Forum Scientium

INFOrum Scientium

Study visits to Edinburgh, Glasgow & Dundee

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The graduate school Forum Scientium at Linköping University, Sweden, has as one part of its responsibilities to stimulate the PhD students career planning as early as possible. One way that this is done is through study visits to research-intensive companies and to research departments at various universities. During the visits, we try to meet senior persons within research and development, as well as persons who recently made the transition from being a PhD student to becoming a professional. The network of earlier Forum members, the so-called Former Scientium, and the PhD student's supervisors are valuable when arranging the study visits and contributes to the high quality of the visits. 20-22 May 2015, Forum Scientium members Theresia Arbring Sjöström and Peter Eriksson, arranged an intensive study visit with an impressive program to Edinburgh, Glasgow and Dundee.

Institute for Bioengineering (IBioE), University of Edinburgh

Our Scottish study visit started at the University of Edinburgh where we visited the Institution for Bioengineering (IBioE) at the School of Engineering. At arrival we were very well taken care of and welcomed by Sue Simpson and Julia Eighteen. The Institute for Bioengineering is a vibrant institute and houses varied group whose interests are in the three key areas, medical diagnostics and biosensors, assistive technology for stem cell medicine and synthetic biology, and industrial biotechnology. Their aim is to do research on and develop innovative diagnostic, therapeutic and real-time monitoring biomedical devices and technologies.

Discussions at IBioE

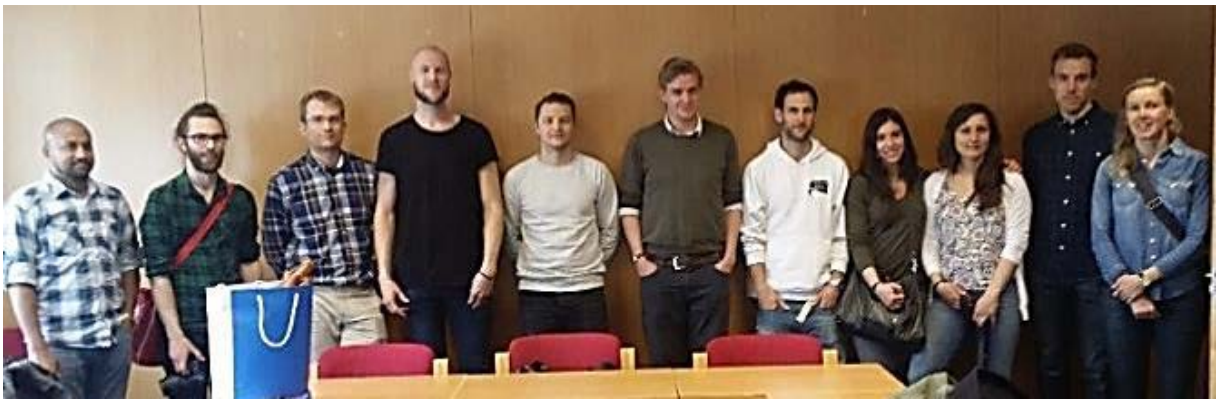
Presentations at IBioE

At our visit we began with a tour around the department, looking at the laboratories and research equipment but also getting an insight in their current research projects. We also got the opportunity to talk with PhD students and post docs from Dr. Pankaj and Dr. Callanan's groups during the whole study visit, which gave us the chance to discuss projects and ideas, and also potential collaborations. The discussions also gave us a better insight into the life as a post doc at the Institution for Bioengineering, which was interesting for possible future career steps. The visit was rounded up with a nice pizza seminar where Alina Sekretaryova, Fredrik Bäcklund and Lía Fernandéz del Rio from Forum Scientium gave presentations.

/Emina Vorkapic & Andrey Höglund

Scottish Microelectronics Centre (SMC), University of Edinburgh

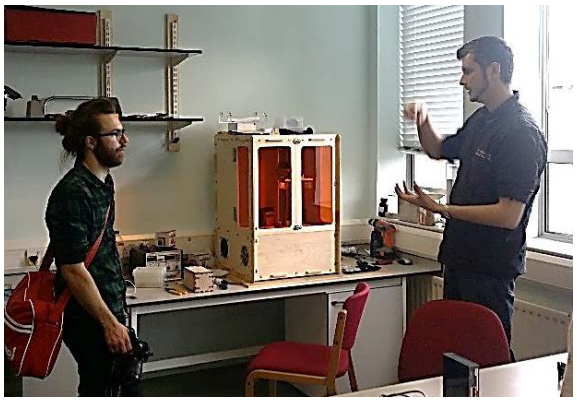
After the presentations at the Institute of Bioengineering Sue Simpson took all of us to the Scottish Microelectronics Centre (SMC) for tours of the cleanrooms and the FabLab. We were introduced to the Head of Soft Systems Group (SMC) and the Director of The University of Edinburgh FabLab Dr. Adam A. Stokes and his FabLab Manager Constantine Talalaev. They introduced us to the facility and we got an overview of the work going on at SMC. The SMC has a significant commercial turnover and is recognized as a leading centre for research and development with a number of companies located within the Centre.



Dr. Adam A. Stokes with Forum Members

Dr. Adam A. Stokes then took us on a tour to the clean room facility and Constantine Talalaev guided us through the FabLab. The clean rooms were of different capacity ranging from class 1 to 10. These rooms are available for academic as well as industrial researchers and are well equipped with all the latest instruments and tools to handle very fine materials and chips, and we saw some of the microelectronics and chips made at these cleanrooms.

At the FabLab Constantine Talalaev showed us the 3D printers and some of the soft material items printed there. He also showed us the laser cutter, robotic arm and tools to handle the items made by printers. He showed us commercial as well as homemade 3D printers.



Constantine Talalaev explaining homemade 3D printers

/Meenu Rajan & Ankit S. Macwan

Wellcome Trust Center for Cell Biology, University of Edinburgh

On Thursday the 21st part of the group had the opportunity to visit WTCCB, one of the eight centers in United Kingdom funded by the Wellcome Trust. The Wellcome trust foundation is a global charitable foundation dedicated to improve health by supporting bright minds in science, the humanities and social sciences, and public engagement. We were fifteen FS members mainly working within Biological Science visiting this resourceful institution in the Kings building's campus of University of Edinburgh. The visit was well structured by three sessions; introductory speeches by the Director Prof. David Trollervey, short presentations by two postdoctoral fellows at WTCCB and last but not least, laboratory visits. During the introductory session we were provided with a very informative booklet that gave us knowledge about the institution starting from the history of foundation to the core of the research done by them. In his introductory speech Prof. David Trollervey wanted us to really consider the opportunities and benefits for us to do our future research with them. Their focal themes of research are mainly cell structure machineries, cell division, epigenetics, RNA splicing and proteomics.

At the center there are 19 research groups that under renowned principal investigators are conducting their specific research. Approximately half of the center works on cellular machinery (cell division mainly) and little less than the other half works on RNA-biology with epigenetics spanning both areas. They try to recruit successful scientists that fit their themes, and then providing them with techniques and methods so that they can do their best to develop their science. The researchers are encouraged to do both experiments and analysis by themselves but with support from e.g. bioinformaticians.

PhD students from Linköping University might have excellent opportunities to communicate with PIs directly to start their postdoctoral research. Those who are interested can ask to borrow the provided booklet or visit their webpage.

The second session was more specific with research talks from two postdocs, Rebecca Holm and Manuel Shukla. Rebecca's research was about "RNA packaging linked to transcription termination" and Manuel's about "Nucleosome dynamics at fission yeast centromeres". They also told us a little about how they went from their PhDs to ending up at WTCCB. The talks were very constructive and many of our FS fellows brought up interesting questions. Over some coffee and tea with tasty biscuits we were able to continue the discussions with some of the post-doctoral fellows and PhD students.

Professor David Trollervey

Greg Andersson, the lab manager for the facility and Lis Blackburn later showed us the protein production facilities (EPPF) where they e.g. produce proteins for over

100 PIs at the university. David Kelly showed us their microscopy facility (COIL) where they among the commonly known confocal and spinning disk microscopes had a "home-made" epifluorescence microscope able to do aberration corrected multifocus microscopy. That is basically a method for high resolution 3D imaging in multiple colours without sequential z scanning (!) developed by (among others) Swedish Sara Abrahamsson (see Nature methods, 2013). Unfortunately we did not have time to stay and play though.

We really enjoyed our short but informative visit and it was interesting to see a center focused on fundamental cell biology. As it was discussed briefly at the visit; there is no shortcut to make your research relevant, there is no easy way so we need the basic knowledge on how our cells work so that we have a platform to build the translational research on.

We thank WTCCB for a very pleasant study visit.

/Angelika Holm & Mohammad Atikuzzaman

Department of Pure and Applied Chemistry, University of Strathclyde, Glasgow

On Thursday morning ten members of Forum Scientium got on a train from Edinburg to Glasgow. In Glasgow, we went to the University of Strathclyde, Pure and applied chemistry, to meet up with Professor Peter Cormack. Prof. Cormack brought the entire group to a conference room at the highest level of the building, which had a great view over the city.

Professor Peter Cormack and Forum Scientium visitors

Prof. Cormack welcomed us with some coffee and biscuits, and started to give an overview of the University of Strathclyde and his research interest. Prof. Cormack and his group are focused on synthesis and use of functional organic materials, molecularly imprinted polymers, microporous solids**,** functionalized polymer microspheres**,** branched polymers**,** and self-assembling systems.

After this interesting information, Charlotte Immerstrand gave a presentation about Forum Scientium in general and some information about Linköping University. When Charlotte finished her presentation it was time for presentations from members in Forum Scientium and a PhD student in Prof. Cormack´s group. Nadia Ajjan presented her work about "Energy conversion and storage using renewable biopolymer conducting polymer" and Onur Parlak presented his work about "Design and development of novel auto-switchable nanobioreactors that are capable of positively responding". When all presentations were finished, we got a quick tour around the lab, before we had to leave for our next visit.

On behalf of Forum Scientium, we want to thank Prof. Peter Cormack for his hospitality and a very interesting session.

/ Andreas Skallberg

Biomedical Engineering, University of Glasgow

Arriving at the Glasgow University campus, we were greeted by Professor Jonathan Cooper. Professor Cooper was formerly head of Biomedical engineering division and today he has the overall responsibility of the Glasgow University's Knowledge Exchange strategy and policies.

After a very inspiring introduction of the University's history, two very friendly students picked us up for a guided tour of the venerable campus. Among many things we had the opportunity to see the intriguing collection of the Hunterian museum, Macintosh architecture at the campus, their new massive library building and also get a glimpse of the Glasgow University's impressive examination hall.

University of Glasgow Campus

Following the campus tour, we visited ModeDX, which is an academic spin-out company of which Professor Cooper was the academic founder. Dr. Li Chen, one of the research scientists at ModeDX, took care of us and introduced us to the company's product, a medical self-diagnosis device for screening bowel cancer and told us the story from starting up ModeDX until now when their first product recently reached the market with very promising results.

Thereafter Dr. Rab Wilson gave us a tour of their clean room facilities, and honoured us with a crash course in how phononic crystals can be used to manipulate micro fluids with acoustic waves. The facility is a crucial component enabling their current research at the division, with an emphasis on Lab-On-a-Chip techniques. Finally, Dr. Andrew Glidle guided us through the facilities of the division. Particularly refreshing was the acceptance for tinkering with laboratory equipment, allowing new ideas to be born and tested. This seemed to be true on many locations during our visit to Scotland, and Glasgow was no exception!

/Robert Pilstål

Imaging Facility, University of Dundee

After leaving Edinburgh Friday morning by bus, we arrived at University of Dundee and were warmly welcomed by Dr. Daniel Melling and Ms Sarah Hussain in the entrance hall of the beautiful brand new building of College of Life Sciences.

Daniel Melling

We were first served delicious espresso coffees, a group photo was taken outside the building and we were thereafter introduced to the Imaging Facility by Dr Sam Swift and Dr Paul Appleton.

It was very inspiring to hear about the function of this facility, as an interdisciplinary technology resource within physical, life and medical sciences. Dr. Swift also talked about the enormous opportunities within the research of biological microscopy and the ambition of this new facility to deliver but also develop the fast evolving technology of imaging to match the demands of solving valuable medical and biological problems. This would be a scientific service supporting and facilitating research projects not only within the University of Dundee but also for users countrywide. We were given an impressive tour throughout the facility, which comprises the latest technologies such as Advanced Light Microscopy, Super Resolution and Fluorescence Lifetime Imaging, Non Optical Imaging and Tissue Imaging. The visit was very exciting and well planned and the time passed very quickly.

/Amanda Nordigården

Outside College of Life Sciences, University of Dundee

Drug Discovery Unit (DDU), University of Dundee

The Drug Discovery Unit (DDU) at the College of Life Sciences was one of the stops during the day in Dundee. The DDU started in 2006 with the aim to bring academic scientific research and commercial drug discovery and development closer together. We met the team leader Dr. Manu De Rycker and he guided us through the lab telling us about their research to discover drugs against diseases for the developing world such as sleeping sickness and malaria. DDU focuses on neglected diseases that the pharmaceutical companies often do not consider to do research on.

The work at DDU is highly automated. Substances from a library consisting of hundreds of thousands of substances are screened against a target, for instance a parasite. Substances showing effect in the initial screen are further studied in several additional assays in the laboratory. Until today, a handful of substances discovered at DDU have moved further into mouse studies.

/Anna Svedberg

Fingerprints Proteomics Facility, University of Dundee

We were given a tour at the Fingerprints Proteomics facility by the very enthusiastic facility manager Dougie Lamont. The first points he made were that they are a core service lab for everyone, and that their field of expertise is quantitative proteomics. The University has invested heavily in this facility last year spending 5 million £ on new equipment. The facility has 21 Mass

spectrometers on one floor and ten of these are brand new Orbitraps from Thermo Scientific. They need this high amount of equipment in order to fulfil their goals of high throughput core services, which include protein identification, characterization and quantification. They also perform chemical and heavy labelling in order to Multiplex the samples, and this means that they can reduce throughput time and easily scale up if they are working with a complicated experiment.

Dougie Lamont (left)

The overall aim of the facility is to have as high productivity as possible; this could be seen in every aspect of their work, all the way from sample preparation to analysis of the results. Everything was designed to be as efficient as possible, the mass spectrometers themselves were a new type of Orbitarp Fusion instrument with variable geometry to give them a wider range of use. These systems can identify up to 5000 proteins per injection. This is achieved by using 50 cm columns running at 500 bar at a higher temperature compared to regular MS. Another step taken to increase productivity is to use a tandem injection system, which allows the cleaning to be performed off line while the instrument is running. They also closely monitor the intensity that each instrument operates at, if it goes below 40 % the results will be affected and fewer proteins will be identified.

Each sample that arrives at the facility undergoes extensive quality control, such as detergents and polymer detection. A fraction of the sample is then tested on an older machine to ensure that it runs smoothly in order to avoid bad samples taking down the entire line. The samples are then labelled and in order to avoid overloading the MS the samples are fractioned into 20 portions using pH 10 reversal. The facility receives around 70 % of its work assignments internally from various groups at University of Dundee, the remaining 30 % is external work from around the globe.

Division of Signal Transduction Therapy, University of Dundee

The division is funded by six pharmaceutical companies (AstraZeneca, Boehringer Ingelheim, GlaxoSmithKline, Janssen, Pharmaceutica, Merck Serono and Pfizer). We were guided by Dr James Hastie and by Dr Hilary McLauchlan. They gave a very good presentation of how the division functions as a bridge between the pharmaceutical industry and academia. Currently they are focusing on mammalian kinase and ubiquitinylation systems, with the aim to find new targets for drugs. In the labs they can produce large amounts of antibodies and clones and they can also produce large quantities of recombinant proteins using a 120 liter *E-coli* fermentor. They also have a smaller parallel system set up for using 6F cells.

/Parmis Sepanloo

Institute of Medical Science and Technology (IMSaT), University of Dundee

The Institute of Medical Science and Technology (IMSAT) is an interdisciplinary institute founded in 2006 by a joint initiative of University of Dundee and University of St. Andrews dealing with future Medical technologies. The visit to IMSAT was divided in two parts, laboratory visits and presentations.

IMSaT possesses a vast state of the art MRI facility including the 1.5 Tesla MRI suite. Exciting research is being done on Thiel embalmed human cadavers as a simulator for MRI-guided interventional procedures. The lab have developed protocols for perfusion and breathing motion in these cadavers to facilitate training and education of highly specialized surgeries. One of the techniques under development used the MRI imaging to direct focused ultrasound on liver tumours.

We were welcomed to IMSaT by Ghulam Nabi, Head of Division for Medical Science and Technology in the School of Medicine.

Presentations by researchers at IMSaT:

Dr. Daniel Melling is Post-Doctoral Research Assistant at the Surgical Technology and Robotics division in IMSaT and his field of specialization is nano molecularly imprinted polymers (NanoMIP's) for use in medical diagnostic, imaging and therapeutics; polymer actuators systems for surgical devices and hydrogel composites to promote healing of chronic wounds. Daniel discussed the medical applications of NanoMIP's in diagnosis, imaging and therapeutics. The NanoMIP's have been used to develop assays that detect vancomycin far better than the traditional competitor assays and were synthesized by imprinting vancomycin on MIP nanoparticles.

Dr. Vittoria Raffa is Associate Professor in Molecular Biology at the Nano-Biology division. She talked about the role of force and mechanical stretching in nerve growth and regeneration and the use of magnetic nanoparticles (MNPs) as a tool to explore these basic mechanisms. Two models of nerve axonal growth were discussed, the tip growth model and stretch growth model, both of which can be divided into initial state, protrusion, engorgement and consolidation. Sutter *et. al.* in 2011 states that the latter model differs in that the growth cone is not being assembled at the edge and disassembled at the neck, instead the entire growth cone advances as a coherent unit. Then she discussed about MNP as a new tool to stretch axons. This clearly exhibited how nanoscience can help provide new solutions for non-invasive therapies on damaged tissues and the final goal being regeneration and restoration of physiological and motor functions.

Dr. Cecilia Tapia is Post-Doctoral Research Assistant at the Surgical Technology and Robotics Group and she presented Robotic locomotion, modelling and control in colonic disease investigation by robotic hydro-colonoscopy. The idea of a robotic

hydro-colonoscopy is to replace the traditional flexible colonoscope with a robotic one for the inspection of the mucosal surface of colon and the use of water instead of the traditional air insufflation, leading to less pain and inconvenience for the patient. The ultimate aim of this project is to design the system so that it would help early diagnosis of the second most common cancer by increasing patient compliance for screening.

Dr. Paul Prentice is the team leader of Cavitation research division at IMSaT. His research is focused on understanding, controlling and manipulating acoustic cavitation to redefine focused ultrasound surgery from the current thermal ablation. He talked about violent cavitation being a high risk of damage to the healthy tissue proximal to the diseased tissue. The project, TheraCav aims to address this issue making cavitation more controllable during focused ultrasound surgery for destroying targeted tissue and help in drug delivery to the affected part.

Dr. William Lewinger is Post-Doctoral Research Assistant in Surgical Technology and Robotics at IMSaT. His research is based on developing a controllable motility method for driving and positioning capsule endoscopy devices in the intestinal system. He discussed how biology has inspired the field of robotics especially in locomotion. The project SONOPILL is dedicated to develop a robotic capsule endoscope for diagnosis and targeted drug delivery.

Dr. Luigi Manfredi is Senior Post-Doctoral Research Assistant in the same division, Surgical Technology and Robotics. He discussed two projects, CODIR (Colonic Disease Investigation by Robot Hydro-colonoscopy) and CARPE (Compliant Actuation Robotic Platform for Interventional Flexible Endoscopy). One of the aims with these projects is to make the procedures more patient friendly.

We found the Institute of Medical Science and Technology an unparalleled platform for innovation and development incorporating academic and industrial partners.

The last day for the visit was packed with exciting events and venues.

Later during the evening, several staff from the departments we had visited joined us for dinner at a wonderful South Indian restaurant called Rishi's where everyone got an opportunity to kindle their palates.

/Jacob Kuruvilla & Jesper Fogelholm