a much stronger focus on climate related education than previously existed in the University. This has further strengthened one of the University's leading research areas: Climate, Seas and Environment.

A specific achievement is that the Doctoral Programme has trained a new generation of climate scientists. It has created a strong link between the four departments that form the core of the Doctoral Programme. This link is now evident in both education and research. Five new interdepartmental climate-related courses have been developed within the Doctoral Programme. All but one of these courses are given annually, the summer school biannually. No such interdepartmental courses were offered before Doctoral Programme was created.

The Doctoral Programme has also supported the development of several departmental climate-related courses on Ph.D. and Master's Levels.

Exchange of Knowledge, Cooperation, and Cross Disciplinary Research Exchange

The courses are playing an important role in the exchange of knowledge and cooperation. Students from the four departments better know each other and have discovered other approaches. The cross disciplinary approach is particularly clear in topics such as the course on historical perspective or the Arctic summer schools and is integrative of the Doctoral Programme.

The Panel's Conclusions and Recommendations for Improvements

The Doctoral Programme has established for the first time courses dedicated to Ph.D. students working in the climate research field. It further plays an essential role to link students from the four departments involved in the Bert Bolin Climate Centre Linnaeus Environment.

The Panel strongly supports BBCC in their willingness to continue the Doctoral Programme even after the end of the Grant.

The Panel makes these recommendations:

- Strengthen the visibility of the BBCC Linnaeus Environment to the Ph.D. students in the four Doctoral-Programme-related departments.
- Encourage further expansion of such activities as the Arctic Summer School that bring international recognition to younger students and maximize interaction between students and faculty.
- Produce a written documentation of course contents such as the Arctic summer course and the History of Climate Science course.

4.4.3 Uppsala RNA Research Center (URRC)

Short Description of the Research Environment

The research conducted at Uppsala RNA Research Centre (URRC) is in the field of RNA, encompassing the disciplines of chemistry, structure and biology. The 2006 proposal defined a mission to “develop 3 interdisciplinary, problem oriented and interconnected research fields based on the interplay of RNA biology/chemistry”: Infectious Disease, Chemical Biology, and Systems Biology. The URRC consists of 16 PIs and 70 associates, most within the Department of Cell and Molecular Biology under the Faculty of Science and Technology at Uppsala University.

The amount awarded by the Linnaeus Grant was MSEK 6.8 per year.

Over the first 5 years of the award period, the overall budget for the Centre included MSEK 34 from the Linnaeus Grant, MSEK 100 from Uppsala University, including URRC-specific co-funding, and MSEK 149 from a variety of external sources including competitive grants from national and international funding agencies, for a total income of MSEK 283.

Scientific Quality and Results

Key Findings and Breakthroughs

Using a combination of chemical, biochemical, computational and structural approaches, this group of investigators has significantly advanced our understanding of RNA processing, gene regulation and protein synthesis. Particularly noteworthy achievements include the development and application of new methods for quantitative analyses of regulatory processes in the context of living cells, detailed

insights into the molecular basis of specific steps in protein synthesis from initiation through termination and the molecular basis of antibiotic resistance, the discovery of sporulation in *Mycobacterium* spp., new synthetic chemistry of oligonucleotides and reconstitution of a cell-free protein synthesis system. The latter example, cell-free protein synthesis, is a particularly good example of the high risk-high benefit scientific activity that the Linnaeus Grants are meant to encourage. Certainly the ability to reconstitute the complex machinery needed to synthesize proteins outside the cell is a very challenging goal. At the same time, such a system would confer the ability to control and modify individual components of the system to generate new proteins with unique properties that could be useful for specific biomedical and technical applications and could not be obtained from any natural system.

In addition to many notable contributions in advancing basic understanding of RNA structure, biochemistry and biology, some of the research accomplished over the past 5 years also represents progress toward the development of novel therapeutics. Specifically, the advances in structural biology of the ribosome, with its implications for development of novel antibiotics, and the development of adenoviral vectors for gene therapy applications have the potential to make significant contributions to global human health.

The substantial impact of these accomplishments at an international level is evident from about 15,000 citations of publications made during this period since 2006, several patents and a significant number of presentations at international conferences.

Important Collaborations

Of particular note are collaborations between the URRC and the strategic research environment known as Science for Life Laboratory (SciLifeLab) within Uppsala University. The URRC self-assessment report also lists 100s of collaborations between individuals within the URRC environment and investigators in Sweden, other European countries, Asia, and the USA. The substantial nature of these collaborations is illustrated in the number of joint publications produced by investigators within URRC.

Added Value and Dynamics Created

The original members of the Linnaeus Environment recognized that continuous renewal would be important for creating a vigorous research environment, particularly in view of the imminent retirement of several of the initial team. Consequently, they incorporated a strategic recruitment program into their original plans, seeking young investigators with complementary areas of expertise. The synergy and interdisciplinary atmosphere has proven to create an extremely favourable situation for recruiting and retaining new investigators. Since the establishment of URRC in July 2006 the Centre has been successful in recruiting seven new investigators, including one professor, one lecturer, and five assistant professors.

It is clear that scientific accomplishments that emerged from the program helped investigators attract new external funding and investigators in the Linnaeus Centre have been very effective in attracting external funding. In one clear example of this kind of leveraging, a collaborative effort between members of the URRC and scientists at the medical faculty produced the Ribosome Center for Research and Education (RiboCORE) that was funded by a large grant from the Wallenberg Foundation in 2011.

The substantial added value of the Linnaeus funding is clearly evident in the fundamental change in the investigators' approach to answering scientific questions. In contrast to the focus on interactions within members of a specific laboratory using a limited set of research tools that is characteristic of most academic research settings, the members of the URRC environment have established cross disciplinary collaborative networks that promote a deep and comprehensive approach to scientific questions of common interest. The long-term nature of the Linnaeus funding that releases investigators from the need to focus on short-term, incremental progress to sustain funding and the emphasis on cross disciplinary, mutually supportive interactions are directly responsible for this positive change in the academic research culture. The success of this approach in promoting outstanding science is evident in the publications, patents and international presentations summarized above.

The research environment created by frequent, multi-level interactions among scientific leaders, students and postdocs with distinct areas of expertise has created a particularly stimulating and mutually supportive intellectual atmosphere that is particularly attractive to young investigators at early stages in their careers, evidenced by the successful recruitment of seven new PIs.

One of the most successful outcomes of the Linnaeus Award has been the creation of an outstanding setting for doctoral education in which students are able to interact informally with enthusiastic and accessible PIs who have diverse expertise in theoretical, biochemical and structural disciplines. In addition to regular weekly meetings held between most students and their main and co-supervisors, students participate in a series of research presentations organized and presented by students, a monthly RNA Club organized by three of the newest PIs, and annual symposia attended by the board of scientific advisors offer regular opportunities for scientific interactions. The practice of co-supervision clearly functions to enhance mentorship on a substantive and practical level and is not a mere administrative formality. When asked how the graduate program could be improved, the students' only wish was that the existence of the Centre be more widely known and shared with more students. This level of satisfaction with their doctoral experience is truly impressive. During the first five years, the Doctoral Programme has produced 34 Ph.D. theses and 73 M.Sc./research training theses.

Future Potential

The URRC PIs expressed a clear vision of their scientific direction involving integration at multiple levels from modelling to biochemistry and from cells eventually to populations. They seemed to perceive few barriers to continued success but did express the need to find solutions to the problems of maintaining and updating equipment and obtaining new sources of funds to support recruitment efforts to continue to bring in young investigators.

The original strategic decisions about the use of the Linnaeus funds provided the foundation for a sustainable program. Linnaeus funds provide support for technicians and administrators with all others permanently funded at the departmental level. This arrangement fully integrates the URRC within the established Department of Cell and Molecular Biology to the mutual benefit of both organisation structures, while at the same time ensuring the long-term support of the URRC PIs.

The second strategic decision to use Linnaeus funds to establish a world-class doctoral programme is very likely to ensure that the impact of the URRC extends well beyond the 10-year period of the award. Students who emerge from the successful URRC graduate program will go on to enhance the stature and reputation of the URRC and they move on to develop their careers with postdoctoral positions in excellent labs throughout the world.

It is very clear the Linnaeus investment in the URRC will have long lasting effects on the quality and impact of RNA science well beyond Uppsala University.

Organization and Leadership

The URRC falls primarily within the Department of Cell and Molecular Biology in the Faculty of Science and Technology at Uppsala University. Governance and oversight are provided by a Board with 11 rotating members including 6 URRC PIs, 4 external members who are scientists from both academic and industrial settings and academic and industrial representatives from URRC, other departments and faculties. The Board is currently chaired by the Dean of Chemistry. In addition, there is a Steering Committee headed by a URRC PI that includes several URRC PIs, Ph.D. students and postdocs and an industrial representative. This organizational structure has clearly served the goals of the Linnaeus Grant.

In regard to gender balance, two of the seven new PIs are women. This is a small but notable step forward in gender balance among URRC PIs. Women also seem to be assuming larger roles in decision-making positions at higher organizational levels within the Uppsala University. Roughly half of URRC Ph.D. students are women.

Level of Commitment of the University

The University leadership appears to be supportive of the URRC group and recognizes the value of the Linnaeus Environment as a model for cooperation that is valuable to other organizational units within

the University. Recruitment of promising young investigators was said to be a very high strategic priority and the value of the Linnaeus Environment was also recognized in this regard. The goals of the Linnaeus Programme also appear to be fully consistent with the University policy to promote integration of research with education and innovation and the goal to increase the proportion of EU funding. The Vice-Chancellor acknowledged that the URRC could have a central role in attracting and capitalizing on the major opportunity offered by the new nationally funded SciLifeLab platforms in proteomics, genomics, and imaging that is to be located at Uppsala University. However, the Vice-Chancellor, having assumed the position on Jan. 1, 2012, was not in a position to make decisions regarding future financial commitments to the URRC until she had an opportunity to become more familiar with the situation.

External Communication

URRC members have been active in communicating and disseminating research findings both externally (to the industrial, scientific and general public) and internally, within Uppsala University (seminars, URRC RNA club etcetera) using the web, TV news media, radio, newspapers and magazines, public lectures, radio programmes, research politics debates, text books, marketing higher education in natural sciences at high schools and also in establishing teaching and research contacts with universities abroad. URRC PIs also participate in external steering committees.

The Panel's Conclusions and Recommendations for Improvements

The added value of the Linnaeus Grant stems from the fundamental change in the general approach to answering scientific questions that were brought about by the long-term investment in an integrated, cooperative and multidisciplinary approach to RNA science. This fundamental change toward enhanced synergy is reflected in enhanced productivity and high quality research that elevated prestige for the investigators and for the University. The high quality of the science combined with the higher profile of the URRC as a coherent research entity enables URRC PIs to leverage the Linnaeus Award to attract more external funding. It also makes it possible to recruit more outstanding scientists at junior and senior levels. Additional scientists and expanded funding in turn feeds back to strengthen the environment and amplify the benefits made possible by the initial Linnaeus Award.

The Panel recommends that the URRC make a strong effort to raise the visibility of the URRC within Uppsala University and to the outside world, perhaps with the advice and support from Uppsala University communication experts. This effort could be enhanced by the URRC hosting a small meeting with the interactive and international style of a Gordon Conference. It is further recommended that the University continue to support on-going recruitment of promising young investigators, particularly women, into the URRC beyond the Linnaeus Award period in order to maintain the high level of energy of the team. A source of stable funding should be identified to sustain the extraordinary high quality of the URRC graduate program beyond the Linnaeus Award period.

4.4.4 Insect Chemical Ecology, Ethology and Evolution (IC-E3) (Swedish University of Agricultural Sciences, Alnarp)

Short Description of the Research Environment

The IC-E3 at SLU is a highly interdisciplinary basic research environment focusing on modulation of insect chemosensory behaviour across a broad range of temporal (msec to millions of years), spatial (micrometre to kilometre) and biological (chemical, molecular genetics, physiological, behavioural, ecological) scales and levels. At the time of this review, IC-E3 has 35 co-workers including 13 junior/senior scientists (all Board Members), 14 postdoctoral and 8 Ph.D. students, together representing 23 nationalities. The project began with 9 PIs, 4 more have been added. The 2011 self-evaluation report identified 21 Postdoctoral and 13 Ph.D. students participating in the Environment since 2006.

Of 11 junior/senior scientists identified in the self-evaluation report, 10 work actively within the Division of Chemical Ecology. The 11th scientist, currently (since 2006) Director of the Department of

Evolutionary Neuroethology, Max Planck Institute for Chemical Ecology (MPICE) in Jena, Germany, was the original Director of IC-E3, and has been a Guest Professor of Chemical Ecology. The Directorship of IC-E3 was changed in 2010.

IC-E3 has been granted MSEK 5 per year by the Linnaeus Grant. Additional funding from SLU (MSEK 4 per year) supports unit expenses including salaries of some IC-E3 scientists. External funding amounts to about MSEK 77 over the last 5-year period.

Scientific Quality and Results

Key Findings and Breakthroughs

In their original application, the IC-E3 group proposed 9 project areas which generally focused on modulation of chemosensory processes in several species of insect, modulation occurring at different organizational levels and across different time scales. The project targeted environmental and behavioural influences on neural processes and behaviour, including influences of host plant, food quality and mating on immediate response (short-term), learned response (mid-term) and evolutionary (long-term) time scales. Evaluated processes included molecular/genetic, physiological (hormonal and neuronal) and behavioural. Animal systems included economic pests and basic research/genetic models. The project offered a highly integrated approach to investigate existing and long standing issues, an approach especially unique in combining two more typically isolated disciplines: fundamental molecular/genetic science and behavioural/physiological ecology. The combination of basic and applied influences carried the added value of offering considerable translational opportunity (i.e. field application).

At the midpoint of their project, the group has been largely successful on all points. Projects have shifted to some degree based on those successes, but have not strayed from the core premise, that a broad integrative approach is needed to solve problems concerning insect chemical ecology. Six areas of achievement are presented; notable among these accomplishments are:

- the demonstration of significant changes in recruitment/attraction respectively caused by (1) plant volatiles, (2) by mating and (3) by feeding, and the identification of physiological/molecular processes underlying these changes; these findings have significantly changed basic intellectual paradigms regarding the processes of insect attraction/behaviour and additionally have clear translational application value in insect control, both in Sweden and globally;
- the development of an evolutionary model for changes in host-preference by blood feeding mosquitoes essentially based on chemo detection, and the identification of information channels based on specific subclasses of odour receptor (OR) genes offers a new framework for studying the evolutionary dynamics of OR gene diversification;
- the documentation that an insect shows greater specificity on selecting an odour trail than it does in subsequently following that odour trail profoundly changes a long standing paradigm arguing the exact reverse, offering further and significant insight into the dynamics of host-plant specificity; this basic finding offers new strategies for applied deployment of odour-based disruptants in crop protection;
- the development of a gall midge (*C. nasturtii*) – plant (*Arabidopsis thaliana*) system offers a new and experimentally manipulatable platform for testing fundamental ecological models that are dependent on plant based signals, by the directed molecular/genetic alteration of those signals allowed using the *Arabidopsis* system.

All of these basic findings have clear application value in insect control, both in Sweden and globally; all contribute significantly to the basic understanding of the fundamental mechanisms underlying insect chemical-sensory based behaviours; all have high potential for external funding.

Important Collaborations

As a consequence of the Linnaeus funding, the IC-E3 group has strengthened existing collaborations and developed new collaborations. Notably, new interdisciplinary collaborations exist with researchers at SLU, Alnarp as well as SLU, Ultuna. Strong collaborations have long existed between members of IC-E3 and faculty of the Dept. of Biology at Lund University. Most recently, IC-E3 has become

involved in the new Plant-Link effort to join activities between LU and SLU. Internationally, the IC-E₃ maintains an impressive network in most European countries, as well as in North America (Canada and USA), South America (Brazil, Columbia), Asia (Bangladesh, China and Japan), Australia and New Zealand. In Africa, IC-E₃ has developed especially strong relationships in Ethiopia (Addis Ababa University) and Kenya (ICIPE). The move of the first IC-E₃ director to Dept. head (and currently acting Director) of MPICE has provided a strong link with perhaps the only other Chemical Ecology institute in the world with similar integrative breadth as IC-E₃. IC-E₃ also co-hosts an annual Ph.D. course with MPICE and Penn State University. The workshop alternates locations between these three institutions. These extensive collaborations inform the IC-E₃ group of current issues maximize impact of IC-E₃ activities and broadcast the accomplishments of IC-E₃ and SLU worldwide. These collaborations also serve strong channels for recruitment of young students and postdocs, and opportunities for career development of IC-E₃ Ph.D. and postdoctoral graduates. Finally, IC-E₃ is partnered with a start-up company, Pheronet (www.phero.net), which is positioned as a commercial outlet for specific chemical products (e.g. insect attractants/repellents) emerging from IC-E₃ activities.

Added Value

The added value of the Linnaeus funding is clear. The cohesiveness and long term stability afforded by the Linnaeus funding has allowed the group to clearly see their position relative to the best worldwide efforts and strategically direct their research to be fully competitive with these outside efforts. This synergy and integration has allowed project to develop that have produced truly novel results that change established paradigms and have clear potential for innovative application (commercial and societal) for insect control and the resulting protection of agricultural crops and human health. The diversity of talent and the environment is allowing truly novel and important findings to emerge which would not have been possible in the absence of Linnaeus funding. The quality of the vision that initiated IC-E₃ was documented from the start, when the founding Director of IC-E₃ was promoted to Department head of the Max Planck Institute of Chemical Ecology in Jena, Germany. Validation of this vision, and evidence of on-going strength, was evidenced in 2009 when IC-E₃ was recognized as one of 8 Outstanding groups (highest evaluation) of 130 groups recently evaluated by SLU, based on an external assessment using defined criteria, and more recently when IC-E₃ was chosen by The Vice-chancellor of SLU as one of 4 groups to represent University research activities during a presentation for the Swedish Minister for Research and Education.

Dynamics Created

Linnaeus funding of IC-E₃ has created an environment of significantly increased productivity, evidenced by a plethora of new findings many of which challenge existing paradigms and/or open significant new opportunities for research, increased quantity and quality of publications, and increased external funding. Before Linnaeus funding, the then existing members of the group were working on related but separate projects; Linnaeus funding has allowed the group to develop a strong overlying focus in which each member is now doing highly integrated and interdisciplinary work; projects are not at all redundant, but have strong overlap with the findings of one project clearly feeding the others. New members are adding strategic layers. The group once intellectually polylingual now speaks a common language and show a strong team spirit with a high degree of excitement and interaction. The group maintains an impressively broad worldwide collaboration base. IC-E₃ group is actively nurturing cohorts of young scientists, in a highly cross disciplinary environment, in a highly visible and exceptionally broad and worldwide collaborative environment, that is providing a clear and positive channel for training and career development; the outcome is innovative and new science.

Future Potential

The future potential of this group is enormous. Break-through findings have emerged from the studies so far, findings which have high potential for external funding as well as impact on applications of both economic and societal relevance. Lack of commitment to long-term financial support from SLU beyond the term of the Linnaeus Grant places significant responsibility for external funding. The

Linnaeus Environment has given the group the support and structure to significantly increase their external funding, evidenced in increase already seen in years 4 and 5 of the grant period. Based on their success to date (significant findings to date, increasing quantity and quality of publications, increasing external funding, and a young and enthusiastic cohort of scientists), the 10-year prognosis is strongly positive.

Organization and Leadership

Currently there are 13 PIs, all serving on an Advisory Board which is headed by a Project Leader and a Deputy Leader; decisions are made by consensus, or by vote as needed. The Board includes 4 women (30%), one serving as Head of the Department of Plant Protection Biology; two women are senior and two women identified as junior scientists junior have recently been promoted to the Board. The entire Board meets monthly. Since 2006, specified amounts of research funds have been given by default to all IC-E3 participants including junior/senior scientists, postdocs and Ph.D. students. The junior/senior scientists can additionally apply for strategic funds through 4 calls each year; such strategic project applications are evaluated by the entire Board. The Board organized an external international evaluation in 2010 (based on an extensive IC-E3 generated report and a site visit) to assess IC-E3 progress and suggest appropriate changes; the self-evaluation report documents that program adjustments were made following these suggestions.

The success of this organizational scheme is evidence by their strategic planning, adding a focusing Lighthouse Project in 2007 following extended group discussions, and managing a major change in directorship following the move of the initial IC-E3 director to MPICE. This organization has done well in coordinating and establishing a robust and leading research programme, and now needs to aggressively focus strategic attention to its sustainability beyond Linnaeus.

Level of Commitment of the University

The Vice-Chancellor report states a strong commitment by SLU to the IC-E3 Environment. SLU recently (2009) hosted an external assessment, using defined criteria to evaluate 130 programs across the 4 SLU campuses; in the N Panel's interview with the Assistant Vice Chancellor and Dean of Faculty, the panel was told IC-E3 was one of 8 identified as Outstanding (highest evaluation). IC-E3 was recently one of 4 programs at SLU presented to the Swedish Minister for Research and Education. IC-E3 is playing a significant role in Plant-Link, which is strategically bridging a gap between SLU, Alnarp and Lund University. SLU clearly recognizes the significant contributions of IC-E3 and its added value to the University. And SLU is contributing MSEK 4 per year as part of the Linnaeus funding. Nevertheless, the N Panel would like to see more evidence of SLU administrative participation in helping IC-E3 to develop an aggressive strategic plan for sustaining the Environment beyond Linnaeus funding.

External Communication

Beyond the usual publications (which have increased in quantity and quality as a function of Linnaeus funding) and attendance to meetings, the unusually broad range of active collaborations and the annual international Chemical Ecology workshop provide significant channels to disseminate IC-E3 derived knowledge. The IC-E3 web site provides a significant platform for interface with other scientists, with industry (promoting findings of translational potential), and the public. External communication is excellent as these channels of communication maintain a high level of national and international visibility of IC-E3 activities.

The Panel's Conclusions and Recommendations for Improvements

Through the self-evaluation report and the site visit, the N Panel considers that the IC-E3 has successfully established a focused, interdisciplinary and interactive community that has opened significant new findings focusing on modulation of insect chemosensory behaviour.

The added value of the Linnaeus Grant is the stability it has provided for the successful development of key new findings, and the development and promotion of a young cohort of scientists. The Linnaeus

Grant has established a center that has impressively broad international collaborations that both communicate IC-E3 accomplishments and bring significant positive visibility to the IC-E3 program and SLU. This fundamental basic research is producing findings that are changing established paradigms and have clear potential for innovative application (commercial and societal) for insect control and the resulting protection of agricultural crops and human health.

The main concern of the N Panel is the low level of University support for salaries, which places significant responsibility for the PIs to increasingly transition to external support. In addition, while Ph.D. students have consistently made valuable contributions to IC-E3 efforts, the current number of Ph.D. students seems small and is projected to decline, largely due to limited funds for salary support. In this context, developing a stronger and proactive long-term strategic planning process may help successfully guide this Centre towards a more sustainable future, with strong support from SLU. The Centre should continue to take every opportunity to promote its accomplishments, continuing develop to its web/internet resources for communication of its activities, and aggressively promote associated workshops and conferences.

The Linnaeus Environment Grant has had a clear transformative effect on this research group. The N Panel notes that during the interview SLU commented that they were changing the way in which they support their leading research groups and allocate funding. No details of these changes were provided, however the N Panel already noted above the apparent lack of long term SLU support and the evident success that the long-term Linnaeus funding has stimulated. The N Panel believes that SLU should consider longer-term internal support funding for leading research groups such as IC-E3. The N Panel also strongly recommends IC-E3 to sustain a doctoral activity with a larger number of Ph.D. students.

4.4.5 Organizing Molecular Matter (OMM) (Lund University)

Short Description of the Research Environment

“Organizing Molecular Matter” (OMM) is a highly interdisciplinary and multidisciplinary group focusing on fundamental properties of colloidal (e.g. proteins, membranes, soft condensed matter) and the interface interactions of these materials in an aqueous environment. Studies focus across a broad range of spatial and temporal dimensions. The group currently includes 22 PIs; during the initial 5-year term 59 students have been active in the OMM environment, and of these 21 have earned their Ph.D. degrees.

OMM has received MSEK 7.5 per year from the Linnaeus Grant. The total amount of the Linnaeus Grant for 5 years has been MSEK 42.5 (MSEK 37.5 from VR, MSEK 5 from LU); plus an additional MSEK 54 in co-funding from LU and MSEK 146 from external funds.

Scientific Quality and Results

Key Findings and Breakthroughs

Of particular note is OMM's use of extensive instrumentation to probe problems of high biological significance. Key examples include:

- Analysis of the formation of amyloidal protein fibrils in the context of Alzheimer's disease, and the use of these models to explore mechanisms of Parkinson's disease. This is new information that is fundamental for effective drug design that might be employed to treat these diseases that have such profound effect on human health. These studies have further impact on our understanding of protein-protein interactions which are widespread in biological systems, both normal and diseased.
- Descriptions of water movement in biological tissues, especially the brain, which impact on widely used magnetic resonance imaging, improving the spatial resolution of these methods. Also, related studies on measurements and models related to the movement of materials through human skin which can relate to invasive drug delivery methods. These efforts can lead to significant improvement in diagnostic medicine. Explorations into processes involved in the self-assembly of biological and non-biological materials into macrostructures. In a biological context, these have implications

for basic questions that range from molecular networks within cells, to development of macrostructures in development. In the context of technological advancement, these have far-reaching implications in the development of nano- and subnano- machines applicable to both life and materials science/technology.

The Linnaeus Environment has provided a unified environment joining researchers from multiple academic divisions, creating highly synergetic interactions that are fostering cutting-edge intellectual and technological advances.

Important Collaborations

The creation of the OMM environment itself created collaborations between separate divisions within the Chemistry Department, divisions which had become isolated as Chemistry had grown. OMM scientists maintain extensive and strong local, national and international collaborations. OMM scientists and students interact with scientists throughout LU through their common use of the Max Lab, and also interact strongly with colleagues in the Department of Food Technology. On the international level, OMM is a partner with the European Soft Matter Infrastructure (ESMI), with centers across Europe; OMM plays a major role in steering these activities, and consequently in enabling each ESMI member access to the best available equipment required for the respective scientific sub-domains. This is an outstanding sign for the success in the involvement of OMM in the developing centralized facilities at LU (e.g. Max IV and European Spallation Source, ESS).

Added Value

OMM scientists work at the interface between basic science and application, and as such produce information that has enormously translational potential, evidenced by many documented interactions with industry. The Ph.D. programme was impressively strong, with students well integrated into the research programs in a multidisciplinary landscape. The groups promised effort to revise the core text "The colloidal domain: the point where physics, chemistry and biology meet" will have a lasting effect on the field. The group has positioned itself to be a major contributor to the Max IV and ESS facilities.

Dynamics Created

The Linnaeus Grant has created an interactive collection of scientists who previously had similar interests but lacked the structure to foster synergistic collaborations. That environment now exists. The group is housed within a common space which has physically brought bodies and minds together into a dynamic creative environment. The N Panel was especially impressed by the Ph.D. students, who confirmed these interactions, and affirmed the value of the daily meeting around coffee that was well attended and where open discussion between all "levels" was encouraged. Indeed the N Panel learned that these frequent interactions served as an effective incubator of ideas.

Future Potential

The future potential is enormous. The group has come together to attack very impressive problems of societal importance, and their successes to date will ensure a strong future. Additionally, there is an obvious opportunity to interact with the Max IV and ESS facilities providing an environment for national and international scientists who will work with this facility; these interactions will further foster dynamic collaborations

Organization and Leadership

OMM members are from 3 divisions within the much larger Chemistry Department. Following the 2008 evaluation of the Linnaeus Grant, a 3 member Board was formed which formally meets 4-6 times a year, and is elected by a General Assembly of all PIs; the Board head is elected by the Board. The Board is entirely and independently responsible for the larger membership in OMM and for all funding decisions. There is also a Program Director who has day to day responsibility for administration. Oversight is provided by a 3 member external Scientific Advisory Committee, members of which currently have strong

collaborative ties to OMM. OMM supported projects are generally proposed by at least two members, thus ensuring synergetic interactions within OMM. Projects are developed informally, enhanced by the effectively structured daily interaction of the whole group over a ritualized coffee “hour”; seed ideas are presented to the Board which decides on funding. Ideas are encouraged from all levels of scientist.

Level of Commitment of the University

Commitment from the University seems strong. Certainly LU is contributing directly to the Linnaeus Environment, but also significantly to other areas needing support. The N Panel is concerned that, if the OMM group is to be involved in a significant way with the Max IV and/or ESS facilities, that LU needs to aggressively support this involvement.

External Communication

External communication is excellent. The group maintains an exceptionally high publication rate in outstanding journals and members make frequent and key contributions at international conferences. A major commitment is for the group to revise the seminal text of the field “The colloidal domain: the point where physics, chemistry and biology meet”, written approximately 15 years ago and now out of date in this rapidly advancing field. This revision will leave a lasting imprint of OMM on future students. The N Panel encourages the group to consider improved publicizing group activities, perhaps through a more dynamically maintained web site with increased student involvement that could archive meeting and workshop events/activities, report in greater depth on research and student activities/accomplishments, and document interactions/accomplishments with industry.

The Panel’s Conclusions and Recommendations for Improvements

The OMM environment has created an exceptional cross disciplinary, interactive, and synergistic group that is applying its impressive technical skill and knowledge to truly important societal problems. The N Panel was especially impressed by the Ph.D. students, who additionally described the intense and positive interactive discussions with fellow students and faculty members from OMM. Prior to Linnaeus funding, organizational problems imposed by separate divisions within Chemistry inhibited interactions; Linnaeus funding has broken down these barriers, and the consequence is an exceptional group producing extraordinary science. The OMM environment has also made commendable progress in achieving gender balance. Finally, the N Panel notes the obvious opportunity for LU to coordinate and support OMM participation in the new Max IV and ESS facilities, providing a hosting environment for both local and international scientists, complementing technical participation by other organizational units. Such an opportunity would clearly need strong support from the University.

The N Panel specifically recommends that OMM:

- continue to encourage open collaborations within and outside the Environment to capture involvement of researchers working at the edges of the current OMM community;
- continue to improve its general management capacity by (1) renewing its external Advisory Board with typically five scientists that do not have close collaborative relationships with OMM members and (2) expanding its Board to include representatives from the Ph.D. students and postdocs;
- develop a future strategy with regard to Max IV and ESS, and develops a management structure commensurate with the challenge of their role with these facilities.

4.4.6 Exploring and Controlling the States of Matter with Light – Multidisciplinary Laser Spectroscopy within the Lund Laser Centre (LLC) (Lund University)

Short Description of the Research Environment

The Lund Laser Centre (LLC) Environment aims to explore and control the states of matter with light and to pursue multidisciplinary laser spectroscopy. Its objectives are to provide a better understanding of the physical world while supporting important societal and industrial needs in domains such

as energy, environment and medicine. The LLC comprises six divisions within the three Faculties of Engineering, Science and Medicine: Atomic Physics, Combustion Physics, Chemical Physics, Atomic Astrophysics, the laser activities at MAX-lab, and the Lund University Medical Laser Centre (LUMLC) which is an umbrella organization that includes several clinical departments. The Centre includes about 100 scientists with 13 professors and about 50 Ph.D. students.

LLC has received MSEK 5 per year from the Linnaeus Grant. Over the first 5 years of the award period, LLC has also received MSEK 5 Linnaeus financing from Lund University, an additional MSEK 135 from Lund University and MSEK 347 from a variety of external sources including competitive grants from national and international funding agencies.

Scientific Quality and Results

Key Findings and Breakthroughs

Several key findings and breakthroughs have emerged during the first 5 years of the award period:

- Examples of very impressive collaboration between LLC and LU Hospital include: Using very advanced lasers for cancer diagnostics and in some cases its curing with laser pulses like pancreatic, prostate, breast and brain tumors; skin lesions treated with laser (non-thermal treatment), which is already routinely used at the Oncology and Dermatology clinics at the Lund University Hospital.
- Development of attosecond laser pulses and their applications in modeling attophysical phenomena; the first video on demonstration dynamics of electron wave packet; impressive example of collaboration of the ultrafast science/attophysics group and the energy and environment. Solar cell research is pursued in the LLC Femtochemistry group, with connections to the LU Theoretical Chemistry and Electrical and Information Technology Divisions.
- The Attophysics Group has combined its attosecond extreme ultraviolet source with an operating photoemission electron microscopy system at the Department of Synchrotron Radiation to perform difficult pump-probe experiments with very high spatio-temporal resolution.
- The Quantum Information Group of the LLC was the first to extend the rare earth quantum memory techniques to spin state storage and for a time had a quantum memory at the single-photon level with a storage and retrieval efficiency higher than any published results.
- The LLC 10 Hz multi-terawatt laser has been used to drive non-linear waves in laser-produced plasma and with these waves accelerate electrons and protons to high energies.

Important Collaborations

The Linnaeus Grant has clearly contributed to raising the status of LU, both nationally and internationally.

Collaboration in the fields of lasers and optics, which have traditionally been strong at LU, is now further enhanced. Notable new collaborations:

- The LLC X-ray and attosecond groups have more interaction with the acceleration- and X-ray activities at MAX Lab, which also relates to preparations for the new facility MAX-IV. Two other LLC groups are closely collaborating and directly involved in the development of MAX-IV experimental end stations.
- The LLC Combustion Physics Division has a new collaboration with the Department of Electrical and Information Technology regarding theoretical calculations of scattering and extinction.
- A new collaboration between the Femtochemistry group of LLC and the Nanometer Consortium of LU has been established.
- Within the Lund University Medical Laser Centre, new very strong and fruitful collaborations have been established with the Ear-Nose-Throat, Radiation Diagnostics, and Paediatrics units of the LU Hospital regarding sinusitis diagnostics and premature infant care.
- The LLC Linnaeus program is also very well established as a platform for international collaboration, for example:
- LLC is part of LASERLAB-Europe, an EU infrastructure consortium for European collaboration in the field of lasers and applications; LLC contributes with an Access program, as well as in the Joint Research Programs (JRAs).

- Collaboration of the LLC and KTH with Zhejiang University, ZJU (Hangzhou), China.
- Contributions of the LLC/Medical Laser Center to the health issues in the Third World.

Added Value and Dynamics Created

When all research at the Lund University was evaluated by international panels in 2008, the Physics Department, which is the base of many of the LLC research activities was mentioned as a “crown jewel” of the university. Further objective measures of research success are the three ERC Advanced Investigator Grants received by Linnaeus LLC researchers, as well as major international prizes and numerous invitations for high-level conference presentations. Clearly, the LLC Linnaeus Environment has developed strongly as a result of the grant, and is producing research at an internationally very prominent level.

At the start of the Linnaeus Award period, MSEK 5 from Linnaeus funding constituted 8% of the total budget for the LLC but now constitutes just 5% due partly to the successful competition for 3 ERC grants. Thus, total funding almost doubled due to the increased scope, diversity and strong collaborations fostered by the Linnaeus Environment.

Although the grant seems to be a minimal contribution in terms of funding, the impact on the environment has been very important. The Linnaeus funds provide very important “oil” in the system, as stated by the Director who promotes synergy and energizes interactions. It supports common activities such as “topical groups” that meet regularly to promote interactions between disciplines among junior and senior researchers. This collaborative and mutually atmosphere attracts excellent Ph.D. students and collaborators in important and highly visible areas. In turn, these strengths enhance the ability to attract additional prestigious grants.

Future Potential

The development of new facilities at Lund University, like hard and soft X-ray sources including the proposed free electron laser in the MAX-IV facility, provides a unique opportunity to facilitate the emergence of new ideas and puts the LLC in a strong position to provide a scientific base for the development of an X-ray free electron laser. Such developments will need to be guided by the strategic visions of the LLC Research Committee and the International Advisory Board. Thanks to the positive effect of the Linnaeus Grant, which stimulated growth of the LLC financially and scientifically, the sustainability of the LLC future seems secure.

Organization and Leadership

The LLC is governed by a Board appointed by the participating faculties and organizations with a Chairman and Directors appointed by the Vice-Chancellor of Lund University. There is a Research Committee consisting of eight members three of which are women. The activity is divided into four topical fields of research, which have regular open meetings. LCC has an International Advisory Board with four members representing University leaders. Every 18 months, there is a “strategy day” in which all participants discuss plans for the future. The organization seems to suit the goals of the Centre very well.

There is a gender imbalance among the LLC employees although the women PIs are very distinguished. Twenty-one per cent of the Ph.D. students, 18% of the post-docs, 11% of the junior researchers and 9% of the senior researchers and professors are women. The impressive list of guest / visiting researchers is also clearly dominated by males. However, efforts are underway to address the imbalance and promote women’s careers including a female scientists’ network and mentoring program for Ph.Ds. Regarding leadership, 3 out of 8 members of the Research Committee are women.

Level of Commitment of the University

Lund University takes great pride in and has a strong commitment to the continued success of the LLC Linnaeus Environment. They recognize them as world class and one of the leading groups at Lund University. The senior administration considers the Linnaeus LLC as a model of the collaborative, innovative combination of basic and applied research activity to be emulated by other groups within the University.

The goals of fostering interdisciplinary research and collaboration of the Linnaeus Environments are certainly shared with Lund University. The University has also contributed substantial funds to the support of investigators within the Linnaeus Environment.

External Communication

LLC has very high scientific productivity with publications in leading journals of the respective fields. In addition to active participations in international meetings, LLC has a very active exchange of guest researchers that gives the Centre international recognition and visibility. LLC has an informative and well-organized web home page.

The Panel's Conclusions and Recommendations for Improvements

The Linnaeus Environment has strengthened the already successful Lund Laser Center (LLC), making it one of the world's great laser centres. The Linnaeus Award enhanced interactions and fostered synergy among existing groups of the Lund Laser Center. It has allowed many new findings to emerge, particularly at the intersections of different fields, which have become strongly competitive for external funding. Moreover, the LLC has grown to have very strong international visibility. This Linnaeus Environment serves as a commendable model for a technology-based organization that is open to applications development but is driven by basic science.

The N Panel recommends that the Centre should continue to refresh and renew the environment with ongoing recruitment efforts in complementary areas.

The LLC should continue strategic planning for its role in the development of the large MAX-IV facility.

The position of the Linnaeus Environment under three Faculties poses unique administrative challenges that require special attention on the part of Lund University senior administration.

The already outstanding Doctoral Programme would benefit further from activities that promote interactions among all Ph.D. students, such as an annual retreat in addition to the on-going topical group meetings.

5. MAIN CONCLUSIONS AND RECOMMENDATIONS

5.1 The General Expert Panel's Conclusions and Recommendations on the Level of the Support

As indicated in this report, the General Expert Panel (GE Panel) was extremely impressed by the overall quality, commitment and productivity of the Linnaeus Environments that have been reviewed. Following discussion of the conclusions and recommendations of the various subject-oriented panels, the GE Panel could justify increased funding for a number of exemplary environments. However, since the total available funding is fixed, increases have only been recommended where the GE Panel believes that there are specific opportunities that can be realised through additional funding for the remaining period of the grant. For the small number of Linnaeus Environments where the grants have not supported the anticipated quality of research or have not, in the GE Panel's view, demonstrated the commitment to the goals of the Linnaeus Grant Programme, the Panel has recommended reductions in support.

The Doctoral Programmes were all regarded as exemplary and the GE Panel recommends that the funding of all of the Doctoral Programmes be maintained at the current level for the remainder of the grant.

ACCESS Linnaeus Center- Autonomic Complex Communication nEtworks, Signals, and Systems (KTH)

The performance of ACCESS is excellent. Noting the specific opportunities for this environment to:

- develop mechanisms for accommodating high-risk, high-payoff research
- start a new research activity in *system security*.

The GE Panel recommends a ten-per cent increase in the level of funding.

ACCESS Doctoral Programme

The GE Panel recommends maintaining the current level of funding.

Linné Flow Centre (KTH)

The FLOW Center has achieved a remarkable level of international visibility by building upon excellent research output. Overall, there is no apparent need for financial adjustments. The GE Panel recommends that funding be maintained at its current level.

Linköping Linnaeus Initiative for Novel Functional Materials (LiLi-NFM)

Faculty and research staff of LiLi-NFM are clearly academically excellent; Linnaeus funding should be continued. However, the lack of Linnaeus branding and the lack of interest in its importance as a culture-changer that is in the best interests of the participants leads the GE Panel to recommend a ten-per cent decrease in the level of funding.

Linnaeus Centre of Engineered Quantum Systems (LINNEQS) (Chalmers)

The LINNEQS environment is excellent in its research and has established a broad and dynamic Linnaeus culture. The GE Panel recommends that funding be maintained at its current level.

LINNEQS Doctoral Programme

The GE Panel recommends maintaining the current level of funding.

Nanoscience and Quantum Engineering at Lund University (NanoQE)

NanoQE is a world-leader due to its excellent scientific results. It has shown leadership in branching into new research fields, some with high risk but high value. The GE Panel recommends that funding be maintained at its current level.

NanoQE Doctoral Programme

The GE Panel recommends maintaining the current level of funding.

Stockholm University Linnaeus Center for Integration Studies (SULCIS)

The GE Panel finds the overall quality of research at SULCIS not up to the standard expected in a Linnaeus Environment. The publication record is not exceptional. The GE Panel recommends a twenty-per cent decrease in funding.

Ageing and Living Conditions (ALC) at Umeå University

ALC is a strong research group that is very productive in terms of publications and research projects that contribute to enhancing the understanding of the needs of the ageing population, their participation in work and society, and successful ageing of individuals. The GE Panel recommends that funding be maintained at its current level.

ALC Doctoral Programme

The GE Panel recommends maintaining the current level of funding.

Learning, Interaction, and Mediated communication in contemporary Society (LinCS) (University of Gothenburg)

LinCS has contributed to a remarkable expansion of multidisciplinary collaboration and has created a successful, dynamic and productive center. The LETStudio, the extension of the research perspectives of LinCS, has the potential to further develop new media ecologies among young people in school and outside and would directly benefit from additional funding. The opportunities to further develop the LETStudio lead the GE Panel to recommend a ten-per cent increase in funding.

Centre for Economic Demography (CED) at Lund University

CED is a productive Linnaeus Environment, where the grant is used well to produce substantial scientific quality and added value. Additional resources could further support the establishment of the CED database. Recognising this, the GE Panel recommends a ten-per cent increase in funding.

CED Doctoral Programme

The GE Panel recommends maintaining the current level of funding.

Innovation, Entrepreneurship and Knowledge Creation: Dynamics in Globalizing Learning Economies – Linnaeus Research at LUCIE (Lund University)

The Linnaeus Grant has strengthened CIRCLE in its early years and has provided long-term support and stability to CIRCLE. The Linnaeus Grant is one source of funding for CIRCLE and the Center identifies themselves as CIRCLE, not LUCIE. Reflecting the lack of recognition of, or commitment to, the Linnaeus Grant for LUCIE and the unspent funds to date, the GE Panel recommends a ten-per cent decrease in funding.

Developmental Biology for Regenerative Medicine (DBRM) (Karolinska Institutet)

The DBRM environment has shown excellent scientific productivity and impact in the area of basic neural stem cell biology. The GE Panel recommends that funding be maintained at its current level.

DBRM Doctoral Programme “DBRM Research School”

The GE Panel recommends maintaining the current level of funding.

STARGET – a Cancer Research Network (Karolinska Institutet)

STARGET activity has markedly increased the interactions between the members of the group, and enhanced the cohesiveness of the scientific outcomes. More visibly and very importantly, STARGET increased the basic science – clinical science collaborations. The GE Panel recommends that funding be maintained at its current level.

The Neuronano Research Center (NRC) at Lund University

The NRC is an excellent, well-functioning centre involving multidisciplinary faculty and trainees, providing true interdisciplinary interactions across a very wide spectrum of expertise. In order to accelerate this complex and challenging interdisciplinary programme the GE Panel recommends a twenty-per cent increase in Linnaeus funding.

Hemato-Linné at Lund University

The GE panel found that the Hemato-Linné is a strong basic research group that has consistently produced a large number of excellent studies. However, there is a lack of clearly defined breakthroughs, limited group collaboration and synergy, and a lack of clear progress in translation. Overall, the recognizable added value tends to be modest. The GE Panel recommends a ten-per cent decrease in funding.

Hemato-Linné Doctoral Programme “Lund Research School in Stem Cell Biology”

The GE Panel recommends maintaining the current level of funding.

Lund University Diabetes Centre (LUDC)

The GE Panel finds that the LUDC is an excellent and internationally prestigious group that has been an exemplary model of an effective approach to implementing and managing a Linnaeus Grant. The GE Panel recommends that funding be maintained at its current level.

The Bert Bolin Centre for Climate Research (BBCC) (Stockholm University)

BBCC has very successfully established a single community for climate scientists from the four departments of the Stockholm University. BBCC creation has been very successful and the GE Panel recommends that funding be maintained at its current level.

BBCC Doctoral Programme “Climate Research School” at Stockholm University

The GE Panel recommends maintaining the current level of funding.

Uppsala RNA Research Center (URRC)

The Linnaeus Grant has developed a very strong integrated, cooperative and multidisciplinary approach to RNA science which drives excellent research. The GE Panel recommends that funding be maintained at its current level.

Insect Chemical Ecology, Ethology and Evolution (IC-E3) (Swedish University of Agricultural Sciences, Alnarp)

The Linnaeus Grant has had a clear transformative effect on this research group. IC-E3 creation has been very successful and the GE Panel recommends that funding be maintained at its current level.

Organizing Molecular Matter (OMM) (Lund University)

The OMM environment has created an excellent cross disciplinary, interactive, and synergistic group that is applying its impressive technical skill and knowledge to truly important societal problems. The GE Panel recommends that funding be maintained at its current level.

Exploring and Controlling the States of Matter with Light – Multidisciplinary Laser Spectroscopy within the Lund Laser Centre (LLC)

The Linnaeus Environment has strengthened the already-successful Lund Laser Centre (LLC), making it one of the world's great laser centers. The GE Panel recommends that funding be maintained at its current level.

5.2 Recommendations to the funding agencies

In concluding, the GE Panel wants to emphasize that the Linnaeus Initiative is an outstanding way to funding science in Sweden and should be continued beyond 2016 for the following reasons:

- The long-term funding enables the initiation of high risk and high pay-off projects which can lead to major breakthroughs as well as projects which need a longer time for development.
- The interdisciplinary collaboration creates particular group dynamics by increasing efficiency and creating responsibility among all researchers involved not only towards the funding organization but also towards their peers.
- The creation of structured Ph.D. programmes has not only had a positive effect on quality but also on systematic training a future generation of researchers able to collaborate in highly interdisciplinary groups.

With respect to the longer-term future of Linnaeus Grants, the GE Panel proposes to have repeat calls for competitive applications approximately every five years. The applications should provide a tangible outline of how the grant would produce an added value. Furthermore, the university leadership planning to host a Linnaeus Environment should be required to give a clear and defined commitment of matching funds and strong support to the environment. Finally, sufficient monitoring should be ensured to prevent stagnation of a Linnaeus Environment.

APPENDIX 1: SCHEDULE PANEL WEEKS

APPENDIX 2: INSTRUCTIONS SITE VISITS



Vetenskapsrådet

Datum

2011-11-03

Diarienummer

353-2011-649

Handläggare

Andreas Augustsson, Margareta Eliasson

To Vice-Chancellors of the universities, Coordinators of the Linnaeus environments and Directors of the doctoral programmes granted in 2006

Midterm evaluation of the 2006 Linnaeus grants and doctoral programme grants

- Instructions for the Linnaeus environments

This document gives an overview of the evaluation process and describes what the Swedish Research Council and the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas) expect of the Linnaeus environments during the evaluation.

Background

The Swedish Research Council and Formas are responsible for organizing the evaluation of the Linnaeus grants.

Twenty research environments received the Linnaeus grant in 2006, five in each subject area¹.

In this document, the term “**Linnaeus environments**” will refer to both the research environments and the doctoral programmes that have received Linnaeus grants.

The Evaluation

The mid-term evaluation of the Linnaeus environments will focus on scientific quality, added value and the dynamics created. High scientific quality can be evidenced by key findings, breakthroughs in research and/or international impact. In addition, the potential for successful research during the next five years should be considered. Aspects of organization and leadership, such as how key persons in Linnaeus environment are replaced, should be commented on. International and national collaboration and gender aspects should also be evaluated. The latter issues include the composition of research groups, and when

¹Engineering Sciences (E), Humanities, Social Sciences and Educational Sciences (HSE), Medicine (M) and Natural Sciences (N)



Vetenskapsrådet

applicable the integration of gender aspects in the research. The methods used by the research group in disseminating research results, and the success of the communication strategy used should also be taken into account.

The evaluation will be performed by international expert panels. There are four subject-oriented expert panels, one for each subject area (see footnote 1) and one general expert panel. The subject-oriented panels consist of five members (including the chair). The general expert panel includes the chairs of the subject-oriented panels plus four international experts with extensive research and/or organization management experience.

In their reports, the international expert panels may recommend changes in the level of support to individual Linnaeus environments. Normally, 20 per cent is the maximum possible increase or decrease in funding during the final years of the grant period, after the evaluation. It should be noted that the total budget of the Linnaeus programme cannot be increased. Consequently, any increases in financial support for some Linnaeus environments must be offset by corresponding decreases in other Linnaeus environments.

Site visits

Each Linnaeus environment will be visited by a subject-oriented expert panel. Each member of the subject-oriented panel will be responsible for guiding the pace and direction of the interview at one of the Linnaeus environments. A representative of the general expert panel will also participate and will be responsible for contributing to give the general expert panel an overview of the Linnaeus environments. Representatives of the Swedish Research Council and Formas will participate in site visits, but will not take active part in the evaluation.

The expert panels will use the self-evaluations provided by the Linnaeus environments as a starting point for the site visits. Other documentation that will serve as input for the panels includes the evaluation report of 2008 (Linné 2006+2), the announcement and call for applications (2006 Linnaeus grants and the doctoral programme grants) and the applications from the 20 Linnaeus environments approved for 2006 and the doctoral programmes tied to eight of them.

The subject-oriented panels will hold sessions with the coordinator of each Linnaeus environment and the director of its doctoral programme, researchers, as well as PhD-students, and the university vice-chancellor (*rektor*). The coordinator, doctoral programme director and some of the researchers will give presentations, followed by questions from the panel. The subject-oriented panels will summarize their impressions in a report.



Vetenskapsrådet

The tentative schedule for the site visits is illustrated in the tables below. Table I relates to site visits to Linnaeus environments with doctoral programme grants, and Table II to Linnaeus environments without doctoral programme grants. Please note that although the order of the sessions may be changed, **the actual content or length of each session must remain unchanged.**

Table I: Schedule for site visits to Linnaeus environments with doctoral programme (suggested order of sessions).

Time	Activity	Participants	Comments
8.30-9.30	Presentations and interview.	Linnaeus environment coordinator, director of the doctoral programme and representatives for the Linnaeus environment.	Coordinator: 20 minute presentation. Director: 10 minute presentation. 30 minutes of questions from the panel.
9.30-10.00	Coffee break		
10.00-12.00	Research presentations and interviews.	Representatives for the Linnaeus environment including Linnaeus environment coordinator.	The session should be divided equally between presentations and for questions from the panel.
12.00-13.00	LUNCH		
13.00-14.00	Interview with PhD-students.	PhD-students.	
14.00-14.30	Coffee break		
14.30-16.00	Interview.	University vice-chancellor, Linnaeus environment coordinator and director of the doctoral programme.	



Table II: Schedule for site visits to Linnaeus environments
without doctoral programme (suggested order of sessions)

Time	Activity	Participants	Comments
8.45-9.30	Presentation and interview.	Linnaeus environment coordinator and representatives for the Linnaeus environment.	Coordinator: 20 minute presentation. 20 minutes for question from the panel.
9.30-10.00	Coffee break		
10.00-12.00	Research presentations and interviews.	Representatives for the Linnaeus environment including Linnaeus environment coordinator.	The session should be divided equally between presentations and for questions from the panel.
12.00-13.00	LUNCH		
13.00-14.00	Interview with PhD-students.	PhD-students.	
14.00-14.30	Coffee break		
14.30-15.30	Interview.	University vice-chancellor, Linnaeus environment coordinator.	

Practical arrangements for site visits

The Linnaeus environments are requested to do the following in preparation for the site visits:

1. Invite representatives for the university and the Linnaeus environment for relevant interview sessions and communicate the schedule for the site visit including premises with the Swedish Research Council no later than 21 January 2012.
2. Provide name cards for all participants during the interview sessions.
3. Provide paper copies of presentations.
4. Provide appropriate premises for the interview sessions (location A).
5. Provide a separate location (B) for the expert panel to meet in close to the location for the interview sessions (A). This location should have Internet access, printing capacity, and be available for three hours after the last interview session.
6. Provide lunch in a separate location for the expert panel and administrative personnel from the Swedish Research Council and Formas².
7. Arrange coffee and tea for the morning and afternoon sessions.

² Bedömargruppen och den administrativa personalen önskar enskild lunch så att en intern diskussion kan föras.



Vetenskapsrådet

Site visits midterm evaluation – Instructions for the Linnaeus environments granted 2006

We would be thankful if you could assign a contact person for the visit. The cost for coffee and lunch will be reimbursed by the Swedish Research Council.

Report

The work of the evaluation panels will result in a report on the Linnaeus environments evaluated. Each subject-oriented panel will report on five Linnaeus environments. When the site visits have been completed, each subject-oriented panel will meet and finalize its report. They will summarize their general impressions of the five Linnaeus environments and recommendations of the level of support and recommended changes (if any), to be forwarded to the general expert panel by the chairs.

The general expert panel will then meet and summarize their overall views of the 20 Linnaeus environments. They will consider the recommendations of the subject-oriented panels and agree on a recommendation on the level of support and they may recommend changes.

Handling and distribution of the report

Each Linnaeus environment will receive a draft of the evaluation report concerning their environment from the subject-oriented panel. The draft will be distributed by the Swedish Research Council to the vice chancellor, the coordinator of the respective Linnaeus environments and the director of the doctoral programme, if any. The Linnaeus environment should review the draft for possible factual errors and reply within a week.

The final evaluation report will be presented to the Swedish Research Council and Formas who will decide on the level of support for the remaining period. When the decision has been taken at the end of May, or beginning of June, the report will be released. Immediately prior to its official release, the report will also be distributed to all the Linnaeus environments.

**APPENDIX 3: SELF EVALUATION REPORT
INSTRUCTIONS LINNAEUS ENVIRONMENTS**



Vetenskapsrådet

Datum
2011-04-20

Diarienummer
353-2011-649

Handläggare
Andreas Augustsson, Margareta Eliasson

To Vice-Chancellors of the universities and the
Coordinators of the Linnaeus environments granted in
2006

Instructions for reports from universities that received a Linnaeus Grant in 2006

It is time for the second evaluation of the 2006 Linnaeus Grants and the doctoral programme grants tied to eight of the Linnaeus environments. According to the terms and conditions for Linnaeus Grants, evaluations will take place on three occasions: after 1.5 to 2 years; after 5 years; and after the conclusion of the grant period.

The evaluation after 5 years focuses on scientific results, the added value afforded, the dynamism created, and the potential for successful research during the final phase of the Linnaeus Grant period. This phase in the evaluation should also clarify aspects relating to gender equality, communication, et cetera. The university should report on how the research is expected to advance during the final phase of the period and in subsequent years.

International experts will conduct the evaluation. Their recommendations may address the organisation and management of the environment, or changes in the level of support. Normally, 20% is the maximum possible increase or decrease in funding during the year after the evaluation. In the event that support for a research environment is withdrawn entirely, the parties must prepare a 2-year phase-out plan. The total budget of the Linnaeus programme cannot be increased. Hence, any possible increases in financial support for some Linnaeus environments must be offset by corresponding decreases in other Linnaeus environments.

Five panels of international scientific experts will be selected. Panel members will have scientific expertise relevant to the research performed by the Linnaeus environments granted in 2006. The panels will evaluate the reports from the Linnaeus environments as well as from the doctoral programmes tied to eight of the Linnaeus environments and will perform site visits. They will present their findings in a report to the Swedish Research Council (VR) and the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas).



Vetenskapsrådet

The following instructions outline the contents of the report required from each of the Linnaeus environments. The Vice-Chancellor of the university should answer the first set of questions, and the Coordinator of the Linnaeus environment should answer the remaining questions.

The report from the Linnaeus environments should be written in English and should not exceed 20 A4 pages, excluding appendices. Use Times New Roman typeface, 12 points. Write the *name of the Linnaeus environment at university* at the top of the first page. The report including the required appendices should be submitted by e-mail in PDF format to Margareta Eliasson at the Swedish Research Council, Margareta.Eliasson@vr.se, no later than **30 October 2011**. Name the PDF file: "*Name of Linnaeus environment. University*". Appendices 3, 5, and 6 should also be enclosed as Excel files.

There are separate instructions and will be separate reports for the Linnaeus environments and the doctoral programmes.

Questions regarding these instructions can be directed to Margareta.Eliasson@vr.se or Andreas.Augustsson@vr.se.

Instructions for the report

Questions to the Vice-Chancellor of the University (questions 1 – 6) (maximum four A4-pages)

The evaluation panels will also have access to the original call for applications, your application, the subsequent decision and conditions regarding your Linnaeus Grant, your report after 1.5 years, and the evaluation panel report from the first evaluation (performed in 2008).

- 1) Since the first evaluation of the Linnaeus Grants (after 1.5 years), have there been any changes in:
 - a) the organisation and management of the Linnaeus environment in the university? If yes, please describe and comment.
 - b) how the Linnaeus environment interacts with other research areas and research groups within your university? Any new synergistic effects? If yes, please describe and comment.
- 2) How important is the Linnaeus environment for national and international collaboration involving the university?



Vetenskapsrådet

- 3) If your university has more than one Linnaeus environment, has there been any collaboration between them?
- 4) What university policies address the gender profile of the group involved in the Linnaeus environment – particularly policies related to leadership? How have these policies been implemented?
- 5) Has the Linnaeus Grant influenced the strategic priorities of the university? If so, in what way?
- 6) Has the Linnaeus Grant had any structural impact on the university-wide level? If so, in what way?

Questions to the Coordinator of the Linnaeus environment (questions 7 – 14) (maximum 16 A4-pages, appendices excluded)

The evaluation panels will also have access to the original call for applications, your application, the subsequent decision and conditions for your Linnaeus Grant, your report after 1.5 years, and the evaluation panel report from the first evaluation (performed in 2008).

- 7) Please comment on how the recommendations (if any) from the evaluation panel conducting the first evaluation (in 2008) have been taken into consideration.
- 8) Provide the website address of the Linnaeus environment, and indicate how often the information on the website is updated.

9) Research performed and planned

- a) Describe the most significant results of the research performed since the start of the Linnaeus Grant, including development of new methods.
- b) Describe how the results from the Linnaeus environment have been disseminated, and describe the impact these results have had in the research community.
- c) Describe briefly the development and standing of the research compared to research performed internationally.



Vetenskapsrådet

- d) Describe the added value of the Linnaeus Grant. Comment on effects of this type of funding.
- e) Describe briefly the research planned for the remaining period. What changes have been made compared to the original plan?
- f) What is your prognosis regarding the standing of the research from the Linnaeus environment 10 years from now? What is your strategy for maintaining a strong research environment after the grant period?
- g) In *Appendix 1* list selected publications (maximum 20) to illustrate the research of the Linnaeus environment since it started in 2006. For each publication describe how the results relate to the research programme of the Linnaeus environment (maximum 500 characters including spaces). Mark with an asterisk (*) the publications that can be attributed to **new** collaboration resulting from the Linnaeus Grant.
- h) In *Appendix 2* enclose Curricula Vitae (CV) (maximum 2 pages) and complete lists of publications (since the Linnaeus environment started in 2006) for a maximum of 15 participating researchers active in the environment. Mark with an asterisk (*) the publications that can be attributed to **new** collaboration resulting from the Linnaeus Grant.

10) Collaboration

Since the first evaluation (after 1.5 years), can any *new* collaborative initiatives be attributed *wholly or partly* to research funded by the Linnaeus Grant? Please list only new collaboration involving the Linnaeus environment:

- a) between the Linnaeus environment and other parts of your university
- b) national collaboration with researchers or research groups at other universities in Sweden
- c) international collaboration
- d) collaboration with industry, the public sector, policy makers, and/or other segments of society.

Include, for example both bi-lateral cooperation and agreements to participate in networks, consortiums, multicentre studies, and



Vetenskapsrådet

other initiatives. For each type of collaboration describe, to the extent possible, the actual or potential synergy effects.

11) External communication/dissemination

Describe your communication strategy. What efforts have been made to communicate/disseminate information about the activities and results of research funded by the Linnaeus Grant? Please note that this question does **not** seek to capture details of scientific presentations made to your peers in academia.

Describe how the results have been, and will be, communicated/disseminated to the public, policy makers, research agencies, et cetera. Please list the method of communication for example textbooks, popular science presentations, or other media.

12) Participating personnel

- a) List the individuals that actively participated in the Linnaeus environment during 1 July 2006 through 30 June 2011, and those expected to participate in the environment during 1 July 2011 through 30 June 2016. Please use the table in *Appendix 3* (of this document) as a template for presenting the active participants in the Linnaeus environment.
- b) Describe strategies for recruiting researchers and research groups. Describe any strategy you might have for appointing new groups or dissolving groups, if needed.
- c) Describe and comment on strategies for recruiting researchers and research groups from a gender perspective. Have the strategies been successful? Describe any planned or needed actions.

13) Organisation and leadership of the Linnaeus environment

- a) Describe any changes in the organisation, leadership, and management of the Linnaeus environment since the previous evaluation (after 1.5 years). Comment on the effect(s) of these changes. Describe any foreseen, planned, or needed changes. In *Appendix 4* please provide an organisational chart to illustrate how the Linnaeus environment is organised.



Vetenskapsrådet

- b) Describe and comment on the current leadership structure in the Linnaeus environment from a gender perspective. Describe any planned or needed actions.

14) Budget and financing of the Linnaeus environment

Please present the budget and the financial plan in one or more tables as *Appendix 5 (a - economic report) and Appendix 6 (b - finance plan)*.

- a) An economic report covering the period 1 July 2006 through 30 June 2011, including:
- Income/contributions received, in cash or in kind, the latter in terms of its value in SEK, divided into
 - the Linnaeus Grant
 - co-financing by the university
 - external contributions relevant to the Linnaeus environment.
 - Costs covered by the Linnaeus Grant and university co-financing for
 - personnel, including employer costs for social and other benefits, listed by category
 - equipment, above 1 million SEK
 - equipment, below 1 million SEK
 - additional costs for research (running costs)
 - premises
 - knowledge dissemination, including conference organisation and participation
 - administrative and other costs (please specify).
- b) Financial plan covering the remaining period (1 July 2011 through 30 June 2016) including income/contributions received and costs as specified in 14a).

Appendices to be included with the report

Appendix 1: Maximum 20 publications selected to illustrate the research of the Linnaeus environment since its start in 2006. For each publication describe how the results relate



Vetenskapsrådet

to the research programme of the Linnaeus environment (maximum 500 characters including spaces). Mark with an asterisk (*) the publications that can be attributed to **new** collaboration resulting from the Linnaeus Grant.

Appendix 2: CV (maximum 2 pages) and complete lists of publications for maximum 15 of the participating researchers active in the Linnaeus environment since its start in 2006. Mark with an asterisk (*) the publications that can be attributed to **new** collaboration resulting from the Linnaeus Grant. See details listed below.

Appendix 3: Individuals participating in the Linnaeus environment (use included Excel file as template).

Appendix 4: Organisational chart illustrating how the Linnaeus environment is organised.

Appendix 5: Economic report of the Linnaeus environment (see point 14 for details).

Appendix 6: Financial plan of the Linnaeus environment (see point 14 for details).



Vetenskapsrådet

Appendix 2 – Curricula Vitae and publication lists

This Appendix should contain the Curricula Vitae (CV) and list of publications for participating researchers (maximum 15 per Linnaeus environment).

Curriculum Vitae

Each CV should not exceed 2 A4 pages. The following headings should be used, where applicable:

- Doctoral degree (research area, year, and university)
- Postdoctoral work (year, position, and university)
- Qualification as associate professor/research fellow (research field, year)
- Current position, period of appointment, share of time spent in research
- Previous positions and periods of appointment (specify type of position).
- Interruptions in research. Indicate if active research time has been interrupted to the extent that it affected the opportunity to acquire qualifications, for example by parental leave, illness, clinical internship/residency, governmental assignments, or other similar reasons. Specify the reason(s) for and the dates and total time of the interruption(s)
- Distinctions
- PhD students awarded doctorates for whom the researcher has been the main supervisor
- Postdoctoral researchers who are or have been engaged in collaboration with the researcher in the research group
- National and international assignments of importance.

Publication list

Attach a list of publications to the CV of each researcher. List only the publications since the start of the Linnaeus environment (2006).

Mark with an asterisk (*) publications resulting from new collaboration in the Linnaeus environment.

Categorise the publications under the headings a – f, in the following order:

- a) Peer-reviewed articles



Vetenskapsrådet

Instructions for midterm evaluation reports of Linnaeus environments granted 2006

- b) Peer-reviewed conference contributions (the results of which are not presented in other publications)
- c) Review articles, book chapters, books
- d) Patents
- e) Open access computer programs or databases developed by the researcher
- f) Popular science articles/presentations

Note! Include only articles (or equivalent) that have been published or accepted for publication.

Appendix 3 (Excel file).

Use the included Excel file as template for presenting individuals participating in the Linnaeus environment. List the participants by category. Add more rows as needed. Please indicate any vacant positions.

Midterm evaluation Linnaeus environments granted 2006

APPENDIX 3

Template for presenting individuals participating in the Linnaeus environment. List the participants by category. Add more rows as needed. Please indicate any vacant positions.

PhD Students											
Position	Name	Year of birth	Year PhD planned	Male (M)/ Female (F)	Starting year in the Linnaeus environment	Ending year in the Linnaeus environment	% (of full time) participation in the Linnaeus environment	% (of full time) funded by the Linnaeus Grant or university co-financing	% (of full time) external funding	Main subject area in postgraduate education	Main supervisor

Postdocs											
Position	Name	Year of birth	Year PhD awarded	Male (M)/ Female (F)	Starting year in the Linnaeus environment	Ending year in the Linnaeus environment	% (of full time) participation in the Linnaeus environment	% (of full time) funded by the Linnaeus Grant or university co-financing	% (of full time) external funding	Main subject area	Research group in the Linnaeus environment

Midterm evaluation Linnaeus environments granted 2006

Junior Researchers											
Position	Name	Year of birth	Year PhD awarded	Male (M)/ Female (F)	Starting year in the Linnaeus environment	Ending year in the Linnaeus environment	% (of full time) participation in the Linnaeus environment	% (of full time) funded by the Linnaeus Grant or university co-financing	% (of full time) external funding	Main subject area	Research group in the Linnaeus environment

Guest/Visiting Researchers											
Position	Name	Year of birth	Year PhD awarded	Male (M)/ Female (F)	Starting date in the Linnaeus environment	Ending date in the Linnaeus environment	% (of full time) participation in the Linnaeus environment	% (of full time) funded by the Linnaeus Grant or university co-financing	% (of full time) external funding	Main subject area	Research group in the Linnaeus environment

Senior Researchers											
Position	Name	Year of birth	Year PhD awarded	Male (M)/ Female (F)	Starting year in the Linnaeus environment	Ending year in the Linnaeus environment	% (of full time) participation in the Linnaeus environment	% (of full time) funded by the Linnaeus Grant or university co-financing	% (of full time) external funding	Main subject area	Research group in the Linnaeus environment

Midterm evaluation Linnaeus environments granted 2006

Technical and Administrative Staff										
Position	Name	Year of birth	Year PhD awarded (if applicable)	Male (M)/ Female (F)	Starting year in the Linnaeus environment	Ending year in the Linnaeus environment	% (of full time) participation in the Linnaeus environment	% (of full time) funded by the Linnaeus Grant or university co-financing	% (of full time) external funding	Research group in the Linnaeus environment

APPENDIX 4: SELF EVALUATION REPORT

INSTRUCTIONS LINNAEUS DOCTORAL PROGRAMMES



Vetenskapsrådet

Datum
2011-04-20

Diarienummer
353-2011-649

Handläggare
Andreas Augustsson, Margareta Eliasson

To Vice-Chancellors of the universities and the
Directors of the doctoral programmes tied to Linnaeus
environments granted in 2006

Instructions for reports from universities that received doctoral programme grant tied to Linnaeus Grant in 2006

It is time for the second evaluation of the 2006 Linnaeus Grants and the doctoral programme grants tied to eight of the Linnaeus environments. According to the terms and conditions, evaluations will take place on three occasions: after 1.5 to 2 years; after 5 years; and after the conclusion of the grant period.

The evaluation after 5 years focuses on scientific results, the added value afforded, the dynamism created, and the potential for successful research during the final phase of the Linnaeus Grant period. This phase in the evaluation should also clarify aspects relating to gender equality, communication, et cetera. The university should report on how the research is expected to advance during the final phase of the period and in subsequent years.

The same international expert panels evaluating the Linnaeus grants will also conduct the evaluation of the doctoral programmes. Their recommendations may address the organisation and management of the doctoral programme, or changes in the level of support. Normally, 20% is the maximum possible increase or decrease in funding during the year after the evaluation. In the event that support for a doctoral programme is withdrawn entirely, the parties must prepare a 2-year phase-out plan. The total budget of the Linnaeus doctoral programme cannot be increased. Hence, any possible increases in financial support for some Linnaeus doctoral programmes must be offset by corresponding decreases in other Linnaeus doctoral programmes.

Five panels of international scientific experts will be selected. Panel members will have scientific expertise relevant to the research performed by the Linnaeus environments granted in 2006. The panels will evaluate the reports from the Linnaeus environments as well as from the doctoral programmes tied to eight of the Linnaeus environments, and will conduct site visits. They will present their findings in a report to the Swedish Research Council (VR) and the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas).



Vetenskapsrådet

Instructions for midterm evaluation reports of doctoral programmes tied to Linnaeus environments granted 2006

The following instructions outline the contents of the report required from each of the Linnaeus doctoral programmes. The Vice-Chancellor of the university should answer the first set of questions, and the Director of the doctoral programme should answer the remaining questions.

The report from the doctoral programmes should be written in English and should not exceed 14 A4 pages, excluding appendices. Use Times New Roman typeface, 12 points. Write “Doctoral programme tied to *name of the Linnaeus environment* at *name of university*” at the top of the first page. The report *including the required appendices* should be submitted by e-mail in PDF format to Margareta Eliasson at the Swedish Research Council, Margareta.Eliasson@vr.se, no later than **30 October 2011**. Name the PDF file: “Doc prog *name of Linnaeus environment*. *University*”. Appendices 1–3 should also be enclosed as Excel files.

There are separate instructions and will be separate reports for the Linnaeus environments and the doctoral programmes.

Questions regarding these instructions can be directed to Margareta.Eliasson@vr.se or Andreas.Augustsson@vr.se.

Questions to the Vice-Chancellor of the University (questions 1 – 3) (maximum two A4 pages)

The evaluation panels will also have access to the original call for applications, your application, the subsequent decision and conditions for your doctoral programme, your report after 1.5 years, and the evaluation panel report from the first evaluation (performed in 2008).

- 1) Has the doctoral programme influenced the strategic priorities of the university/HEI (higher education institution)? If so, please describe.
- 2) What share of the courses offered by the doctoral programme are new courses at the university?
- 3) Has the doctoral programme strengthened the postgraduate education and, if so, how?



Vetenskapsrådet

**Questions to the Director of the doctoral programme
(questions 4 – 16) (maximum 12 A4 pages, appendices
excluded)**

The evaluation panels will also have access to the original call for applications, your application, the subsequent decision and conditions for your doctoral programme, your report after 1.5 years, and the evaluation panel report from the first evaluation (performed in 2008).

- 4) Describe how the doctoral programme has been managed and organised since the previous evaluation (conducted in 2008). Which parts have performed well, and which ones have not performed as well? Have the organisation and the management been changed and, if so, how and why?
- 5) Please comment on how the recommendations (if any) from the evaluation panel conducting the first evaluation (in 2008) have been taken into consideration.
- 6) Have the goals, as formulated in the call for applications, been achieved?

“ – To further strengthen the research environments receiving the Linnaeus Grant, by enabling them to obtain knowledge and methods from other research groups through the teachers and courses in the doctoral programmes concerned. The knowledge and methods concerned may be anything from unique methodology to the use of major research facilities.

– To provide access to this knowledge and these methods from the strong research environments for doctoral students engaged in other research projects. Recruitment to the doctoral programme should therefore be through open calls for proposals. The programme must host doctoral students from other groups, environments, and/or HEIs. “

- a. How has the doctoral programme strengthened the Linnaeus environment?
 - b. How has the doctoral programme's association with the Linnaeus environment affected postgraduate students in other research groups?
- 7) Describe the courses currently offered in the doctoral programme and the reasons for arranging these particular courses. Are there courses that would have been desirable to



Vetenskapsrådet

Instructions for midterm evaluation reports of doctoral programmes tied to Linnaeus environments granted 2006

organise within the doctoral programme, but could not be arranged for various reasons? If so, please describe the reasons.

- 8) Has there been any attempt to determine what the postgraduate students think about the education provided by the doctoral programme (for example by a questionnaire)? If so, what were the results?
- 9) Describe the ways in which the doctoral programme has influenced the education of postgraduate students.
- 10) What are the plans for the doctoral programme for the remaining period? What changes have been made compared to the original plan?
- 11) What is your prognosis regarding the standing of the doctoral programme ten years from now? What is your strategy for maintaining a strong doctoral programme after the grant period?
- 12) With which research groups does the doctoral programme collaborate? Describe this collaboration and its added value.
- 13) How are postgraduate students admitted to courses in the doctoral programme? How many applicants are there for each place? Describe the profile of the applicant group (including gender distribution) and the selection process.
- 14) In *Appendix 1* include a list of courses, course leaders, lecturers, and participants in courses that the doctoral programme has offered since you submitted the report for the previous evaluation (performed in 2008). Present the list in Excel, using the following headings:
 - Course name
 - number of higher education (HE) credits
 - course leader
 - name
 - sex
 - academic title
 - lecturers
 - name
 - sex



Vetenskapsrådet

Instructions for midterm evaluation reports of doctoral programmes tied to Linnaeus environments granted 2006

- academic title
- department
- research group
- university
- course participants
 - name
 - sex
 - department
 - research group
 - university
 - year admitted as postgraduate student.

Also state if the participants are part of the Linnaeus environment associated with the doctoral programme, or are part of another Linnaeus environment.

15) In *Appendix 2* present an economic report for 1 July 2006 through 30 June 2011 per calendar year, listed in Excel under the following headings:

- Cost categories:
 - coordination and study follow-up function (engaged in part-time teaching, up to 50% or equivalent)
 - costs of course development
 - lecturers (travel, lodging per diem allowance and recompense for working time)
 - participants (travel, lodging, per diem allowance)
 - rental of premises for meetings.

16) In *Appendix 3* present a financial plan or budget for 1 July 2011 through 30 June 2016 per calendar year, listed in Excel under the same headings as those shown in point 15 above.

Appendices to be included with the report

Appendix 1: Present in Excel a list of courses, course leaders, lecturers, and participants in courses that the doctoral programme has offered since you submitted the report for the previous evaluation (in 2008). (See point 14 for details.)



Vetenskapsrådet

*Instructions for midterm evaluation reports of doctoral programmes tied to
Linnaeus environments granted 2006*

Appendix 2: Present in Excel an economic report of the doctoral programme for 1 July 2006 through 30 June 2011 per calendar year (see point 15 for details).

Appendix 3: Present in Excel a financial plan or budget of the doctoral programme for 1 July 2011 through 30 June 2016 per calendar year (see point 16 for details).

APPENDIX 5: LIST OF PANEL MEMBERS

Appendix 5

Short biographies

Generalists

Professor Barbara M. Kehm

International Centre for Higher Education Research Kassel (INCHER-Kassel), University of Kassel, Kassel, Germany.

Expertise: Professor Kehm was the Managing Director of the International Centre for Higher Education Research (INCHER) at the University of Kassel (Germany) from 2004 until 2011. She is the creator of an international research oriented Master Programme "Higher Education Research and Development" running since 2004. She has been a member of the EAIR Executive Board and the German Society for Higher Education Research. She is Secretary of the Consortium of Higher Education Researchers (CHER) and a member of the International Advisory Board of the University of Helsinki since 2011. She is also member of the editorial board of four international higher education journals. She has carried out several large-scale projects for international organisations such as UNESCO, the OECD, the European Commission, the Council of Europe, and the European Science Foundation.

Research area/field: Higher Education Research, especially issues of internationalisation of higher education and new forms of higher education governance.

Website: <http://www.incher.uni-kassel.de>

Professor Leif C. Andersson

Department of Pathology, University of Helsinki, Finland.

Expertise: Professor Andersson is currently professor of Pathology at the University of Helsinki. He has been the Chairman of The Finnish Cancer Institute (2003-2011), President of The Finnish Society of Sciences and Letters (2007-2010) and President of The Finnish Medical Society (1995-1997). He has also been a Member of The Novo Nordisk Forsknings Kommitté (2001-2010).

Research area/field: Pathology, Cancer biology, Cell biology, Membrane biochemistry and Immunology

Website: <http://www.hi.helsinki.fi/english/research/pathology.html>

Professor Dr. Neil Geddes

Director Technology, STFC Rutherford Appleton Laboratory, Harwell, Oxford, UK.

Expertise: Dr. Geddes was the Director of the e-science programme at STFC, and participated in setting up the LHC Grid computing project. He is from April 1st 2012 Director of Technology at STFC. He was the first Chairman of the worldwide LHC Computing Grid Collaboration. Since 2005 he has led the e-Science Department at the UK Science and Technology Facilities Council (STFC), with responsibility for data management, scientific computing and grid technology in support of the scientific facilities operated by STFC. Since 2004 he is the Director of the UK's National Grid Service, with responsibility for coordinating UK work in Grid deployment. Dr. Geddes is also the UK delegate to the EU e-Infrastructure Reflection Group (eIRG) and he has been active in developing e-Infrastructure for research across Europe.

Research area/field: High Energy Particle Physics

Website: <http://www.stfc.ac.uk/e-Science/People/22381.aspx>

Professor Emeritus Ian Swingland

Hérons Hall, Nash, Kent, UK.

Expertise: Professor Swingland holds the Emeritus Chair in Conservation Biology at the University of Kent, where he founded The Durrell Institute for Conservation and Ecology (DICE). He also held Chairs at the Universities of Michigan, Florence, Auckland, and Manchester Metropolitan. He worked on the China-GEF Country Planning Framework - Land Degradation in Dryland Ecosystems and continues advising the People's Republic of China. Professor Swingland advises the World Bank, the Global Environment Facility, the Asian Development Bank, and the UK Government on conservation and biodiversity management. He was the Board Chairman of Iwokrama International Centre for Rainforest Conservation and Development in Guyana and continues as Chair of the Operation Wallacea Trust and the DICE Trust. Professor Swingland was made an OBE in 2007 for his services to conservation.

Research area/field: Ecology, Zoology, climate change

Website: <http://www.hérons-hall.co.uk/>

E Panel

Professor Dr. Huub W. M. Salemink

Department Kavli Institute of Nanoscience, Research group Photronic Devices, Delft University of Technology, The Netherlands.

Research area/field: Semiconductor nanophotonics.

Website: <http://www.ns.tudelft.nl/en/about-faculty/departments/quantum-nanoscience/research/research-groups/photronic-devices/people/profdr-hwm-salemink/>

Professor Dr. Samuel D. Bader

Materials Science Division, Argonne National Laboratory, Argonne, Illinois, USA.

Research area/field: Nanomagnetism, magnetic films, multilayers and surfaces of metallic systems.

Website: <http://www.msd.anl.gov/bader>

Professor Dr. Tamer Başar

Department of Electrical and Computer Engineering, Decision and Control Laboratory, University of Illinois at Urbana-Champaign, Urban, Illinois, USA.

Research area/field: Modeling and control of communication networks; control over heterogeneous networks; formation in adversarial environments; estimation and control with limited sensing and transmission; resource allocation, management and pricing in networks; mobile and distributed computing; and security issues in computer networks.

Website: <https://netfiles.uiuc.edu/basar1/www/>

Professor Dr. Mervyn Miles

Nanoscience & Quantum Information Centre, H.H. Wills Physics Laboratory, University of Bristol, Bristol, UK.

Research area/field: Nanophysics and Soft Matter, Scanning Probe Microscopy.

Website: http://www.phy.bris.ac.uk/people/miles_m/index.html

Professor Dr.-Ing. Nikolaus A. Adams

Institute of Aerodynamics and Fluid Mechanics, Technische Universität München, München, Germany.

Research area/field: Modelling of transitional and turbulent flows, unsteady aerodynamics and flow-structure, Microfluidics and multi-phase flows interaction, Numerical methods.

Website: <http://www.aer.mw.tum.de/en/faculty/cv/prof-adams/>

HSE Panel

Stephanie Shipp, PhD

IDA Science and Technology Policy Institute, Washington DC, U.S.A.

Research area/field: Economic evaluation, demography, public policy, innovation, competitiveness, advanced manufacturing, technology transfer and commercialization, federal laboratories

Website: <https://www.ida.org/stpi/about%20stpi/leadership%20and%20staff.php>

Amelie F. Constant, Ph.D.

Executive Director DIWDC, 1800 K Street, NW, Office Suite 716, Washington, DC 20006 USA.
Program Director Migration, IZA – Bonn Germany.

Visiting Professor at George Washington University, Elliott School of International Studies, 1957 E Street, NW, Washington, DC 20052 U.S.A.

Research area/field: labor economics, econometrics and economics of migration

Website: <http://www.diwdc.org/index.php?page=4>

Professor Antoinette Fauve-Chamoux

Maître de conférence à l'École des Hautes Etudes en Sciences sociales, Paris.

EHESS – Centre de Recherches historiques.

Research area/field: History of the family; Comparative family studies; Family reproduction models; Gender history; Historical Demography (fertility, Malthusianism); Domestic service & Short or long distance migration; Economic history: domestic service and female labour; History & civilisation of Europe.

Website: <http://esopp.ehess.fr/document.php?id=308>

Professor Sven-Erik Hansén

Faculty of Education, Åbo Akademi University, Finland.

Research area/field: Curriculum development, mother tongue education, teacher education, teachers' professional development

Website: <http://www.vasa.abo.fi/users/shansen/>

Professor Leo J.G. Van Wissen

Director, Netherlands Interdisciplinary Demographic Institute NIDI, and Faculty of Spatial Sciences, University Groningen, the Netherlands.

Research area/field: demography, spatial modelling, migration

Websites: <http://www.nidi.nl/Pages/NID/24/870.bGFuZz1OTA.html>

<http://rug.nl/staff/l.j.g.van.wissen>

M Panel

Professor Dr. Ronald G. Gill

School of Medicine, Department of Surgery, University of Colorado, Anschutz Medical Campus, Aurora, Colorado, USA.

Research area/field: Biology, immunobiology of transplantation and autoimmunity

Website:

<http://www.ucdenver.edu/academics/colleges/medicalschoo/departments/surgery/Research/CCTCARE/Pages/RonaldGGill,PhD.aspx>

Professor Dr. Clemens A. van Blitterswijk

Department of Tissue Regeneration, MIRA Institute, University of Twente, Enschede, The Netherlands.

Research area/field: Tissue engineering and regenerative medicine, and biomaterials science

Website:

http://www.utwente.nl/tnw/tr/Staff/professors/Prof%20Dr_Clemens%20van%20Blitterswijk.doc/

Professor Dr. Ana Cumano

Lymphopoiesis unit, Institut Pasteur, Paris, France.

Research area/field: Immunology, lymphocyte development, and hematopoietic stem cells

Website: <http://www.pasteur.fr/recherche/unites/Devlym/en/welcome.html>

Associate Professor Dr. Vivian K. Mushahwar

Centre for Neuroscience, Heritage Medical Research Centre, University of Alberta, Edmonton, Alberta, Canada.

Research area/field: Bioengineering, neural interfaces, smart neuroprostheses, neural injury and disease, and rehabilitation engineering/neuroscience

Website: <http://www.cellbiology.ualberta.ca/en/FacultyMembers/VivianMushahwar.aspx>

N Panel

Professor Sylvie Joussaume

Laboratoire des Sciences du Climat et de l'Environnement, Gif-sur-Yvette, France.

Research area/field: Climate research and modeling, geophysics, geology

Website: <http://www2.cnrs.fr/en/35.htm>

Professor Martha J. Fedor

Department of Chemical Physiology, Skaggs Institute for Chemical Biology, The Scripps Research Institute, La Jolla, California, U.S.A.

Research area/field: Mechanisms of RNA folding and catalysis, specifically bacterial regulatory RNAs and self-cleaving ribozymes that cut and rejoin RNA substrates.

Website: <http://www.scripps.edu/chemphys/fedor/html%20pages/fedorcv.html>

Professor Szymon Suckewer

Plasma Science and Technology Program, School of Engineering and Applied Science, Princeton University, Princeton, New Jersey, U.S.A.

Research area/field: development and application of X-ray lasers, powerful picosecond and femtosecond lasers, laser interactions with matter, the application of lasers to gas and plasma diagnostics, spectroscopy, and atomic processes in plasmas and gases, medical applications of ultra-short pulse lasers.

Website: <http://www.princeton.edu/mae/people/faculty/suckewer/>

Professor Richard Vogt

Department of Biological Sciences, University of South Carolina, Columbia, South Carolina, U.S.A.

Research area/field: molecular neuroethology; insect chemosensory behavior

Website: <http://www.biol.sc.edu/faculty/vogt>

Professor Thomas Zemb

Institut de Chimie Séparative de Marcoule, Bagnols-sur-Cèze, France.

Research area/field: Measure and model non-DLVO forces, complex fluids

Website: http://www.icsm.fr/icsm_engl/zembt.html

APPENDIX 6: LIST OF ACRONYMS

Appendix 6

List of Acronyms

CEIFO	Center for Research in International Migration and Ethnic Relations
CIDER	CIRCLE Innovation Databases for Economic Research
CIRCLE	Centre for Innovation Research and Competence in the Learning Economy
CRA	Constructing Regional Advantage
CVD	Chemical Vapour Deposition
DNS	Direct Numerical Simulations
E	Engineering Sciences
EDSD	European Doctoral School of Demography
ERC	European Research Council
ESS	European Spallation Source
FINSWED	the Finnish-Swedish Longitudinal Immigration Database
Formas	Swedish Council for Environment, Agricultural Sciences and Spatial Planning
GE	General Expert
HSE	Humanities, Social Sciences, and Education Sciences
ICT	Information and Communication Technology
IEEE	Institute of Electrical and Electronics Engineers
KTH	Royal Institute of Technology
LETStudio	University of Gothenburg Learning and Media technology Studio
LU	Lund University
M	Medicine
MPICE	Max Planck Institute for Chemical Ecology
N	Natural Sciences
PI	Principle Investigator
SEDD	Scanian Economic Demographic Database 1646-2011
SHARE	Survey of Health, Ageing and Retirement in Europe
SLU	Swedish University of Agricultural Sciences
SOFI	Swedish Institute for Social Research
SPaDE	Social Policy and Family Dynamics in Europe
SSF	Swedish Foundation for Strategic Research
SU	Stockholm University
SWINNO	Swedish Innovations
T1D	Type 1 diabetes
T2D	Type 2 diabetes
VINNOVA	Swedish Governmental Agency for Innovation Systems
VR	Swedish Research Council
WIRM	Wallenberg Institute for Regenerative Medicine