Report from a semester at Nanyang Technological University (NTU) - Singapore

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Preparation and planning

In April 2012 my wife and I traveled to Singapore and NTU on a planning trip. Our stay at NTU was very well planned by NTU. During the whole process we have had the same administrator, Ms Fern Yeo, something that facilitated the process significantly. We directed all questions to Ms Yeo and she handled all immigration issues as well as housing and schools.

The first day at NTU was a general introduction by professor Er Ming Hwa, the vice-president for international affairs. We then continued with a guided tour of campus apartments followed by a visit to a local school - Xingnan Primary School - where the teacher of one primary class was interested in accepting our oldest daughter as extra pupil. We continued by looking at a local daycare center for our youngest daughter.

The next day was focused on meetings with the Division of Chemistry and Biological Chemistry at the School of Physical and Mathematical Sciences at NTU, where we discussed teaching. I then met five faculty members and had very interesting discussions. At that time, we could not set the exact teaching duties since the school had to further discuss the responsibilities for all faculty members. In addition we had opportunities to discuss the research at the Chemistry Division.

During the planning trip we stayed at Nanyang Executive Centre, a combined hotel and conference facility on campus.

To summarize: The planning trip was essential in order to get to know some of my colleagues as well as to investigate housing and schools. The personal contact with our local administrator facilitated the process significantly. In addition it was valuable to learn more about NTU and Singapore in order to plan the stay.

Tasks and responsibilities

I have held a position as Visiting Professor at NTU. Thus I have had a personal office equipped with computer and printer. My responsibilities have been to teach two classes; one undergraduate basic organic chemistry class (CM1031) and one PhD-level class (CBC723). The term is divided in two halves, separated by a recess week. I have had the full responsibility for the second part of these classes, while other teachers have instructed the first part of each of the two classes. I have been responsible for construction of half the final examinations in both classes. In addition I have been responsible for mid-term exams in CM1031 as well as continuous assessments in CBC723.

Activities during the semester

•*Teaching of CM1031*

CM1031 is a course in basic organic chemistry with 191 students. The course is taught in a classical way with lectures, tutorials, laboratory work and homework. I have thus given a total of 14 lectures on the following topics: Aromatic compounds, Electrophilic aromatic substitution, Organohalides, Nucleophilic substitutions and eliminations, Alcohols and phenols, Ethers and epoxides, Aldehydes and ketones, Carboxylic acids and nitriles.

In Lund, I have always lectured using chalk and blackboard, since this gives the students possibilities to see how organic reactions are drawn - which is very important for the understanding of organic chemistry. However, with almost 200 students in a very big lecture theatre this was not possible. In addition, all lectures at NTU are supposed to be given using slide presentations. I have had access to last year's lectures but I preferred to produce my own material, using Keynote - a program that is very powerful for animations. Thus I could show slides that still showed how structures are drawn. In addition I could show three-dimensional structures - something that is not possible using chalk and blackboard.

The lectures given in lecture halls at NTU are automatically recorded. Five minutes after the lecture is finished it is automatically uploaded in the edveNTUre system - NTUs system for e-learning. The edveNTUre system display slides, a movie of the lecturer as well as sound. This is a very powerful tool that makes it possible for the students to go through the material after the lecture. This is of course extra important for students that do not have English as mother tongue.

In addition, a number of tutors were involved in the course. These tutors worked with tutor sessions and practical laboratory sessions. I interacted a lot with these teachers and we discussed both tutor sessions and the construction and grading of mid-term exams as well as final exams. I was not part of the grading of the final exam.

The Student feedback was very positive. I received a Mean Teaching Index of 86.23 (out of 100), which is a very good grade (mean of all lecturers is 83). I got especially high ratings on communication and the use of practical examples in my teaching.

•*Teaching of CBC723*

I also taught the class CBC723, which is a class in synthetic organic chemistry for PhD-students. The class had 18 students. In comparison with the CM1031 class the student group in CBC723 was much more heterogenic and a majority of the students did not have English as the mother tongue. I decided to give this course as an interactive seminary series. The first lecture was thus an introduction were I presented my research and myself. The students then gave short presentations. These presentations enabled me to better understand the students' prerequisites, both in chemistry and language.

I gave a total of six four-hour sessions with the following themes: Carbohydrate Chemistry, Protective groups, Formation of Alkenes, Pericyclic reactions, Reduction and a Case Study on the Mechanism of Reductive Openings of Cyclic Acetals. The latter session was problem-based and served as part of the continuous assessment of the students. The Student feedback was very positive. I received a Mean Teaching Index of 84.29 (out of 100), which is a very good grade (mean of all lecturers is 83). I got especially high ratings in engagement and communication.

•*Other teaching activities*

I arrived one month before my actual teaching begun, which was important in order to understand how teaching is performed at NTU. I thus visited a number of lectures in my own classes as well as tutorials and laboratory classes.

I have also had several pedagogical discussions with my co-teachers as well as my tutors and laboratory instructors. I have also given feedback to the tutors of my class.

•*Other academic activities*

I have participated in parts of the academic work at the Division of Chemistry and Biological Chemistry (CBC) at the School of Physical and Mathematical Sciences (SPMS) and NTU. I have thus had several meetings with colleagues in order to discuss chemistry and possible future collaborations and I have participated in lectures given by visiting scientists, as well as personal meetings with these guests. Since I have only been here for four months I have not been considered as a full member of the community and thus not involved in board meetings.

I also had a very fruitful and interesting meeting with the NTU president, professor Bertil Andersson.

Important lessons

•I have adopted new teaching aids, especially the use of animations for large groups of students.
•I have used a very good system for e-learning. This system enabled me to communicate with students, tutors and other teachers.
•I have used recordings of lectures. This tool is very important for the students but equally important for me as a way to improve my lecturing techniques.
•I have trained a lot on teaching in English.
•I have gained insights in the problems to teach students who are not proficient in English.
•I have got a better understanding of South East Asia, a region that most certainly will be very important in the near future.

Comparison between the foreign and the home institutions (in Sweden)

This comparison is between Nanyang Technological University (NTU) and Lund University (LU)

•*Student population*

NTU is, with 33000 students, the biggest University in Singapore (almost the same number of students as National University of Singapore). 23500 are undergraduate students and 10000 are postgraduates. NTU is one of the fastest growing universities in the world. It was recently ranked in the QS World University Rankings as number 47 (a rise of 11 positions from 2011) and as 86 in the Times Higher Educations World University Rankings.

Most of the undergraduate students are from Singapore while a majority of the postgraduates are from other countries, mainly China. The students are very motivated. However, a creative discussion is somewhat hampered by language and tradition. It is very difficultto interact with the students in the big classes and difficult in small groups.

LU is of similar size as NTU. However, the student groups are more homogenous. It is easy for me to discuss chemistry with students in Lund, even in classes with 100 students. I have taught organic chemistry at all levels and with all different group sizes at Lund University. I all cases the students have been more active during lectures.

•*The relation between research and education*

Most teachers at NTU are also researchers. Teachers usually teach both undergraduate and postgraduate classes. The undergraduate classes are usually more general while postgraduate classes often reflect the researchers interests. Consequently I lectured topics from my own field of research in CBC723. Good Mean Teaching Index (student evaluation) is very important in the tenure-track system at NTU.

•*The relation between teacher and student*

The students at NTU are very polite, yet straightforward. Even if they do not ask questions in class, I was often approached after classes with questions and comments. The normal opening phrase was "Hi Prof" or "Professor Ulf".
The teachers are correct and mostly ambitious.
I hade set office hours for my two classes.

•*The institution's view of breadth versus specialization in education*

NTU has expanded from being mainly a Technological University. In addition to a College of Engineering, NTU also houses Nanyang Business School, A College of Science, a College of Humanities, Arts and Social Sciences and a School of Medicine. Furthermore, The National Institute of Education, i.e. the institute for training of teachers, is part of NTU. NTU is thus a broad multi-faculty university.

•*Competence development for teachers*

This topic was not discussed during my time at NTU. I have the impression that this is a somewhat neglected area.

•*Teacher recruitment*

NTU mainly hire researchers. However, teaching ability is very important. 65% of the faculty are from countries other than Singapore.

•*Pedagogy and its importance*

Since a good Mean Teaching Index is very important for tenure, most teachers spend a lot of energy in getting a good impression on the students. Each year the School of Physical and Mathematical Sciences gives a prize to those teachers that have received excellent Mean Teaching Index.

•*The status of pedagogical merits compared to research merits*

My impression is that pedagogical merits are equally important as research merits. This is thus in stark contrast to the situation in Sweden, where teaching merits for a long time been less important compared to research merits. However, this seems to slowly change with the introduction of Excellence in Teaching merits at for example

LTH/LU, as well as other universities in Sweden. Most importantly, these qualification systems are also connected to a rise in salary and addition funding to the division.

•*Curriculum and courses offered*

The Division of Chemistry and Biological Chemistry at the School of Physical and Mathematical Sciences offers an extensive list of chemistry courses.
For a list of courses in chemsitry and biological chemistry please see:
http://www.spms.ntu.edu.sg/CBC/Undergraduates/ProspectiveCurriculumafterAY2011.html

•*Forms of examination*

Most courses at NTU are examined using a combination of continuous assessment and a final exam. The final grade in CM1031 class was comprised of a combination of results from laboratory work, two mid-term exams and a final exam. The final grade in CBC723 class was comprised of a combination of continuous assessment, in the form of homework as well as presentations, and a final exam.

•*To what extent educational programs conform to labour market needs*

Singapore is an advancing country with a very high standard of living. However, since the country has virtually no natural resources, Singapore is dependent on a highly educated population. Two thirds of the students are hired before graduation.

•*Use of technology*

NTU use a high degree of technology for enhanced teaching. All major lecture theatres have equipment for automatic recording of lectures and subsequent publication in the edveNTUre system. During my time at NTU the system functioned well and the few problems that appeared was solved in minutes. All students are equipped with clickers that can be used in all lecture theatres and conference rooms.

Smaller lecture rooms are equipped with video projectors as well as TV-screens that work independently. The class ca, for example, be diveded into smaller groups that are equipped with one monitor each. Furthermore, all lecture rooms are equipped with interactive smart boards.

One problem with the recorded lectures is that the students tend not to buy the books. This is obviously not optimal since the lectures can only cover the most important topics and thus only one view of the topics.

•*Distance education*

NTU has a very well functioning system for distance education. One reason seems to be the outbreak of avian influenza (bird flu) in 2004. Consequently, all teachers are supposed to prepare the material in such way that all lectures can be given as distance education. Each term there is an e-learning week when all lectures should be recorded and presented via the edveNTUre system.

•*Relation between the institution and its environment*

NTU is situated in the western parts of Singapore in a beautiful campus of about 200 hectares. The campus is very well maintained. Several of the main buildings are environmentally friendly, for example covered with grass. The university is very well respected in Singapore and worldwide.

•*Special investments in education at the institution.*

A new school of medicine will be finished in 2013.

Action plan - topics to address and if possible introduce in Sweden

•*Personally*

I have already started lecturing KOK012, a course in general organic chemistry at Lund Institute of Technology. I am now using Keynote lectures, in part produced for my CM1031 course at NTU, with advanced animations of chemical reactions and molecular properties. These lectures are very popular with the students. The use of slides makes it easier to include practical examples. It is also easy to discuss news related to organic chemistry.

In addition I have got excellent insights in the creative process. In order to be creative it is obviously very important to work in different, and new, surroundings. My thoughts about mobility of Swedish researchers were published in Naturvetaren, nr 8, 2012 (Appendix 1 to this report).

•*For the department*

I have started a discussion on how to use e-learning at The Chemistry department at Lund Institute of Technology. In addition it would be very interesting to use recorded lectures in the Swedish educational system.

I have discussed my stay at NTU with several of my colleagues. The XInT-scholarship is not very well known. I will try to change this at Lund Institute of Technology and the chemistry department.

•*For the institution*

I will write an article about my stay at NTU for Lärande i LTH - a magazine for pedagogical articles at Lund Institute of Technology.

•*In the Swedish research and education system.*

I will continue to publicly discuss the importance of mobility for Swedish researchers. In order for academic teachers and researchers to stay creative, it is important to experience new academic and industrial milieus. The XInT program is therefore of outermost importance.

Appendix 1

Article in Naturvetaren nr 8, 2012

GÄSTKRÖNIKAN

Kreativa idéer i ny miljö

Klyftan som skiljer konst från naturvetenskap är bråddjup och det ses inte med blida ögon när någon försöker korsa den. Det är extra sorgligt eftersom konst och vetenskap bara är två sidor av samma mynt, två tankesätt med kreativitet som gemensam nämnare. Under vår barndom utvecklas vår hjärna och hjärncellerna förses med ett skyddande hölje av fett som gör att signalerna går snabbare och vi blir smartare. Samtidigt blir det svårare att bilda nya kopplingar. Lite ironiskt är det därför svårt att vara både kreativ och smart. Processen börjar längst bak i hjärnan och går som en våg mot pannloben.

Detta gör att vi som vuxna har svårt att tänka nya tankar. Trots att naturvetenskapliga forskare förväntas bidra med revolutionerande forskning är det så mycket lättare att bara fortsätta den invanda vägen. Det är nog tyvärr så att många forskare, liksom författare och konstnärer, inte kommer på så särdeles många, konceptuellt nya, tankar i livet. Men vi kan försöka bättra på oddsen.

Många forskare är ganska lika och det är därför olyckligt att vetenskap och konst gått åt olika håll eftersom det är i möten mellan människor med olika bakgrund som nya tankar föds. Det är sällan viktiga kemiska upptäckter sker i fältet, utan istället i gränslandet till fysik, biologi och medicin och varför inte katalyserat av konst. I grunden gäller samma kreativa process i alla ämnen – det är bara tekniken och uttryckssätten som skiljer dem åt.

Istället för att välkomna slumpartade möten där nya idéer föds, låser vi in oss alltmer. Vi har knappt tid att fika längre – vilket varit den svenska vägen till avspända och kreativa möten på arbetsplatsen – och många äter hellre en lunchmacka på kontoret – allt i syfte att hinna med lite mer okreativt arbete.

Så vad ska vi göra? Det absolut bästa sättet att tänka nytt är att flytta på sig och arbeta i en annan miljö. Men, mobiliteten minskar istället och varannan forskare uttrycker att det är svårt, för att inte säga omöjligt att flytta på sig. Det finns dock en enklare väg. I många länder är sabbaticals en självklarhet. Vart femte år kan forskare få en termin ledigt för att arbeta vid ett annat universitet, gärna utomlands - något som gynnar både värd och gäst. Medan en permanent flytt kan vara besvärlig är det enklare att under några månader leva och arbeta i en annan del av världen. Sabbaticals kanske är det vi behöver – ett enkelt, billigt och mycket spännande sätt att vitalisera svensk forskning.

Ulf Ellervik är professor i bioorganisk kemi vid Lunds universitet. Han forskar kring cancerläkemedel. Han är även författare till populärvetenskapliga böcker och artiklar och var 2012 sommarpratare i P1. För tillfället lever han som han lär och är gästprofessor vid Nanyang Technological University i Singapore.