99

# Graduate School of Science and Technology International Evaluation report 2015

Aarhus University 2015

## Evaluation of the Graduate Schools of Aarhus University

### Background

According to the Ministerial Order no 960 of 14 August 2014 (concerning the Act on Universities) § 14, 5 the Rector and the head of the Graduate School shall initiate an evaluation of the University's Graduate Schools.

Aarhus University has initiated evaluations of its four Graduate Schools. Each evaluation will take the form of an international evaluation based on two elements: a self-evaluating report written by the individual school, and a visit to the school by an international assessment committee.

Aarhus University will write up the final evaluation and a plan of how to implement the recommendations of the evaluations.

The reports will be made public on the graduate schools' websites.

### Composition of international panel

The following three persons were appointed by the Vice-dean for Talent development Jes Madsen as members of the international panel:

- Professor Kell Mortensen (chair of evaluation committee), X-ray and Neutron Science, University of Copenhagen
- Professor James W. Hicks, Associate Vice Chancellor for Research, School of Biological Sciences, University of California, Irvine
- Professor Pim Brascamp, Animal Breeding and Genetics, Wageningen University

The panel members were considered as independent and internationally recognized experts.

### Procedure

Graduate School of Science and Technology (GSST) prepared a self-evaluation report based on existing data regarding a number of specified subjects.

This self-evaluation report including various enclosures were sent to the joint international panel on February 26th 2015.

The international panel paid a site visit to GSST, Aarhus University on 13-14 April 2015. During the visit the international panel held interviews with:

- **The Head of the PhD School Jes Madsen**
- **PhD students**In first instance with
  - Rasmus Kock Flygaard
  - Sigrid Schøler Nielsen
  - Morten Graversgaard (vice chair of PhD board)
  - Guilherme de Maura Maciel
  - Peter Nørby
  - Sofie Vej Ugelvig
  - Kristine Engemann Jensen
  - Sabrina Tang Christensen

  On committee's request to meet more international students
  - Patrick Laub
  - José Ulises Urbina
  - Niklas Stausberg
  - Simone Marzioni
  - Alessandro Malusá
  - Feng Gang
  - Beatrice Plazzotta
- **Programme committee chairs**
  - Lis Wollesen (Agroecology)
  - Jan Tind Sørensen (Animal Science)
  - Kurt Thomas Jensen (Bioscience, Chair of PhD Board)
  - Anders Møller (Computer Science)
  - Steen Christensen (Geoscience)
  - Søren Wandahl (Engineering)
  - Ole Hertel (Environmental Science)
  - Ernst-Martin Füchtbauer (Molecular biology and Genetics)
  - Duncan Sutherland (iNano)
  - Lars Bojer Madsen (Physics and Astronomy)

**Supervisors**
- Ole Højberg (Animal Science)
- Henrik Balslev (Bioscience)
- Poul Nissen (Mol. biology and Genetics)
- Brigitte M. Staedler (iNANO)
- Hans Kjeldsen (Physics and Astronomy)
- Christian Storm Pedersen (Bioinformatics)

A detailed description of the programme can be found in the appendix of this report.

Bente Lynge Hansen and Ida Marie Gerdes helped in the logistics, administrative items and making notes during the sessions.

**Initial comments:**

The Graduate School of Science and Technology was founded in its present form in 2011, after the major reorganization and merger of Danish Universities and Public Research Institutes. The Graduate School of Science and Technology (GSST) was formed as a merger of The Aarhus Graduate School of Science (AGSoS) and The Graduate School of Agriculture, Food and Environment (SAFE).

GSST appears to be a very well organized graduate school educating PhD students with high qualifications as related to international standards. The Danish PhD is organized by a series of rules and regulations that, at first glance, may constrain exploration of high risk, yet high reward doctoral research projects. This results from a regulatory environment that constrains the PhD study to a normalized 3 year period (180ECTS), that also includes half a year of duty work and half a year of course work (30ECTS). The emphasis on coursework and teaching effectively reduces the research period to only 2 years for both research, writing of papers and the production of a final thesis. The regulations are, however, open to differentiation in study-plans, giving the possibility to integrate the MSc and the PhD studies and thereby the possibilities for optimal planning of the research. GSST does manage to follow there rules in a positive and flexible manner securing education of very high standard. Even though the Danish PhD education do not require any specified number of publications prior to the defence, the PhD's graduating from GSST have, according to statistics provided, an impressive number of scientific papers published in international journals although these data were measured after handing in the thesis and also included papers to which PhD-candidates had a minor contribution. Only few students drop out of the program (approximately 10%) before graduating as a PhD.

The school has a very good balance between Danish and international students, and for almost all of the areas of study a very fair gender balance. It is noted, that the gender distribution does vary from Program to Program and even more from group to group, suggesting that there might still be a need for new initiatives on these aspects.

The PhD school is organized through the Head of the PhD School, the PhD Programs and Program Committee, the Committee of Progamme Leader and the PhD Committee. There is significant overlap between for example the Programme Committees, Program Leaders and the PhD Committee. Most daily issues are discussed and approved within the Programmes or by the Programme Chairs. Only more fundamental issues are taken to the Head of the PhD-School.

The students representatives in the formal organization committees are highly dominated by Danish students. The lack of proportional representation of non-Danish students may result in specific issues experienced by international students not being adequately expressed or discussed. Most PhD documentation appear in English, but many discussions taken up by the formal organizations are in Danish. Also seminars are, according to the international students, often publicised in Danish and signposting in the buildings is in Danish.

**Enrollment and Employment**

The panel finds that it is a very good idea and fair that a minimum level of standard (or "threshold") for admittance is maintained. The panel strongly supports the philosphy that standards for admittance into the graduate program should not be lowered, even though funding may be available for projects.

There was a concensus among the supervisors that in the evaluation of the applicants for admission, there may be too much of an emphasis on the Bachelor's grades if the applicant already has obtained a Master's degree.

- The panel recommends a more balanced evaluation of the applicants. Specifically there should be less emphasis on the performance during the early years of study when considering applicants with a strong Master's degree.
- The panel recommends that GSST pays attention when appointing supervisors prior to commencing the PhD students. Specfically, the panel recommends that the opportunity of appointing co-supervisors be actively used when appropriate to the project..

There are different models of enrollment: The panel finds that the flexibility of the different models is useful, but that the strengths and weaknesses differ between the models. Also supervising staff should be aware of the model for specific students. Starting the PhD studies in parallel with master studies can work well, however, there should be room for all models.

- The panel is concerned with the new rules of dimensioning in some programmes. The good intensions of dimensioning has unintended consequences that might reduce the possibilities of recruiting outstanding international PhD students before Master's degree.

**Progress Management and Quality Assurance of the Individual PhD study**

There was a general consensus of current students, supervisors and program chairs, that the time provide for PhD study is rather tight. This may give rise to both feeling uncertain about the expectations of the project and promote additional stress. Of the groups interviewed, some individuals expressed the viewpoint that the rather tight timeline for the PhD plans was helfpul in structuring the work, and finishing within limited time. Regardless, most students expressed that they experience, especially late in their study, a great deal of pressure and often feel a significant rush to complete the degree. Some students concluded that their PhD study did not fulfil their own expectations. It is, however, the panel's impression that these latter cases represent a minority of the students. The timeline problems discussed may be somewhat less problematic for the 3+5 and 4+4 students, who have more flexibility in planning and conducting their research program, even though the unfinished MSc study may create additional pressure.

THE LENGTH OF TIME

Overall, there is a perception from the representatives that the panel met, that the time limit is a challenge as the PhD students have to do many things in a fairly short period of time, e.g. teaching, 6 months of courses work and the mandatory extended stay in another scientific environment. For many international students, an additional issue may be associated with the change of environment resulting from the move to Denmark. This time challenge might negatively affect the quality of the doctoral research, although is was not possible to quantitatively assess this notion given the available data.

- The panel recommends that the GSST take an active approach to assessing the quality of the PhD program through standard quantitative metrics, e.g. impact factors of journal publications and contribution of PhD-candidates (e.g. major or minor), employment after degree (academic, postdoctoral, industry), postdoctoral positions obtain both in Denmark and internationally. The goal is to quantitatively assess that PhD students are able to compete on the international market following their completion of the program within GSST.

DUTY WORK / TEACHING

The work requirement, in the form of teaching, appears to be rather diverse in form and extent, and depends both on which Program the student is affiliated and who is their supervisor. In some Programs the teaching is organized centrally, while in other programs, the teaching scheme and teaching load is very much determined by the supervisor. Some students are assigned their course or teaching assignementonly a few days prior to start of the academic period.. While such flexibility may be valuable in some context, one might argue for a more strict organisation of the duty work not to overload some students, and to give the students time for realistic planning.

- The panel recommends that there is made an effort to make sure that teaching is offered to all PhD students.
- The panel recommends that teaching assignments are prepared and organized well in advance and taking account for stays abroad etc.
- The panel recommends that all PhD students take a course in science pedagogy early in their PhD studies and ideally prior to their first teaching obligations.

PhD PLAN and HALF-YEAR REPORT

The PhD plan and Half-Year reports are good tools as part of the project planning, and should be used actively as such by the students and their supervisors. Although the students are aware of these positive aspects, many failed to use the reporting actively and some viewed the process as bureaucratic. In the successful cases, the students developed an initial PhD plan that was rather broad with respect to the research goals, allowing for significant changes in focus and directions as the project evolved. The half-year reports are often found as administrative requirements rather than tools to actively follow-up on the progress of the scientific results, and often the half-year report is not used to engage prior discussion with the supervisor(s). The panel concluded that a rather open, broad based PhD-plan is a very good mechanism that provides the PhD-students with flexibility and encourages the possibility to make their own independent contribution to the research direction. The half-year reports could be used more actively and effectively, and include valuable discussions with the supervisor(s) on the progress of the research and the possibility to discuss and make changes in the PhD plans.

- The panel recommends a broader based approach to the initial development of the PhD in order to promote and encourage student involvement in the evolution and direction of the thesis project.
- The panel recommend a more active use of the half-year reports in terms of project planning.

PhD COURSES

The Danish PhD regulations require that the PhD students follow courses or other educational elements corresponding to approximately 30 ECTS. An aim of this course work is to bring the students into a high level of scientific knowledge and insight into state of the art within their project area. The students' views of the coursework requirements were varied. While some find that 30ECTS course work is in the lower end of their wishlist thus appreciating the formal requirements, others find that the courses takes too much time away from research. GSST has a flexible approach to the course requirements following the new PhD regulations. MSc courses, journal clubs, seminar series and conferences may be accepted as PhD courses, as long as the relevant supervisor/program leader accept it. The evaluation committee appreciate this approach, recognizing that the aim of the course work is to give the student state-of-the-art knowledge to the scientific field, and that such knowledge is effectively received through conferences, seminars and journal readings. Still, some students find that it may be difficult to find enough relevant courses, and they sometimes experiences enrollment in courses that are not useful just to fulfil the 30ECTS requirement.

- The panel recommends that there should be a central pool of funds (either at GSST or at the University level) allocated to the development and implementation of PhD courses. The resources should provide the opportunity, where appropriate, to inviting external researchers to help teach the course.

The value of including external researchers promotes research collaborations with the AU faculty, and contributes to the development of academic networks for students (i.e potential future postdoctoral positions and jobs).

- The panel recommends that sufficient time is allocated on issues relevance of science for society, scientific misconduct and the code for good scientific practice including staff and students.
- The panel recommends a generic course in career planning with the focus of both career paths within Academia as well as outside Academia.The panel encourages that GSST considers that some types of conferences can give ECTS as recently allowed for in the Ministerial Order. The panel recommends that the GSST define a maximum number of ECTS associated with conferences, in the order to ensure a broad outcome of the course work.

SUPERVISION

The quality of the supervision depends clearly on the individual supervisor. While students generally experience highly committed supervisors, other students express difficulty in having regular meetings with their supervisors. The well-considered choice of the supervisor and co-supervisions at the start of a project is expected enhance a succesful supervisory process. The quality of the supervisions seems not necessarily directly related to the number of students of the supervisor. The panel can therefore not recommend that supervisors in general will be allowed to have only a given maximum number of students. The PhD school may strongly recommend that all supervisors follow courses in supervision, even though there is no guarantee this will make any changes for all supervisors. The panel is therefore not recommending the course to be mandatory for all supervisors.

- The panel recommends that GSST explicitly pays attention to the appointment of supervisor and co-supervisor before the start of a project. This may include considerations about the composition of an advisory committee (see below).
- The panel does recommend that it is a requirement that all students have a meeting with their main supervisor as well as the co-supervisors prior to the student making the half-year evaluation. If at all possible the panel recommends the presence of a member of the programme committee as well.
- The panel recommends considering an advisory committee to meet with the PhD student every six month prior to the half year evaluation in order to provide advice and input for specific elements to the thesis. The advisory committee would be comprised of the supervisor(s) and up to two additional faculty members that can provide expert input to the PhD project.
- Alignment of expectations for the PhD project is very important. The panel recommends that this is addressed at the first meeting or shortly after the instruction day at the latest.
- The supervisors should be aware of the different types of enrollment options and the requirements of each.

BUDGET

When a PhD student is enrolled at GSST, the institute guarantees that there is budget for the full study. Most students have, however, no insight into the budget and they have no knowledge to the budget available for courses, conferences and daily expenses. There is a significant lack of transparency.

- The panel recommends that each PhD student is assigned a small budget.
- The panel stresses that more budget transparency is needed regarding the individual students opportunities. This could be helpful for students as well as supervisors.

OTHER TOPICS:

- The panel finds it important that the PhD students are aware of the competences they achieve as PhD students.
- The panel has the experienced that the work-life balance seems to be overall okay.
- The panel is pleased to find out that there is a PhD career counsellor doing proactive work for PhD students.

- The panel points out that all Department seminars etc. should be publicised and held in English and also that signposting buildings and notices in English enhances the international character of the School.

**Internationalisation of the PhD education**

The Danish regulation of the PhD education requires that the students take parts in active research environments, including a stays at another, mainly foreign research institutions, or a private research laboratory.

The GSST PhD students are generally very happy with this requirement and happy to make extended stays in international laboratories. However, sometimes familiar or other personal reasons prevent extended stays in international laboratories, and visits to Danish institutions are organized. Some students experiences, however, that their supervisor argue that staying at AU will be more beneficial than going abroad. In these cases the formal requirement may help the student in their argumentation to make an international change of environment.

The students who met with the panel were clearly not aware of possibly AU funding for such stay abroad, funding from GSST centrally or from projects within the Programs. Some students were convinced that the international stay should be paid by themselves, or possible by funds they could raise themselves beyond the project funding.Some departments may consider such applications as part of the student's training, which the panel accepts providing the funding anyway is guaranteed when other applications are not successful, and this is clear to the student.

The panel accepts the notion that it is beneficial for PhD students to visit other research institutions and strongly believe this should be encouraged.

- The panel recommends that the length of the environmental change should remain flexible.
- There is a concern that some PhD students do not go abroad due to financial issues. The panel recommends that there need to be transparency as to the financial aspects of a stay abroad.

YOUNG RESEARCHERS

Young researchers need to get established at the university and in the research environment and having PhD students is one tool in achieving this. The question of the price of a PhD student compaired to post doc was raised stimulating them to prefer post docs while supervising PhD students is an important part of university life.

- The panel recommends start-up packages for young researchers including financing allocated to PhD students.

RECRUITMENT OF INTERNATIONAL STUDENTS

The panel finds that websites are important in order to attract international students not associated with Aarhus.

- The panel points out that it is important that there are good descriptions (in English) on the department websites describing the research areas and the researchers. These areas need to be highlighted and easily found by those outside of Denmark.

EMPLOYABILITY OF THE PhD CANDIDATES

The employment of Danish PhD students within natural and technical sciences, including those from GSST, is generally very high. The PhD students at GSST experiences generally that their PhD supervisors are quite open to discuss career planning after their PhD degree, as long as the students aim for a career within academia. Some students indicated that if they express interests in an industry career, or in governmental administration, on the other hand, the students experienced a rather negative attitude from the supervisor and members of the PhD program. The consequence is that the students avoid to have such discussions. While it may be difficult to alter the opinions of individual supervisors about non-academic careers, the GSST should provide and encourage the desimmination of information on alternative career paths for students with a PhD in science and technology fields.

**Conclusion and Questions**

The International Panel generally finds GSST to be a very successful PhD School, which fulfills the regulations effectively and flexibly, and educates PhD students of high international quality. A number of recommendations for even further improvements are given above. GSST has moreover asked the Panel for advice on the following specific matters concerning the PhD education:

1. How to secure that more Danish top talented students are recruited to a PhD study at GSST?
    - Use more money for recruitment, use the social media, use the present PhD students and their network
2. How to recruit more talented students from top universities currently underrepresented at GSST?
    - Promote collaboration, use supervisor/professor networks, use the double and joint degree to promote awareness of GSST
3. How to improve recruitment of bright international students immediately after they obtain their Bachelor's degree?
    - The panel finds that the focus should be to recruit more bright international students for a full degree Master and then recruit for PhD studies at GSST in the course of their Master studies.
4. How to expand the portfolio of project-relevant PhD-courses in a cost-effective manner in fields with a limited number of students?
    - Make compressed courses such as summer schools and provide the resources to development and implement these courses. Encourage the involvment of international researchers by using the collaborative networks of the faculty.
    - Collaboration with other universities to attract more students. National and international collaborators, as well as external lecturers at the given course may bring external students to the GSST courses.
    - The panel recommend "hybrid courses" using the internet for parts of the course program (not all online courses)
5. How to ensure the possibility for PhD students with eg. family obligations to go on extended research visits abroad?
    - The panel points out that an environmental change can be done in Denmark.
    - One could try to secure funding for kinder garten etc. to bring the family along.
6. How to improve the gender balance in fields where there is currently an imbalance?
    - Having role models as supervisors, program chairs, etc, is usefull in this aspect. The panel doesn't, however, think it is an issue that GSST can influence directly, but must be considere in a broader context.
7. How to better engage international students in teaching activities, given that most introductory courses are taught in Danish?

- The panel is pleased to find that the English entry requirements are more strict now, and thinks that it will help getting more international students to engage in teaching activities.
- It could be accepted that a limited part of an introductory course is taught in English i.e. lab or theoretical exercises.
- Co-teaching with a Danish-speaking teacher.

8. How to increase the number of Industrial PhD projects?
    - The university should make an even more active effort to get more collaboration with private companies.
    - Have a PhD day where private companies are invited to see the PhD students present their work. This could be combined with topics on career oppurtunities in order for the companies to recruit PhD students afterwards.

9. How to further reduce the drop-out rate?
    - The panel finds that the drop-out rate is very low at present, so a further reduction is not very realistic.
    - The panel recommends that the students that withdraw from the university without a PhD degree be invited by GSST to an interview with the head of school (happens now) OR alternatively to provide their reasons for ending the studies in an email .

10. How to further improve the employability and competences of the PhD candidates following a career outside academia?
    - Giving courses on life outside academia
    - Inviting the industry to participate in PhD days
    - The panel encourages GSST to make a course in career planning.
    - The panel recommends that the Head of School and the Programme Chairs make it clear for all supervisors that career oppurtunities are to be discussed, and address the fact that many PhD students will have a career outside academia

11. How to further improve the supervision of PhD students?
    (has been addressed previously)

Appendix: Programme with names

| Monday 13 April 2015 | | |
|---|---|---|
| Time | | Participants:<br><br>**Panel**:<br>Kell Mortensen, Chair<br>James Hicks<br>Pim Brascamp<br><br>Bente Lynge Hansen and Ida Marie Gerdes will assist the panel according to the panel's needs of assistance all through the meetings (incl. notes and report writing). |
| 11:30 am | Pick up at hotel (if needed) | |
| 12.00-01.00 pm | Lunch – preliminary panel discussions | Panel |
| 01.00-02.30 pm | Short introduction and discussions with Jes Madsen, Head of School | Panel<br>Jes Madsen |
| 02.30-03.00 pm | Break | |
| 03.00-04.30 pm | Meeting with PhD students<br><br>Student representatives from the PhD committee and from the PhD student organisation at Science and Technology (PHAUST)<br><br>Chair: Kell Mortensen | Panel<br>Rasmus Kock Flygaard<br>Sigrid Schøler Nielsen<br>Morten Graversgaard<br>Guilherme de Maura Maciel<br>Peter Nørby<br>Sofie Vej Ugelvig<br>Kristine Engemann Jensen<br>Sabrina Tang Christensen |
| 04.30-05.30 pm | Panel meeting<br>Preliminary drafts for report | Panel |
| 05:30 | Transport to hotel | |
| 06:40 – 07.00 | Pick up at hotel (walk to restaurant) | |
| 07:00- 09:00 pm | Dinner<br>At restaurant near the hotel | Panel<br>Jes Madsen, Head of PhD school<br>K. Thomas Jensen, PhD committee chair<br>Morten Graversgaard, PhD committee vice-chair<br>Bente Lynge Hansen<br>Ida Marie Gerdes |
| 1.0 Tuesday 14 April 2015 | | |
| 8:40 am | Pick up at hotel | |
| 9:00-10:00 am | Meeting with 5-8 supervisors<br><br>Chair: Kell Mortensen | Panel<br>Ole Højberg (Animal Science)<br>Henrik Balslev (Bioscience)<br>Poul Nissen (Mol. biology and Genetics)<br>Brigitte M. Staedler (iNANO)<br>Hans Kjeldsen (Physics and Astronomy)<br>Christian Storm Pedersen (Bioinformatics) |

| | | |
|---|---|---|
| 10:00-11.30 am | Meeting with heads of programmes<br><br>Chair: Kell Mortensen | Panel<br>Programme chairs:<br>Lis Wollesen (Agroecology)<br>Jan Tind Sørensen (Animal Science)<br>K. Thomas Jensen (Bioscience)<br>Anders Møller (Computer Science)<br>Steen Christensen (Geoscience)<br>Søren Wandahl (Engineering)<br>Ole Hertel (Environmental Science)<br>Ernst-Martin Füchtbauer (Molecular biology and Genetics)<br>Duncan Sutherland (iNano)<br>Lars Bojer Madsen (Physics and Astrono-my) |
| 11.30-12.00 | Panel meeting | Panel |
| 12.00-01.00 pm | Working lunch<br><br>Clarifying discussions | Panel<br>Jes Madsen, Head of PhD school<br>K. Thomas Jensen, PhD committee chair<br>Morten Graversgaard, PhD committee vice-chair<br>Bente Lynge Hansen<br>Ida Marie Gerdes |
| 01.00-06.00 pm | Report writing<br><br>Breaks according to needs | Panel |
| 06.00 pm | Departure | |