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INFOrum Scientium Special Stockholm

Information from the multidisciplinary doctoral programme Forum Scientium.

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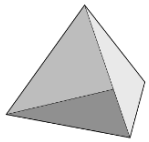

Introduction

As part of the career planning Forum Scientium makes study visits to research intensive companies and to research departments at universities. During the visits we try to meet newly hired PhDs. The network of 76 earlier Forum members, Former Scientium, makes it even easier to have high quality visits. April 17, 2009, we went to Stockholm.

Biosensor Applications

Biosensor Applications was originally founded by the Swedish defence industry (Bofors) in 1995 in response to wishes to produce more peaceful technologies. The company is since 2006 listed on Aktietorget stock exchange in Stockholm and develops, manufactures and sells biotechnology based vapour and trace detection systems. Our host for the visit was Per Månsson, Head of R&D at Biosensor.

Biosensor is located in Solna and has 20 employees of whom 5 have a PhD degree and the remaining 15 are engineers (civ.ing.). The technology is founded on a unique, patented technology that is based upon a Quartz Crystal Microbalance (QCM). The gold covered sensor surfaces (BioCells) are modified with a protein repellent thin film to which analogs of the explosives and narcotics of interest are attached. Before injection of the sample, the surface is loaded with antibodies that bind these analogs. If any of the target substances is present in the sample a pronounced increase in the dissociation of the antibodies is observed, signalling a hit. The current instrument can simultaneously detect 12 different substances within the picogram level for both explosives and narcotics with an investigating time of less than 1 minute. Traces can be in vapour, solid or in liquid form. Sampling is possible through collection of sweat by sweeping a cloth on e.g. the arm or the leg of a person. This cloth is placed in the instrument and the collected molecules desorbed by rapidly heating the cloth to ~300^{o}. The desorbed molecules are adsorbed on a cold finger and transferred into a liquid phase (buffer) and flown into the BioCells. Sampling of other body fluids as well as non-human objects and surfaces such as a steering wheel, bags, clothes etc is also possible. Customers are Customs and Border control, Correctional and Police authorities, Military and Security, as well as Workplace control and Rehab. Most of the technology is developed in house whereas production of antibodies is outsourced.

After a presentation of the company and the technology by Dr. Månsson, we were shown around in the lab and some of us were also tested for drugs. No comments on the results.

Daniel Aili and Sara Nilsson

Neuroscience at Karolinska Institutet

We visited Prof Ola Hermansson, Ass prof Ana Teixeira and former Forum member now postdoc Anna Herland.

In the Hermanson lab, they do research on transcriptional regulatory mechanisms governing the genetic and epigenetic cues that regulate the proper development and function of neural cells and brain circuits involved in autonomic function and cognition. They focus on methods that could lead to cures for various neurological disorders. They are also part of the Linné Center DBRM (Developmental Biology for Regenerative

Medicine), which have become a world-leading research center in the fields of developmental biology, stem cell research and neurobiology, areas that are cornerstones for regenerative medicine.

Stem cells are cells found in almost all multi-cellular organisms. They are characterized by the ability of self-renewal by mitotic cell division and differentiation to one or more specialized cell types. There are three types of stem cells: embryonic stem cells, fetal stem cells and adult stem cells. There is also a fourth group called cancer initiating stem cells.

Ola, Ana and Anna gave us an interesting overview of the field of stem cell research and ways of using stem cell technology as medical treatment. Anna will, during her post doc, combine her knowledge in polymers to develop better methods for the stem cell culturing. She will of course also try to use the properties of the conjugated polymers that she worked with during her time at (IFM/LiU).

After lunch Peter Åsberg gave us a quick view of BioChromix's new laboratories at KI.

Daniel Kanmert and Fredrik Lysholm

Swedish Institute for Infectious Disease Control (SMI)

The Swedish Institute for Infectious Disease Control (Smittskyddsinstitutet or SMI) is a governmental expert agency founded in its present form in 1993. It has about 350 employees and is located on the campus of Karolinska Institutet in Solna, Stockholm. SMI has the mission to monitor the epidemiological situation for infectious diseases in humans, especially for diseases covered by the law of disease control. It is also responsible for promoting protection against such diseases.

SMI is divided into *six departments*:

- Bacteriology
- Epidemiology
- Immunology and Vaccinology
- Parasitology
- Mycology and Environmental Microbiology
- Virology
- Centre for Microbiological Preparedness

SMI is active in research and conducts both basal and applied research in the field of disease control, financed by external and governmental funding respectively They have collaborations with medical universities, for example Karolinska Institutet which is located just next door to SMI. Furthermore, SMI carries out special medical diagnostic test for Swedish laboratories. Our host for the visit was Tomas.

At our arrival at SMI we were welcomed and given a short introduction about the history and mission of the institute. We were thereafter escorted through many high security doors to reach the Biosafety Level 3 and 4 Laboratories (P3- and P4-labs). The P3 and P4-labs are designed for working with highly contagious bacteria and viruses, for example HIV, SARS and Antrax. The safety is rigorous and the Swedish Security Service must approve entry for all visitors entering the facilities were these labs are located. Sándor and Jonas, our guides for this part of the tour, both worked in the P4 lab. Only around 15 of the staff at SMI have the proper training to be able to work in the P4-laboratory.

After the Biosafety Laboratories, the visit continued to the Electron Microscopy section. Here, Katarina showed us different virus samples they had received for diagnostics and also a specimen of Ebola virus from a research project. During the last part of the study visit our host Tomas showed us the microbiology lab where he worked and conducted his research. Currently they were enrolled in a research project investigating a possible connection between gut flora and autism in children.

Pernilla T Eliasson and Marie Oskarsson

Silex Microsystems AB

From the outside, the Silex plant in Järfälla has a humble appearance – a low building looking no different than the neighbouring factories and workshops. There is really nothing that reveals what hides behind the walls. However, after our visit, we know about the state-of-the-art facilities within, where very small things are created on a large scale.

Goran Klenkar, who has a PhD from the Molecular Physics group at IFM and is a former Forum Scientium member, greeted us at Silex and gave an introduction to the company. Goran works as a Process Engineer, and during the few years he has worked at Silex his work tasks have mainly involved developing methods for quality control, mainly involving electrical and optical measurements.

Silex is a so-called MEMS foundry. The term is used to describe a factory that produces MicroElectroMechanical Systems (MEMS) for other companies. The MEMS are used in a broad range of devices, many with biomedical applications. An example is a pressure sensor for intravascular blood pressure measurements. The sensor has dimensions of a few millimetres but is still a fully functional device with precisely engineered components. Silex is quite successful in its field and has customers all over the world. The company has about 80 employees and about 10 hold PhDs.

The techniques used at Silex are very similar to those used to produce computer chips in the semiconductor industry. Everything starts with a wafer of silicon, glass or some other suitable material. Using photolithography and etching techniques, layers of material are then added to or removed from the wafer. After all these steps are finished, each wafer can contain thousands of individual devices produced in parallel. Silex is currently building a fabrication plant ("fab") for 8 inch wafers, to complement the 6 inch fab which is already in use. Larger wafers mean more efficient production, and effective production is what Silex is all about. To achieve this, they have well-equipped facilities with, in the eyes of us visitors at least, very impressive production equipment. Goran took us for a tour around the fabs, showing both the 6 inch facility and the new 8 inch facility. We could not enter the fabs (which are in effect clean rooms) but large windows gave a good view of what was going on inside. When the new fab is up and running, Goran will be in charge of its metrology section and he proudly showed us the new instruments, some of which had been acquired rather cheaply in the wake of the financial crisis.

After the tour and some additional information, we finished the visit and thanked Goran for his nice introduction to Silex Microsystems.

Tobias Ekblad and Stephen Macken

Eli Lilly AB

We were ten PhD students that visited the pharmaceutical company, Eli Lilly in Solna, Stockholm.

As you enter the buildings of Eli Lilly, you are astonished by the 21st century's architecture, huge glass walls filling the interior with oak board nicely framing the glasses. When entering the office at Eli Lilly we are met by the slogan "Answers that matters" which is the best way to describe Lilly's way of working; by informing the customers and collaborating doctors of the products.

At Eli Lilly we were welcomed by Harriet Nilsson, who has been working for Eli Lilly since 2001. By curiosity, Harriet Nilsson did her dissertation in 2001 at the Faculty of Health Sciences in Linköping and during her time as a PhD student was a member of Forum Scientium. Harriet is employed as Scientific Communication Associate but also as a medical writer. Even though spending many inspiring hours in the laboratory as a PhD, Harriet was eager to leave the laboratory and was challenged to join the team at Eli Lilly as a medical writer. During her talk we were introduced to the world of clinical trials and were given an overview of the different steps needed before releasing a product on the market.

Eli Lilly has its head office in Indianapolis, US but was actually founded by a Swedish descendant, Elias Liljas in the 19th century. Today, sites are found in US, Sweden, Denmark and Norway. Eli Lilly's main drug areas are CNS, Endocrinology, Cardiology, Osteoporosis, Urology and Oncology.

At the site in Solna, there is no laboratories as the main focus is clinical trials. During the visit we also met other employees at Eli Lilly such as Harriet's boss, Sofia Brodin, who works as a Clinical Research Associate, CRA. Sofia's presentation was very inspiring on how you can get a career within the company. Many people start as product specialists to work their way up to other positions within the company.

After enjoying a nice cup of coffee and cardamom bun, Harriet presented more into detail her work as a medical writer. In her position she is responsible for the information shared to people working within the clinical field such as; scientific medical doctors, statistics, authority, customers and public. Despite leaving the academic world in the early 21st century, Harriet still joins conferences and writes articles, and she seems to enjoy her work a lot.

The study visit at Eli Lilly inspired us greatly and gave us the opportunity to meet the people working within the industrial field of pharmaceutics.

Hanna Björck and Patricia Wennerstrand

Nobel Museum

After some troubles with the rush hour traffic in Stockholm this Friday afternoon we found our accommodation at the youth hostel Skeppsholmen (one of us even got an extremely nice single room at the old sailing ship Af Chapman).

A ten minute walk later we were at the Nobel Museum

located next to the Royal Castle in Gamla Stan (Old Town). There we were welcomed by a skilled guide introducing us to the creativity behind some of the Nobel Prizes.

Courage to think on entirely new lines, daring to question established theories, innovative combinations of insights from the different fields – these are some of the characteristics of creativity.

We got examples of individuals like Linus Pauling, who got the Nobel Prize twice, 1954 in Chemistry and 1962 the Peace Prize, and Frederick Sanger, who also got the Nobel Prize twice, 1958 and 1980, both in Chemistry. We also got examples of successful milieus like Cambridge in the UK and Cold Spring Harbour, US. We all concluded that we preferred the positive academic milieu in Cambridge.

Dinner with Former Scientium

Finally we continued to build our network by having a dinner together with some former Forum Scientium members.

The Former Scientium members participating in our inspiring study visit to Stockholm were:

- Harriet Nilsson, Eli Lilly AB, Sth
- Goran Klenkar, Silex Microsystems AB, Sth
- Peter Åsberg, BioChromix AB, Sth
- Andreas Larsson, LingVitae AB, Sth
- Charlotte Immerstrand, Upper Secondary Teacher, Mjölby
- Tobias Nyberg, Division of Neuronic Engineering, KTH
- Per Spångéus, Consultant, Sth
- Elisabeth Hallin, SMI, Sth

and

- Per Björk, Acreo AB, Sth
  (He is further presented below.)

During this study visit we did not have time enough to meet Former Scientium members:

- Martin Testorf, Scientific Editor, Swedish Museum of Natural History, Stockholm
- Anna Hermansson, Patent Attorney, Bergenstråhle & Lindvall, Stockholm

This will be done in the near future.

Interdisciplinary Post doc – Per Björk

With a master's exam in Engineering Biology and a PhD in Biomolecular and Organic Electronics, I have always stayed in the border between physics and biology. This was also the reason why I in December 2007 got a two year Post doc position divided 50/50 between Acreo and Karolinska institutet within the European project EuroHear. After running the project for a while, they came to the conclusion that they needed someone that could function as a link and communicate with both the physicists at Acreo and biologists at Clinical Neuroscience. And who could be better suited for this than a Former Scientium?

The research project is focused on developing new platforms for understanding the functions of the inner ear and especially on how regeneration of nerve communication possibly can be achieved after hearing impairments. We use two main approaches. The first is to develop a miniaturized in vitro cell culture chamber in PDMS mimicking the inner ear, where we can do co-cultures of embryonic inner ear neurons and target cells in separated compartments interconnected via micro channels. This allows us to evaluate communication processes and appropriate growth conditions relevant for a therapeutic transplantation situation. The second approach is to chemically pattern surfaces with proteins in the micro regime that confines Schwann cells to specific tracks. This should in term function as a feeder layer for regenerative outgrowth of axons from existing neurons in the inner ear to restore degraded commutation pathways. Practically, I take part in the design and fabrication of the cell culture chamber and the stamps used fore micro patterning in the clean room at Acreo. Then I bring the structures to KI where I prepare the chambers and make the surface patterning, and finally I take part in the curling and evaluation process.

The multidisciplinary focus in Forum Scientium has been a great way to prepare me for my current situation. The knowledge of how to talk to scientist with different backgrounds is more and more asked for and the last years accelerated speed of the collaboration between Acreo and Clinical Neuroscience shows the importance of this. I have also regular contacts with people that were involved in Forum at the same time as me, and we have continuous discussion about possible joint research projects.