Forum Scientium –
Study visit to Cambridge/Oxford 2004

Background

The 6th to the 10th of June 2004, the graduate school Forum Scientium of Linköping University, Sweden made a study visit to Cambridge and Oxford. In total 23 members of the graduate school participated. The group visited a number of university departments as well as companies in the regions in and around Cambridge and Oxford. Following are brief summaries of each of these visits.

The graduate school Forum Scientium is a multidisciplinary graduate school of natural sciences, engineering and biomedicine that was established in 1996 by Linköping University and the Swedish Foundation for Strategic Research. The PhD-students have backgrounds in biology, medicine, physics and technology. The research area is sometimes called "Life Science Technologies and Biomedicine". More information can be found on the homepage www.ifm.liu.se/Scientium.

MRC-LMB

The Medical Research Council (MRC) - Laboratory of Molecular Biology (LMB)

040607 morning

13 graduate students and Prof. Carl-Fredrik Mandenius visited LMB.
Björn bid us welcome us in the foyer and showed us an original replica model of the alpha-helix as build by Crick and Watson for which they were honoured by receiving the Nobel Prize in 1962. Björn then introduced us to Tony Crowther and Kiyoshi Nagai where they informed us about all the successful scientists that had been working in there laboratory and in Cambridge in general and they gave a short historical overview. They also talked about their organization with many different areas combined in one house that all shared the same equipment. This gives them a very good basis of good cooperation and it works out thanks to global funding.
The group where then divided into four subgroups. Thus, group one and four stayed in the seminar room to listen to Ph.D. students of the structural studies department. This was a pretty large group divided into several minor divisions. From these divisions three Ph.D. students presented there projects. As it is the case in the entire Great Britain the Ph.D. time lasts only for three years without any pressure of doing publications. It was in fact ok to not publish anything at all as long as you did a good job in the eyes of the group leader.

Group two went with Mike Gaits to be introduced to his groups work about applications of synthetic oligonucleotide analogues and their peptide conjugates.

Group three went with Björn, where he showed the neurobiology lab and introduced them to Leon Lagnado's research about exocytosis and endocytosis at the synapse.

The Ph.D. students of structural studies did presentations on the following subjects:

Elena Menicheli - The signal recognition particle. Elena was trying to determine the structure of a subpart of SRP that binds to RNA and thereby changes the function and structure of the complex.

Philip Robinson - Structure of chromatin fibres
Studies how the chromatin fibres is packaging and regulating DNA.

Mohan Madan Badu - Gene regulatory network
Building models of gene regulatory networks in the computer and use that to for example study the evolution of species.

MRC-LMB Structural biology
The goal of the Laboratory is to interpret biological phenomena at the molecular level by a wide range of studies on the structure of proteins, nucleic acids, membranes, organelles and viruses, and by research on the mechanisms and control of gene expression and the three-dimensional organization of cells.

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Mohan Madan Badu - LMB Structural Studies

/Jonas Carlsson and Janosch Hennig

Epson

040607 morning

On Monday June 7th before lunch, we visited Epson. Epson is a Japanese company with a research centre situated in Cambridge where about 20 persons are working. At Epson, Thomas Kugler, a Ph. D. from IFM, LiU, introduced the company and showed a presentation of the company and the research areas. We were also guided in their clean room by a research engineer. Ink-jet printers, spinners, surface energy analyzers were demonstrated in the clean room.

The research in Cambridge is focused on device manufacturing by ink-jet printing. The ink, with polymers as the active material, is used to produce structures such as polymeric field effect transistors and polymeric displays. The main reasons for choosing the ink-jet technique are reduced cost, environmental aspects and reducing the manufacturing equipment size. The ink-jet printers at Epson have many of their parts in common with normal office ink-jet printers. The substrate used is most often Indium Tin Oxide (ITO) and each droplet of ink is usually about 20 µl or more. To increase the precision, surface energy patterning is used. By doing this, the droplets are directed and self-aligned. They also optimize the solvent and the drying process to avoid coffee stains.

/Per Björk

Cavendish

040607 morning

On Monday June 7th before lunch we visited the famous Cavendish laboratory in Cambridge and Doctor Carlos Silva was our guide there. Silva's lab research is mainly focused on ultrafast electronic processes in organic semiconductors, energy and charge transfer phenomena in organic materials, correlation between film morphology and excited-state dynamics, exciton dynamics in supramolecular assemblies and protein folding and misfolding dynamics. Carlos demonstrated his purpose built optical bench with a femtosecond laser for studying these properties in polymeric materials. Sub-picosecond time-resolved spectroscopy is needed to study formation and evolution of polaronic electronic excitations and exciton dynamics in conjugated polymers. He also showed us a set of posters of all the research carried out in the Cavendish laboratory and particular those with his own research.

After this Carlos showed us the Cavendish museum where we could find pictures of all the famous professors that has been there. Maxwell, Rayleigh, Thomson, Rutherford, Bragg and Mott just to name a few. The first Cavendish Professor was J.J. Thomson (Cavendish Professor 1884-1919). I found it especially interesting to see Maxwell's old desk and Watson and Cricks DNA model!

/Peter Åsberg

Mullard Radio Astronomy Observatory

040607

The Astrophysics group of Cavendish Laboratories carries out a wide range of research programmes, with particular emphasis on the fields of optical stellar interferometry, the cosmic microwave background radiation, star formation, and galaxy evolution. Under the direction of Professor Sir Martin Ryle, the laboratory pioneered within the field of radio astronomy from 1945 to 1982. The pioneering work was recognised by the award of the 1974 Nobel Prize for physics to Professor Ryle and Professor Hewish.

Nowadays the observational work is made using a range of facilities world wide in addition to the telescopes at the Mullard Radio Astronomy Laboratory. The Mullard Radio Astronomy Laboratory is the local laboratory of the astrophysics group and is situated a few miles from Cambridge at Lords Bridge. The observatory houses world class telescopes such as the Ryle telescope, the Cambridge Optical Aperature Synthesis Telescope, and the Very Small Array.

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The Mullard Radio Astronomy Laboratory:
http://www.mrao.cam.ac.uk/telescopes/

/Henrik Peterson and Roger Klingvall

EBI

EBI: European Bioinformatics Institute

040607 afternoon

The European Bioinformatics Institute (EBI) is a non-profit academic organisation that forms part of the European Molecular Biology Laboratory (EMBL).

The EBI is a centre for research and services in bioinformatics. The Institute manages databases of biological data including nucleic acid, protein sequences and macromolecular structures.

The mission of the EBI is to ensure that the growing body of information from molecular biology and genome research is placed in the public domain and is accessible freely to all facets of the scientific community in ways that promote scientific progress.

On a very fine and blazing hot Monday afternoon in June a small group of scientists, took a cab from the crowded Cambridge out to the rural Hinxton area and to the European Bioinformatics Institute in order to meet up with renowned microarray scientist Alvis Brazma and his honoured college Christos Ouzounis, the computational genomics researcher. The road sign outside the EBI saying “Right for Genome Campus” might initially have caused some amusement but once actually on the site, we found that to be a very accurate description. The area itself is huge, the buildings are impressive, more are already on the way, and this just might be a really nice place to work when you graduate.

As you might already know, microarray experiments are an increasingly popular way of studying gene expression levels, and two of the signifying traits associated with this method are that it generates a staggering amount of data, and that it generates a staggering amount of noise. Alvis Brazma held a little talk on what he called “Staying afloat in microarray data” where he presented the public repository for gene expression data that his group has been developing. During the last six months approximately 100 GB of microarray data has been stored in different public domain databases, and an additional 25 microarray hybridization experiment result sets arrive every day. The purpose of the repository is not only to pool this data, but also to provide some added value in the form of protocol collection, automated annotation and to provide data quality and validity estimation. On a longer perspective the amassed knowledge in the repository might be sufficient to create a gene expression atlas of sorts, and possibly also to create gene expression networks of adequate reliability to permit simulation of disease mechanisms and pathways.

Chistos Ouzounis talked about their work on automated annotation of genomic data, which is increasingly important today considering that 157 genomes already have been completely sequenced, and that even more soon will be produced in the 1077 separate genome projects currently in progress worldwide. It is obvious that automated methods must necessarily be employed when handling these massive amounts of data, and new methods to optimize the inference process are constantly being developed. Clever reasoning along with mathematical shrewdness is a base requirement in order to minimize the risk of error propagation in this field where one erratic annotation may otherwise spread to hundreds other entities in the blink of an eye. The methods employed comprise natural language text mining in article databases, pattern recognition and statistical machine learning methods.

/Joel Hedlund and Anders Bresell

Celltech

040608 morning

On 8th of June, in the morning, we visited Celltech R&D. Our hosts were: Dr. Ben Perry, Senior Medicinal Chemist and Dr.Peter Bunyard, Cell Biologist. They presented the company's activity and the research work and then, we presented our activity and our interest. Finally, we made an interesting tour through the impressive laboratories.

We were happy to find out that Celltech R&D is one of the leaders of the European biopharmaceutical sector. It is the discovery

and development business of Celltech Group plc with an outstanding drug discovery capability and an innovative pipeline of novel therapeutic products including antibodies and NCEs (CDP870, CDP860, Myloterg). The drug discovery efforts are concentrated on new approaches to treat cancer, autoimmune disease, inflammation and bone disease.

Areas of Research: Celltech has identified, cloned and characterized a critical gene, which controls the formation of bone in humans. Based on the identification strategy, the gene is envisioned to be an ideal target for treating diseases associated with bone loss, in particular osteoporosis. Celltech have also focused on the study of immune responses and diseases of immunological origin. In Celltech Mouse mutagenesis program represents a large discovery effort designed to develop novel mouse models of common human disease, including autoimmunity and inflammatory disorders.

Contact information
www.celltechgroup.com

/Luminita Savitchi

CDT

Cambridge Display Technology

040608 morning

A 30 min drive from Cambridge, Godmanchester and the main office of CDT is situated. We were welcomed by Jeremy Burroughes, CTO, who first showed us the development, production and test laboratories. CDT has two lines where they manufacture their LEP (light emitting polymer) displays, one 14"x14" mostly for well developed production and one 6"x6" mostly for new development. In these lines the first step is to pattern and etch glass, the substrate for the displays. PEDOT, a polymer with metallic conduction properties, and light emitting polymers are deposited by spin coating and spray coating. Finally a cathode is deposited and the whole display is encapsulated using physical vapour deposition (PVD). In the test lab tests of e.g. the run time, the temperature and humidity resistance are performed. We were shown still working displays that had been in use for over two years at room temperature.

The guided tour was followed by a presentation of CDT. The research behind CDT had a major breakthrough in 1989 when PLEDS was discovered in Cavendish Laboratory at Cambridge University. While working in the research group of Professor Richard our host Jeremy Burroughes discovered that LEDs (light emitting diodes) could be made using conjugated polymers. In 1991 the first displays developed (3 x 5 pixels). And in 1992 the company CDT was founded. In 1996 the business strategy of CDT was changed and they started to secure the first licensees (Philips and Uniax). The technology is today so well developed that there are two commercial products out on the market, Philips´ innovative shaver with electronic display and Philips´ incorporated polymer LED display into the 'Magic Mirror' mobile telephone. Finally we were shown a very impressive full colour display with surprisingly good resolution.

/Anna Herland

Graduate school

The graduate school of Biological, Medical and veterinary sciences, Cambridge.

040608 afternoon

The 8th of June, the hottest day this year (more than 32ºC) Forum Scientium visited the Graduate School of Biological, Medical and Veterinary Sciences at Cambridge University. We were welcomed by our host, graduate student Derin A. Balogun. The study visit started with a well-needed lunch at Gonville & Caius College dining hall, and a short historical presentation of the dining hall and its windows, where research from honourable fellows like Stephen Hawking were artistically displayed. After lunch, the afternoon began with Dr. Stefan Klintström introducing us and giving a short presentation of why we were in Cambridge. Dr. David Summers continued and talked about the Cambridge experience, including his research with the E. Coli bacteria, how it is to be a college fellow and entrepreneurship. Drinking port and walk the grass seemed like an attractive idea in the heat. His presentation showed many similarities with us and our supervisors work at Linköping University. Kristofer Hallén then presented Forum Scientium and the way of the creative researcher, pointing at twinning projects, cross-disciplinary research and the importance to be in a research school like Forum

Scientium. A small discussion about similarities and differences between the two graduate schools started, like the credit system, to participate in courses to widen horizons, and 'paper demand'. Daniel Aili held a short presentation of his research on gold nanoparticles, and how to use them as sensors. Then Paul Mayhew from the Graduate School presented his research about hip fractures, from an engineer's point of view. The discussion continued on how to avoid and some ideas why hip fractures occur.

This ended the study visit at the Graduate School of Biological, Medical and Veterinary Science, thus most of us continued the conversation on the way down to the pub, where research, school systems, bookkeeping and banking were thoroughly considered.

/John Olsson

Sir William Dunn School

040609 afternoon

Talitha Bakker, postdoc in Anton van der Merwe´s Molecular Immunology Group had organised the afternoon at Dunn School. In her group the research aim is to understand how T-cell surface molecules contribute to cell antigen recognition. We were given 5 different presentations from people at the Sir William Dunn School of Pathology:

William James: William James talked about aptamers and the HIV-virus. Aptamers are specific RNA or DNA oligonucleotides or proteins, which can adopt different three-dimensional shapes. R5 strains of HIV-1 are resistant to neutralization by antibodies due to the nature of the binding pockets on the surface glycoprotein (gp120). RNA aptamers, in contrast to antibodies, are able to bind neutralization sites on the gp120. A probable region on the aptamer essential for gp120-binding has been identified and a truncated aptamer with this smaller region has been shown to retain its binding to gp120. Further investigation of the structure of the truncated aptamer might lead to alternative anti-HIV-1 drugs.

Alice Kearney: Alice Kearney talked about the principles behind the Biacore-instrument and gave examples of what it is useful for. Biacore is based on surface plasmon resonance (SPR). SPR is an optical phenomenon that is used to measure changes in the solution concentration of molecules at a biospecific surface and allows detection of molecular interactions without the use of labels. The Biacore instrument can for example be used for equilibrium studies, concentration measurements, kinetic studies etc.

Nigel Rust: Nigel Rust talked about the principles behind flow cytometry and what it can be used for. Flow cytometry is a method for analysis of physical and chemical characteristics of cells or particles as they travel in suspension one by one past a light source as sensing point. The cells are coloured by a fluorescing substance. The light scattering from the laser hitting the cells is detected and analysed. Depending on what fluorochrome used, the method can be used for various purposes, such as look at cell size and structure, the cell cycle, calcium flux, DNA etc. The flow cytometer can also be used for cell sorting.

Nick White: Nick White talked about Laser Scanning Microscopy (LSM). In this technique a focused beam of light pointwise illuminates a specimen. An image is recorded by scanning the beam of light over the specimen, and the reflected or fluorescent light from the specimen detected. By collecting images from different depths, you get three-dimensional images of the specimen. It is also possible to get 4D images by adding the time. The technique can for example be used to look at Na+/K+ pumps, the cells volume regulation in situ in a tissue etc.
He also talked about Multiphoton laser scanning microscopy (MPLSM), which is used to get rid of problems with reflection, refraction scattering etc that comes with normal LSM. This technique resembles X-ray, since you can use it to look at things in vivo, such as blood vessels.

Liz Adams: Liz Adams talked about the atomic force microscope, AFM. In AFM a sharp tip is scanned over a surface with feedback mechanisms that enable a piezo-electric scanner to maintain the tip at a constant force or height above the sample surface. AFM can be used for making three-dimensional topographical maps of a surface. AFM can image non-conducting surfaces and can be used to look at cells, proteins, protein unfolding etc.

After the presentations we got the opportunity to see more of Oxford guided by people from

the Dunn School and ended up having dinner in a nice Indian restaurant.

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/Jenny Carlsson

Structural Genomics Consortium

040609 afternoon

On Wednesday the 9th of June, a part of the group went to visit The Structural Genomics Consortium. It is a non-profit organisation with the aim to determine three dimensional structures of human proteins in order to use it in medicine. The determination of the protein structures is done by X-ray and the goal is to develop technologies for rapid, parallel structure determination. The structures will not be patented by the SGC but available for the public.
SGC started in January 2004 and they are still in the process of recruiting and expanding. During this first year, their goal is to determine 25 structures and in the future they want to be able to determine the structure of 200 proteins each year. SGC get their sponsoring from Canadian and British sponsors, from both the public and private sectors and for now, they have got funding for three years.

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/Sara Arvidsson

ISIS

ISIS at CCLRC, Rutherford Appleton Laboratory

040610 9:00 AM - 11:20 AM

ISIS is the world's most successful pulsed neutron and muon source, and the major facility at CCLRC's Rutherford Appleton Laboratory, outside of Oxford. The first neutrons were produced in 1984, and the Laboratory has from that developed into a major asset in condensed matter research. Some 1600 researchers visit annually from over 30 different countries, including both

academic and industrial scientists.

All participants of the Forum Scientium study visit to England followed along to this final event of the trip. We travelled by bus from the youth hostel in oxford, and drove south for some 20 minutes. There, we arrived at a large research complex known as the Rutherford Appleton Laboratory, of which ISIS is a part.

We were greeted by Ms Emma Gilgunn-Jones, Dr Stephen King, and Prof Jeffrey Penfold. First, we were given an introduction to the research lab; its history, its current status and the future. The biggest thing was that in four year's time there will be a new and improved, secondary research station, of which we could see the early stages being constructed.

We were divided into two groups; one was led by Dr King and the other by Prof Penfold.

They took us into the main building, which housed the neutron generator and all the instrument stations, where the actual measurements are being performed. The facility was quite impressive, both in aspect of its size and the research being conducted there. You somehow got the feeling of being in a James Bond movie; inside the super-villans base. The tour took approximately 1 hour, in which we saw all of the neutron generator and most of the many instrument stations.

We received a copy of their annual report (from 2003) and some pamphlets, which can be found in my office for those who are interested.

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/Goran Klenkar