



Issue 2, July 2015

Newsletter



PARALLEL SENSING OF PROSTATE CANCER BIOMARKERS PROSENSE

Dear colleagues and other interested parties,

Susana Liébana Girona and Pawan Jolly, as editors of the PROSENSE newsletter would like to introduce the second issue of the PROSENSE newsletter. We would like to thank everyone from the PROSENSE team for their inputs to the first PROSENSE newsletter from which, we had great feedback from everyone.

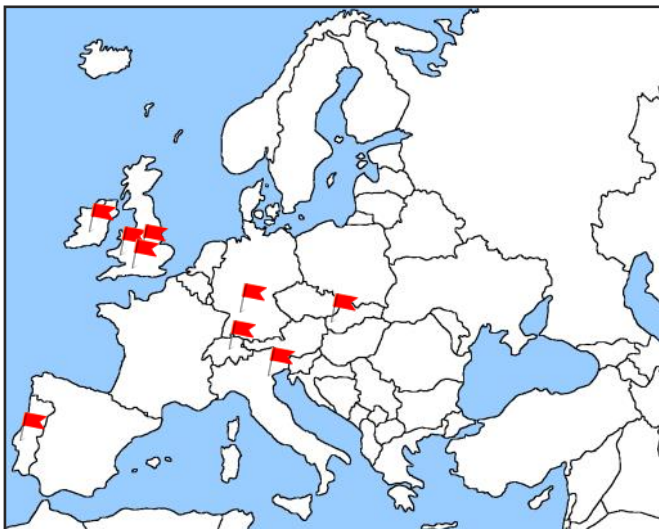
Indeed its because of inputs from both the ERs and ESRs, that we are able to provide this next issue. Last but not the least, we would like to thank the supervisors as this would have not been possible without the constant support and cooperation from the supervisors involved in the projects across PROSENSE.

Current issue will give more in depth to Fellows' work, which not only relates to their independent research, but also to other extracurricular activities. The newsletter will introduce the two new Fellows that joined the PROSENSE team recently and will highlight various secondment experiences from the Fellows in different institutions across the network. The newsletter also draws light on the active participation of the Fellows in different activities from attending conferences to outreach activities.

We hope everyone reading the second issue of PROSENSE newsletter will enjoy and show interest as much as we enjoyed executing it again!

“Research is to see what everybody else has seen, and to think what nobody else has thought “

— Marie Curie



PROSENSE Fellows network coverage

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Welcome to new PROSENSE Fellows

ER: Dr. Katarzyna Koczula



Katarzyna (Kate) is a new Experienced Researcher (ER) who joined Xeptagen in June 2015. After finishing her master degree in Medical Biotechnology in Wroclaw (Poland), she was working on her PhD in Cancer Sciences in Birmingham (UK). During her doctorate she invented the novel method for measuring metabolic alternations in living cancer cells in real time, using NMR spectroscopy. Her studies were mainly conducted on primary CLL (Chronic Lymphocytic Leukaemia) cells. The main discovery was the identification of metabolic shift in

CLL cells as they transit between normoxic and hypoxic conditions, which represents a potential therapeutic target for this disease. After completing her PhD, Kate was working as an R&D Project Manager in the Bone Therapeutics company in Brussels (Belgium). Her project involved investigating of anti-inflammatory properties of stem cells. Kate's role in Xeptagen will be developing the Lateral Flow Immunoassay with the ultimate goal of creating the easy to use, portable prostate cancer device.

ESR: Mr. Pavel Zhurauski

Pavel Zhurauski is a new Early Stage Researcher who joined the University of Bath in March 2015. He finished his master studies in biomedical engineering from the University of Rome, Italy. Pavel also completed his master thesis project from the same University in the nanotechnologic lab of the electronic engineering department. The master project focused on development of an optical filter for the detection of ochratoxin A for medical applications. In this project Pavel worked on amorphous silicon semiconductors where he developed conductor patterns for photodiodes and worked with different characterization techniques and manufacturing systems commonly used in the thin film integrated structures. Pavel's current work is based on the development of Electrochemical Localised Surface Plasmon Resonance (E-LSPR) for detection of novel prostate cancer biomarkers. Pavel will focus on the development of transmission mode of LSPR technique using gold-nanoparticles and biotinylated peptide specific to prostate specific antigen (PSA) and how that could be integrated with electrochemical sensors.



Past events

1. The PROSENSE workshop on "Biosensor commercialisation" took place in Cardiff/Pontypool, UK on the 14th to 16th January 2015. It included an insight to screen printed electrodes manufacture both at theoretical and practical level.

2. The PROSENSE Summer School "Clinical perspectives and commercial forces on biosensor devices" took place in Bath, UK on the 15th to 19th September 2014. This event included a 2-day workshop on "Clinical perspectives and commercial forces on biosensor devices" open to the public (17-18th September 2014), as well as a "Public engagement and science writing" workshop for the PROSENSE Fellows.

3. The PROSENSE Workshop "Application of lectins in various format of analysis for glycoprofiling" took place in Bratislava, Slovakia on the 23rd January 2014.

4. The PROSENSE Workshop on "The production and application of antibodies and their use in biosensors and arrays" took place in Dublin, Ireland on the 2nd and 3rd July 2013.

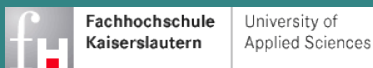


Fellows group in Pontypool, UK



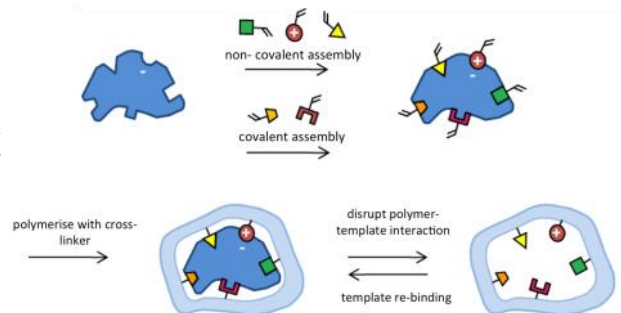
Secondments

As part of Marie Curie fellowship I spent two months in University of Bath for a secondment. I worked on various collaborative projects with Pawan Jolly. I was trained in electrochemistry and automated peptide synthesis during my lab rotation. I had a great time exploring the beautiful city and making new friends. I also spent a week in Germany learning different techniques like Scanning Electron Microscopy and Atomic Force Microscopy. We were also introduced to clean room facilities for device fabrication. I worked on some of the devices developed by the partner lab in Germany to come up with ideas for new collaborative projects.



Who is Vibha Tamboli?

My name is Vibha Tamboli and I have completed two years as Marie Curie ESR Fellow in PROSENSE. I completed my undergraduate degree in biochemical engineering in India. After that I moved to US for completing my Masters at Northwestern University. I also worked in a start-up, which fuelled my interest in biosensor development and motivated me to do a PhD in an allied field.



My research focuses on the development of artificial antibodies also called Molecularly Imprinted Polymer (MIPs) for prostate cancer (PCa) biomarkers. Antibodies are the most widely used biomolecules for protein recognition in any biological assay or biosensor and are designed in body to work with high affinity and selectivity towards their target. In an attempt to mimic nature, molecular imprinting is a technology that designs synthetic or artificial receptors much like antibodies to biomolecules. The technique is similar to making a plastic mould of an object of interest. In molecular imprinting functional polymerisable monomers are allowed to interact with the template and these interactions are locked in place by cross-linkers in presence of ultraviolet (UV) rays and heat. After the polymer is formed the template is extracted and what remains is cavity with shape and chemical selectivity towards the template. An understandable question is why develop artificial receptors when antibodies work so well. The answer is simple, antibodies are not stable over time at room temperature and are difficult to engineer on to sensor devices. MIPs overcome these issues as they are more robust and also less costly to produce.

Last summer I worked on a collaborative project with Pawan Jolly at the University of Bath where different approach was used for developing a MIP sensor for prostate specific antigen (PSA) which is a biomarker for PCa. DNA aptamers with established affinity for PSA were combined with molecularly imprinted polymer to develop a highly sensitive electrochemical sensor. The sensor was sensitive down to 1 pg/mL and also displayed good selectivity when challenged with other proteins. The paper is being submitted for peer review for publishing in scientific journal.

In my project we aim to make more such collaboration for the use of these synthetic receptors on various other devices for development of novel detection techniques.





4th International Conference on Bio-sensing Technology, Lisbon

Taking over 4th International Conference on Bio-sensing Technology, Lisbon

Once again, PROSENSE had been stealing places at international conferences. This time it was at the 4th International Conference on Bio-sensing Technology celebrated in May 2015, Lisbon, Portugal. Among nearly 300 posters from the bio-sensing field, Pavel Damborsky was awarded 3rd best poster on the work entitled "Lectin-based glycoprofiling of prostate specific antigen using SPR and microfluidics". This is a great achievement for the whole PROSENSE.

Furthermore, three more PROSENSE Fellows (Pawan Jolly, Vibha Tamboli and Susana Liébana) presented their research through oral and poster presentations at the conference. The Bio-Sensing Conference brought together leaders from industry and academia to exchange and share their experiences, results, and to spark new ideas, with the aim of developing new projects and exploiting new technology for bio-sensing applications. The conference focused on the different topics concerning bio-sensing such as Novel biomarkers, Biosensor surfaces, Novel detection technologies, Instrumentation & Integration and Commercialisation & Impact. PROSENSE Fellows attracted a lot of professionals from biosensing background. The interaction was interesting and fruitful leading to new ideas in terms of how the technology can be applied in clinical research.

ICREA workshop on Graphene Nanobiosensors



ICREA workshop, Barcelona

One of our Fellows, Ling Xu from the University of Applied Sciences Kaiserslautern, Germany, participated in the workshop organized by *Institut Català de Nanociència i Nanotecnologia* (ICN2 – Catalan Institute of Nanoscience and Nanotechnology) recently accredited as a Severo Ochoa Excellence Research Center, in the city of Barcelona, Spain. The aim of this workshop was to integrate graphene or reduced graphene oxide into innovative (bio)sensing systems which will lead to high sensitive, high selective and cost-effective analysis and monitoring in fields like medicine, environment, security and other industries. The poster 'Reduced graphene-oxide based biosensor platform' was presented. It was an inspiring event to bridge the academic network with the associates and comprehend this field more extensively.

Participation in Label-Free Technologies Cambridge, MA



Label-Free Technologies, Cambridge, MA

On the dates of 12-14 March 2015, two PROSENSE Fellows, Vibha Tamboli and Stefan Belicky, participated in the 2nd International Conference on Label-Free Technologies held in conference facilities of Boston Marriott Cambridge, MA, USA. This conference was focused on the latest advances and applications of label-free technology in life sciences and drug discovery. Two posters were presented aiming to promote the use of Molecular Imprinted Polymers (MIPs) and the important role of glycans in living systems and the possibility of employing glycan analysis in development of new diagnostic methods. It was truly a great experience for both fellows, visiting such a place as Cambridge in USA, one of the most important scientific and technological centers in the world, with Universities as Harvard or Massachusetts Institute of Technology (MIT) was very inspirational for both of them.

Paper published in Sensors and Actuators B

More from collaborations

•Pavel Damborsky is a co-author of a paper from the Department of Glycobiotechnology, Institute of Chemistry SAS. The paper is focused on glycan biosensor for detection of lectins and influenza hemagglutinins.

•Susana Liébana is a co-author of two papers in collaboration with the Sensors and Biosensors Group, at Universitat Autònoma de Barcelona. Both papers are related to the use of the magnetic particles on food-borne pathogens detection.

•Katarzyna Koczula is a co-author of a publication related to her previous research in cancer metabolism field at University of Birmingham. The publication is about investigating the mechanism of action of combination of redeployed drugs in leukaemic cells.

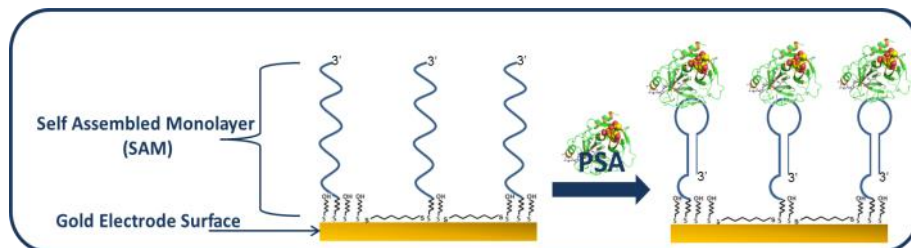


UNIVERSITY OF
BIRMINGHAM



UNIVERSITY OF
BATH

A new paper on “Optimisation of an Electrochemical Impedance Spectroscopy aptasensor by exploiting Quartz Crystal Microbalance with Dissipation Signals” with Pawan Jolly as a co-author.



The paper is based on the optimisation of the surface density of DNA aptamers specific for prostate specific antigen (PSA) on the surface of gold electrodes. DNA aptamers are an alternative to antibodies which are single stranded DNA that can bind to its target with high affinity and specificity by undergoing conformational changes. The study was performed to optimize the surface density of these aptamers on gold electrodes in order to have maximum binding in terms of signal change. The response of an Electrochemical Impedance Spectroscopy (EIS) sensor using DNA aptamers is affected by many factors such as DNA density, charge and conformational changes upon DNA-target binding and buffer conditions. It is reported for the first time the optimisation of an EIS aptamer-based sensor by using Quartz Crystal Microbalance with Dissipation mode (QCM-D). PSA detection was achieved by functionalizing the gold sensor surface via thiol chemistry with different ratios of thiolated-DNA aptamer and 6-mercapto-1-hexanol (MCH) used as spacer molecules. PSA binding efficiency can be monitored by measuring QCM-D signals which not only provides information about the mass of PSA bound on the sensor surface but also crucial information about the aptamer conformation and layer hydration.

Data generated through QCM-D analysis provided the optimal conditions in terms of aptamer/MCH ratio to maximize the PSA binding. The ratio of 1:200 for DNA aptamer/spacer molecule was found to be optimal to ensuring maximum PSA binding. However, this study showed how a maximum analyte binding does not necessarily correspond to a maximum EIS response, which revealed to be enhanced if a ratio of 1:100 for DNA aptamer/spacer molecule was used. Moreover, by monitoring the QCM-D signal, for the first time a value of the dissociation constant (K_d), equal to 37 nM, was found for the PSA DNA aptamer towards its target. The combination of QCM-D with EIS techniques provide further insight into the effects of mass loading and charge effects that govern the response of an EIS aptasensor, serving as a valuable support for future EIS aptamer-based applications.

Full papers available at:

- ⇒ <http://www.sciencedirect.com/science/article/pii/S0925400515006681>
- ⇒ <http://pubs.rsc.org/en/Content/ArticleLanding/2015/CC/C5CC00922G#divAbstract>
- ⇒ <http://cancerres.aacrjournals.org/content/75/12/2530.long>
- ⇒ <http://www.sciencedirect.com/science/article/pii/S0039914015003999>
- ⇒ <http://www.sciencedirect.com/science/article/pii/S1871678415000539>

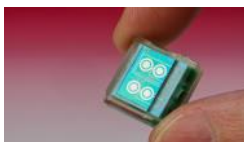
Grant award and Collaborations: Mr. Pawan Jolly



Hot Seat: Dr. Sandro Carrara

“Knowing the precise and real-time effect of drugs on the metabolism is one of the keys to the type of personalised, precision medicine that we are striving for,” -Said Dr Carrara.

Dr. Carrara group in *École Polytechnique Fédérale de Lausanne* unveiled their latest development on 27.05.15 at the International Symposium on



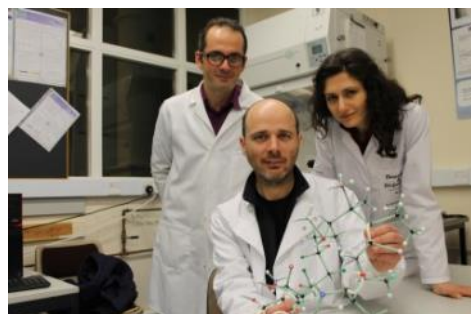
Circuits and Systems in Lisbon, Portugal. The group developed the world's first chip about a centimeter long, that can be placed under the skin. It is capable of not only measuring pH and temperature, but also metabolism related molecules like glucose, lactate and cholesterol, as well as drugs.

Read more: <http://actu.epfl.ch/news/a-chip-placed-under-the-skin-for-more-precise-medi/>

Pawan Jolly was awarded a Cancer Research at Bath (CR@B) Seedcorn Grant for the project "An electrochemical biosensor platform for the sensitive detection of miRNAs specific for prostate cancer" in collaboration with Dr. Pedro Estrela and Prof. Mark Lindsay (Department of Pharmacy & Pharmacology, University of Bath). The award is a great achievement for Pawan Jolly as a principal applicant to show both responsibility and management duties. This will indeed prove to be helpful in both his personal and professional development.

Pawan Jolly with Dr. Pedro Estrela also collaborated with Prof. Lin-Chi Chen and his PhD student Deng-Kai Yang from National Taiwan University - Department of Bio-Industrial Mechatronics Engineering. They work together on aptamer based detection of alpha-methylacyl-CoA racemase protein (AMACR), a biomarker for prostate cancer.

It was indeed a great honour and success for not only Pawan Jolly, but for entire PROSENSE team, to work beyond PROSENSE network in order to fulfil the requirements of the project and its respective progress.



Dr. Pedro Estrela

-PhosphoSense technology

“New technology could speed up life-saving drug discoveries”

Dr. Pedro Estrela and group has developed a revolutionary new biochip device

that will lead to a faster and more cost effective way of discovering new life-saving drugs. The 'PhosphoSense' technology screens compounds for use in drugs and has produced a new way of detecting the activity of enzymes called kinases. In normal healthy human cells, kinases regulate a number of biological processes important for survival. However, when kinases become over-active or dysregulated, it can cause a range of life-threatening diseases such as cancer, autoimmune disorders, Alzheimer's and diabetes. This patented technology will allow pharmaceutical companies to measure simultaneously a large number of compounds and select which one can be developed into drugs to fight against diseases.



“The simplicity is the strength of this technology.”

The device was developed in Bath University by researchers Mr. Nikhil Bhalla and Dr. Pedro Estrela from the Department of Electronic & Electrical Engineering, Dr. Mirella Di Lorenzo from the Department of Chemical Engineering, and Dr. Giordano Pula from the Department of Pharmacy & Pharmacology.

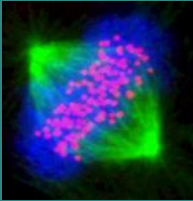
Read more: <http://www.bath.ac.uk/research/news/2015/04/08/new-technology-could-speed-up-life-saving-drug-discoveries-2/>



CR@B meeting, Bath, April 2015



New cancer therapy based on cell division



Professor Andrew Fry at the University of Leicester and his colleagues have discovered new information about cell division process that has provided new insight on how future cancer treatment might be. They have provided information on how cells pass the right amount of genetic materials to their daughter cells. The two papers published by this group explain how two enzymes called Nek 5 and Nek 6 control the stability of the structural scaffold (shown in green in the picture) at the time of division. They also lead to recruitment of chaperone named Hsp70 on the scaffold to keep the cancer cells alive inside the stressful environment of tumours. Inhibiting these chaperones can cause the cancer cells to die, which has been attractive for the drug companies to prepare a new range of medicines for cancer therapy.

Read more:

www.worldwidecancerresearch.org/cancer-research-news/2015/destroy-cancer-cells#

Latest News on Cancer Worldwide

Western diet could increase the risk of death for people with prostate cancer

Despite the fact that many researches and studies have been focused on investigating the parameters that may lead to cancer development, very less is finally known about the real etiologies of prostate cancer (PCa). Among the possible reasons reported, it was suggested that the high intake of animal protein might increase the incidence of PCa by enhancing growth hormone activity, for example the production of insulin-like growth-factor-I (IGF-I), which in turn may promote the development of prostate cancer.

The close link between unhealthy food habits and the potential of cancer development is widely accepted after extensive and intensive research worldwide. Moreover, the consumption of high-fat animal foods is studied and correlated with both incidence and mortality from prostate cancer.

Eligible men of the European Prospective Investigation into Cancer and Nutrition (EPIC) - a multicenter prospective study designed to investigate the relationships between diet, lifestyle, environmental factors and cancer- were recruited from the population of defined geographical areas in eight European countries and were invited to participate in the study giving informed consent and completed questionnaires on their diet, lifestyle and medical history. Dietary intake during the year before enrolment was measured by country-specific validated food frequency questionnaires (FFQs) or diet histories, as previously described. For this analysis, animal foods included total meat and meat products, white fish and shellfish, dairy products (and the subcategories milk and milk beverages, yoghurt and cheese) and eggs. Estimated daily nutrient intakes were calculated by multiplying the nutrient content of each food of a specific portion size by the frequency of consumption as stated on the FFQ using national food tables from each country. Associations were examined using Cox regression, stratified by recruitment center and adjusted for height, weight, education, marital status and energy intake and after an average of 8.7 years of follow-up.

From this study, it was found that the consumption of protein derived from dairy foods was significantly positively associated with cancer risk. It was estimated that even a 35 g day increase in consumption of dairy protein was associated with an increase in the risk of prostate cancer of 32%. The results support the hypothesis that a high intake of protein from dairy products may increase the risk for PCa. Furthermore, these results indicated positive associations with red meat, fast food like hamburgers, beef or cooked processed meat for either total or advanced PCa.

Nonetheless, results based on wide range of fish intake, provide no evidence of cancer development but on the contrary, a negative association is reported for fish consumption, leading to decrease in risk of cancer development. Furthermore, lycopene a substance commonly found in the diet mainly from dishes prepared from tomatoes depicted a positive impact in preventing PCa, possibly due to lycopene affecting mechanisms of prostate cancer development. In addition curcumin a spice common in Asian dishes has many advantages to beat cancer. It is considered a powerful antioxidant that is also anti-viral and anti-bacterial; plus it seems to have great potential to fight cancer in a number of ways. It was found that this spice can inhibit the action of the enzyme COX-2 known to produce negative, inflammation causing localized enzymes (eicosanoids). Such inflammation is a known precursor to cancer. It has also been shown to inhibit vascular epithelial growth factors. Every tumor needs a blood supply - the growth factors build one, but curcumin seems to stop them. Moreover, it was proved to inhibit metastases and to kill cancer cells (B lymphoma cells). Finally, it prevents re-growth of cancer stem cells which lie at the heart of many tumors.

Overall, it is proven that a healthy diet based on fresh vegetables, fruits and white fish while keeping as low as possible the consumption of red meat and fat dairy products, may finally have a pivotal role in the prevention of PCa development and incidence.

Engaging with public

Family Science Fair in Bath Taps into Science



Family Science Fair, Bath, UK.

PROSENSE Fellows Susana Liébana (Applied Enzyme Technology), Vibha Tamboli (Cardiff University) and Pavel Zhuravski (University of Bath), together with a Fellow from the ITN-SEWPROF, Zhugen Yang (University of Bath) successfully held a stand at the Family Science Fair in Victoria Park, Bath as part of the "Bath Taps into Science" festival on the 21st March 2015. The event was organized to generate interest and curiosity in young minds in the field of science.

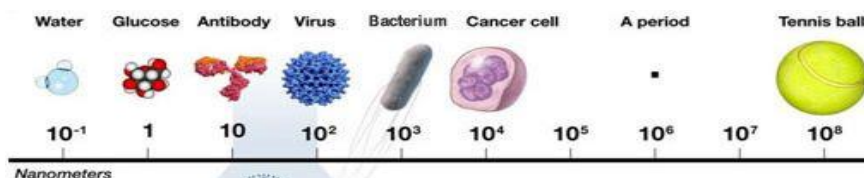


People of all ages and over 1500 students from a wide range of local schools visited the family science day in Bath. The Fellows presented the PROSENSE global project and showed the general public and pupils how biosensors work and its benefit in the future for healthcare, especially for cancer detection. The Fellows explained the basic working principals of biosensors and the growing importance of nanotechnology in our day-to-day life. School children were shown with the help of an interactive map the scale of nanoparticles and its application in biotechnology and biosensors. Magnetic and gold nanoparticles solutions were exhibited on the stand to make the concept of nanoparticles clear and understandable to the general public. Even if the scientific side of biosensors was not so easy to understand, people were really attracted and involved in the demonstration. School children used pH strips to understand the pH of a solution by identifying the change in colour making the concept of biosensor easy to understand. The features of gold and magnetic nanoparticles, the pH detection and the assembly of lemon battery were highly appreciated by public.

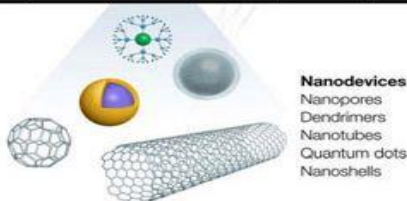


The Fellows also talked to parents accompanying the students and promoted the PROSENSE research network by talking about research involving prostate cancer detection and distributing the newsletter from the previous issue. The stand had really great success as a lot of children were excited to learn the concepts and the parents encouraged them to ask more questions. The community of Bath discovered a different science dimension and the fellows were really enthusiastic to share their knowledge with the present public. Below an example of the cards shown on the stand:

What are nanoparticles?

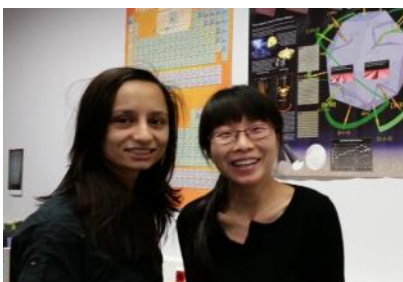


Nanoparticles are particles which are between 1 to 100nm in size.



MACRO

NANO



Ms. Dipti Rani and Ms. Ling Xu

Profile check: Dipti Rani & Ling Xu

Dipti Rani and Ling Xu are the two ESRs working in Prof. Sven Ingebrandt's group at the University of Applied Sciences Kaiserslautern, Germany.

Dipti Rani is originally from New Delhi, India. After her bachelors in Physics from Delhi University, she joined Master's course in Nanotechnology in the same university. She specialized in Nanophysics in Joseph Fourier University, Grenoble, France. She is passionate about working at interface of nanophysics and biology because of its various applications in the field of medicine.

On the other hand, Ling Xu did her bachelor study in Information Display and Optoelectronic Technology in the University of Electronic Science and Technology of China. After, she enrolled in master about Nanoscale Engineering in l' *Universite de Lyon*, France and University of Munich. Ling believes all hard work in PROSENSE network will bring breakthrough in prostate cancer diagnosis.

Focus on the work of Dipti Rani and Ling Xu

Diagnosis of chronic diseases is a big concern in developing countries because of lack of cheap, fast diagnostic tools. During past several years various diagnostic tools have been developed but most of them are time consuming, require laboratory equipment and are not sensitive enough to detect various analytes. It is challenging to develop a single portable device that is easy to use and yet sensitive to detect multiple analytes. A plethora of biosensors based on transduction of biological or chemical binding event to a measurable signal have been tested. Indicatively, piezoelectric, electrical, calorimetric, optical (surface plasmon resonance (SPR) based). Among electrical biosensors, transducers based on Field Effect Transistors (FETs) alone, provide several advantages such as label-free detection, real-time measurements, and miniaturization.

Within FET based biosensors, nanowire (NW) and reduced graphene oxide (rGO) FETs have attracted attention because of their high sensitivity and selectivity. In a conventional NW or rGO FET potential applied to the reference electrode placed in the analyte test solution is used to change the surface potential through the nanowire surface resulting in change in current through source and drain electrodes. These sensors have been explored in various domains of biomolecules detection.

PROSENSE Fellows Dipti and Ling are working on developing a Silicon nanowire FET based and rGO FET based biosensors that can be used for early screening of Prostate cancer (PCa) biomarkers. Dipti's work targets at exploring the potential of Silicon nanowire based FETs and Ling focuses on the development of a rGO FETs based device that can be used for detection of multiple biomarkers with high selectivity and sensitivity.

These biosensors will be integrated with microfluidics system and a portable readout system will be developed in order to produce a hand-held device. The complete device will be tested with the clinical samples by cooperating with the company Euroimmun. It is expected that these projects will pave the way to commercialize a device for PCa diagnosis.

As part of this project in September 2014, Ling visited Royal United Hospital in Bath with the experienced researcher Narayanan Srinivasan. It was a great opportunity for her to collect valuable information from clinical sessions about the methods available to diagnose and treat prostate cancer, more importantly, hear the experience of the clinicians and patients. Although it is hard to fully understand what patients confront, the urgency to detect the prostate cancer biomarkers in early stage without misdiagnose deeply motivates them to work together against PCa. Currently, with the fabricated rGO biosensor Ling is doing her secondment in the University of Bath to investigate various methods of immobilization of receptor molecules, which can recognize the PCa biomarkers with precise selectivity. At the same time, Dipti is focused on the specific immobilization of PSA aptamers on Si NW FETs using microspotting technique and doing electronic detection of PSA. In July 2015, she will be working on the fluidic integration of their SiNW chips in INESC-MN, Lisbon (Portugal).



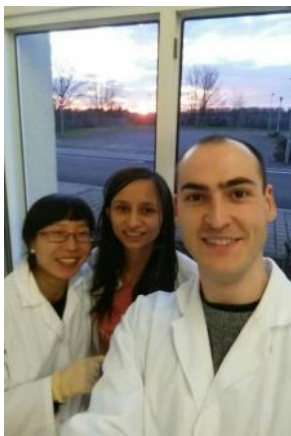
Fachhochschule
Kaiserslautern

University of
Applied Sciences

Secondment Experiences

Fernando Cortezón

-From Bath to Germany



As part of my secondment plan, I spent two months at the beginning of this year at the University of Applied Sciences of Kaiserslautern in Zweibrücken (Germany).

My work during the secondment consisted on the investigation of the conditions to build a biosensor based on carbon nanotubes. The topic of my PhD work is on the functionalisation of carbon nanotubes in solution state for imaging and in vitro analysis, so this was a great opportunity to translate my research into the field of biosensors. We immobilised the carbon nanomaterial by dielectrophoresis between the gold electrodes of glass chip substrates that could allow both optical and electrical detection. The functionalisation of the carbon nanotubes included their oxidation and the deposition of copper nanoparticles that can act as a catalyst in click chemistry cycloaddition reactions.

The team in FH KL, including the two Prosensians, were really friendly, helpful and patient when it came to explaining their research, the use of the equipment and also with the language! The environment in the group was really nice and welcoming which helped a lot in my training process to get used to procedures and instruments in a field that was mostly new for me.

Besides, Zweibrücken is located in the Rheinland-Pfalz, a beautiful area with a wine producing tradition and well positioned to visit to other interesting and historic places as Heidelberg, Trier, Karlsruhe, Strasbourg or Paris.

Julia Zapatero and Shikha Sharma



-From Dublin to Pontypool

After a short flight, a couple of train trips and a car drive, we finally arrived to Gwent Group Ltd., in Pontypool, on April 16th.

As planned with the supervisors, we evaluated the performance of the magnetic beads based platform using the anti-PSA recombinant antibodies generated in

DCU. During our month-long secondment we worked on optical and electrochemical magneto-immunoassay. The quality of the preliminary results obtained in the secondment has motivated us to further pursue this research project. In addition to this, we received a theoretical and practical training in screen-printing manufacturing of electrodes.

Visiting a company was a completely new and enriching experience, which helped us to acquire new scientific skills. We strongly believe that this experience will help us to decide about our future career plans.

Susana Liébana

-From Pontypool to Bath

I started in 2013 as experienced researcher based in Applied Enzyme Technology, part of the Gwent Group, in Pontypool. Since then I am enjoying all the challenges that PROSENSE has for us. Among them, the secondments are a great opportunity for us to grow not only professionally, but also personally. My first one-month secondment was in February 2015, in Dr. Pedro Estrela's group at the University of Bath. Together with Jolly Pawan, we worked on the optimisation of a magneto-aptasensor for PSA detection. I also had the opportunity to learn from the experience of the group about Self Assembled Monolayers using gold macroelectrodes, and widen my knowledge about electrochemical techniques. I am very glad, I had the opportunity to share this period with the amazing people in Bath and learn from each member of the group. I would like to thank the entire group for all the coffees and dinners together and the great welcoming feeling! Especially to Pedro for the supervision and Pawan for the never-ending hope and source of new ideas. Now, I am looking forward to enjoying the next secondment in Xeptagen, Italy!



Secondment Experiences



Pavel Damborsky

-From Slovakia to Lisbon and Bath

First of all, visiting another laboratory is always an enriching experience, helping you to acquire new scientific skills, exchange ideas with communicative people and broaden your horizons by getting to know other approaches and points of view inside the PROSENSE Network.

I had an opportunity to visit two different research institutions so far. My first secondment took place at INESC-MN based in Lisbon, Portugal. I spent there together more than one month (November 2014 and January 2015). The cooperation with the institution arised from previous secondment of Dr. Narayanan

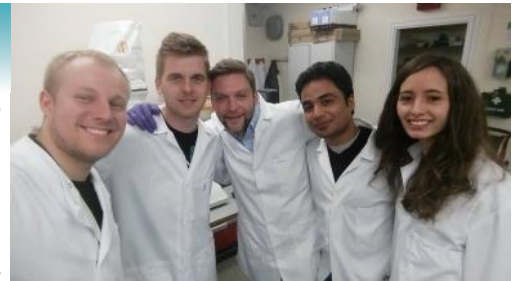
Srinivasan at SAS. Since microfluidics plays an important role in nearly all biosensor integration, it was great opportunity to visit INESC-MN. The experiences I had there not only helped me develop my personal and professional skills, but also led to understanding of different work ethics and culture giving, an international exposure. Together with Narayanan and Pawan Jolly (UBath), we obtained good results which are very promising and will definitely leading to a publication.

In May 2015, I came to the beautiful medieval city of Bath, UK for my second secondment. This time, I had the chance to be hosted in Dr. Pedro Estrela's laboratory, in the department of electronic and electrical engineering, at the University of Bath together with my colleague Stefan Belicky from SAS. I cooperated with Pawan Jolly and Pavel Zhuraski, where I extended my knowledge on localized surface plasmon resonance (LSPR), where the focus was on PSA glycoprofiling, based on previous cooperation in Lisbon and its implementation on LSPR platform. I learnt a lot of new thing and especially I got additional point of view on my research. I had great time in Bath because of the international and friendly atmosphere in the lab.

In this point, I would like to specially thank to supervisors Dr. Virginia Chu, Prof. Joao Pedro Conde (INESC-MN) and Dr. Pedro Estrela (UBath) for their support, help and interest, as well as my laboratory colleagues Dr. Narayanan Madaboosi, Pawan Jolly and Pavel Zhuraski for sharing their experiences and ideas, for exchanging proposals and future plans. I have to definitely admit that both secondments were a very constructive experience. I came back to my base at SAS with many new ideas a great impulse in my plans performance along with high motivation to continue working on our collaboration.

Stefan Belicky

-From Slovakia to Bath



My first secondment was 1 month at the University of Bath in July 2014, where I joined Dr. Pedro Estrela's team. It was already my second visit to their lab, so I was looking forward not only to learn new methods and techniques, but also to meet other fellows from the lab. I, along with Pavel Damborsky, had a great pleasure to meet our new Fellow colleague who just joined in the project- Pavel Zhuraski. As UBath is a home place for Pawan Jolly and by the end of May we were joined by Julia Zapatero, in the end there were 5 PROSENSE Fellows in one place - great opportunity to share experience, support each other and also to have some fun. During the stay in Bath, Pavel Damborsky and I were able to visit the Urology department at the Royal University Hospital in Bath. This was possible thanks to Mr. Jonathan McFarlane, who arranged the honorary contract from RUH for two days clinical experience training for us. During these two days we met Miranda Benney, Ros Helps and Elizabeth Hancock, nurses and cancer specialists at the RUH, who also cooperate with Macmillan and Prostate cancer UK charities. They guided us through the process of diagnosis, treatment options and follow-up care for PCa patients. We were able to attend a session with men who already underwent a successful treatment and



we also had a chance to stay in the consultancy room with the clinical nurse specialist when she informed her patient of his biopsy results. This was truly an eye-opening experience, where we could see how the results of a research can influence patient's lives and that our work is not about solutions and tubes, but in the end is all about and for the people. Last but not least, I would like to thank everyone who made all of this possible, especially Dr. Pedro Estrela, Dr. Jonathan McFarlane, all the nurses at RUH, who are doing such a great job and of course all the PROSENSE Fellows for their help during the secondment.



University Hospital of Wales and School of Medicine

Dr. Hrish Joshi

-Filling the gap between technology and clinicians

Tell us a bit about you, background studies, professional career...

I am a Consultant Urological Surgeon and Honorary Clinical Teacher at the University Hospital of Wales, Cardiff. After obtaining the Fellowship of the Royal College of Surgeons (FRCS) in 1996, I spent two years as a research fellow at the Bristol Urological Institute and completed my MD at the University of Bristol. I completed higher Urological training in East Anglia (Cambridge & Norwich). Along with practising General Urology, my subspecialist interests are Endourology and stone diseases, uro-technology, diagnostics and drug delivery, outcomes assessments and health services research in urology including HrQoL.

Moreover, I am a principle and co-supervisor for PhD, MSc and student projects (Cardiff University). I am also regular reviewer for 1) The Journal of Urology, 2) Journal of Endourology, 3) Urological research (formerly Urolithiasis) and PLoS (online journal); and member of a grant committee –HTA grant proposals.

What made you interested in urology and particularly on prostate cancer (PCa)? Do you think researchers and clinicians are close enough?

Prostate cancer (PCa) is one of the common conditions in what urologist are involved in dealing with. From technology point of view, there are many aspect that still remain to be addressed. Purely, diagnostic is not satisfactory because of lack of reliability and good testing. Hence, there is a significant interest in the PCa diagnostics for urologist interested in research. I would say, that what made me decide to work on PCa was the real clinical need of research platform to integrate different technologies in order to offer a reliable test for people.

What sensors are in current practice for prostate cancer detection?

Currently, the gold-standard is the biopsy. Serum Prostate Specific Antigen (PSA) test is useful when combined with digital rectal examination (DRE) for the detection of prostate carcinoma. The need for a prostate biopsy is determined by the age specific PSA level together with DRE result and the presence or absence of co-morbidities or other risk factors (age and ethnicity). There are no sensors currently available for PSA test, the commonly used method is based on immunoassay formats such as Chemiluminescent Microparticle Immunoassay (CMIA).

Dr. Hrish Joshi

- Outside work

I am married, with two young children. I have a keen interest in sports including cricket and swimming. I also have an interest in music and play various percussion instruments. Last but not the least, I am also involved in organising local social events.



Dr. Hrish Joshi

Bridging the Gap

What do you expect from PROSENSE?

We would expect a step towards establishing a prototype, either a sensor or diagnostic platform, that could be useful for both diagnostics and treatment of patients, which would be ready for clinical evaluation. We hope that this collaboration would help clinicians in working out which patients need treatment and those who do not need aggressive treatment.

What do you think about future of PCa detection?

We need a sensitive and specific test technology that could diagnose well differentiated and non-well differentiated prostate cancer at an early enough stage in a reliable manner. The real need is not only an early detection, but also the following-up of the patients, to monitor the progression of the cancer.



Why is PSA testing controversial?

PSA occurs in three major forms in the blood. The major immunodetectable form is PSA complexed with the serine protease inhibitor, alpha-1-antichymotrypsin (PSA-ACT). Uncomplexed or free PSA is the other immunodetectable form in serum. A third form of PSA is complexed with alpha-2-macroglobulin. This is not immunodetectable due to the engulfment and subsequent masking of PSA epitopes by the alpha-2-macroglobulin molecule. Total PSA assay currently in use in most of the hospitals measures both PSA-ACT and free PSA. This test has several limitations, such as:

- ◇ Patients who have human anti-mouse antibodies (HAMA) following treatment which contains mouse monoclonal antibodies, may show falsely elevated or depressed total PSA results
- ◇ Patients who have heterophilic antibodies due to routine exposure to animals or animal protein products are prone to anomalous results due to interference of the antibodies with the reagent immunoglobulins
- ◇ Total PSA results vary between assays from different manufacturers, due to differences in methods, calibration, and reagent specificity
- ◇ Hormonal therapy can affect PSA expression; therefore a low PSA result in a patient who has received hormonal therapy may not be accurate
- ◇ PSA can be increased following prostatic massage, digital rectal examination, needle biopsy and ejaculation
- ◇ Severely haemolysed samples affect the assay

Therefore, although PSA test is commonly used, this method is not reliable enough. Also, no other marker is used in day practice, so there is clearly a need of research in the field.

Do you think researchers and clinicians are close enough?

Clearly there is a need for researchers working in different technologies to come together along with the clinicians. There is involvement of urologist interested in research and researcher interested in going out of the lab and understanding the real need and application of their research. However, there is always a need of getting more people involved in collaborative projects as PROSENSE to get the two fields closer.



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Upcoming Events



6th Graduate Student Symposium on Molecular Imprinting

27-28th August 2015, Kent, UK

<http://mipsoc.org/SMI/events.php?item=32>



IEEE SENSORS 2015

1-4th November 2015, Busan, South Korea

<http://ieee-sensors2015.org/>

Biosensors 2016

26th Anniversary World Congress on Biosensors

25-27th May 2016, Gothenburg, Sweden

<http://www.biosensors-congress.elsevier.com/>



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