NTU DOCTORAL SCHOOL

NOTTINGHAM TRENT UNIVERSITY

"Creating future innovators and impact for education, industry, the professions and society"

School of Science and Technology, University Funded PhD Studentship, 2017 Entry

Important note: applications for the projects described below **do not** require a research proposal. Please ensure you specify in your application which project you are applying for. Please note the application closing date for each project.

Biomedical Sciences (A03)

1. Dr Glen Kirkham - Investigating Cell and Extracellular Matrix Interactions within the Bone Marrow Stem Cell Niche

2. Dr Cristina Montiel-Duarte - AGAP2 expression: involvement of G quadruplex structures and a long non-coding mRNA

3. Professor Sergio Rutella - Use of high-throughput digital technologies for immune profiling and identification of predictive outcome biomarkers in haematological malignancies

Materials and Engineering (B15)

4. Professor Paul Evans – High-speed material specific X-ray imaging

5. Professor Haida Liang - Remote laser spectroscopy at standoff distances

Please see the project descriptions below.

1. Dr Cristina Montiel-Duarte - AGAP2 expression: involvement of G quadruplex structures and a long non-coding mRNA

For informal discussion regarding the project, please contact: cristina.montielduarte@ntu.ac.uk

One gene, one mRNA, one protein. We know that what it was the central dogma in biology is now obsolete. And we know the RNA molecules have more functions and are more ubiquitous than once anticipated. The next generation sequencing has opened our eyes to the many types of RNA which function is still unclear. However, what it is clear is that, in RNA, the secondary structure (and not just the sequence) is relevant.

This project aims to understand the role of G quadruplex structures and a long non-coding RNA in the expression of AGAP2. AGAP2 is a proto-oncogene: it is a protein overexpressed in brain and prostate cancer, amongst others, that contributes to the progression of the disease. Its actions are mainly mediated by the interaction and modulation of AKT activity. But while AGAP2 functions are beginning to be elucidated, not much is known about how its expression is regulated.

Our group previous data suggest the 5' untranslated region of AGAP2 is a key regulator for the mRNA translation. Furthermore, the expression of a long non-coding antisense RNA seems to be negatively associated to AGAP2 expression. Using molecular biology, state of the art technology and the collaboration with Dr Keith Spriggs at the University of Nottingham and Dr Christos Polytarchou in NTU, the student undertaking this project will investigate how AGAP2 expression is regulated in cancer cell lines.

Entry Criteria
UK 1st Class / 2.1 Bachelor's degree (or UK equivalent according to NARIC) and/or UK Master's degree with a minimum of a merit/commendation (or UK equivalent according to NARIC) in Cell Biology, Biochemistry, Molecular Biology, or a related discipline.

The **closing date** for receipt of completed application forms for this studentship is **5pm (UK time) on 24th March 2017.** This deadline will be strictly adhered to. Application by CV only or incomplete applications will **not** be accepted.

2. Dr Glen Kirkham - Investigating Cell and Extracellular Matrix Interactions within the Bone Marrow Stem Cell Niche

For informal discussion regarding the project, please contact: glen.kirkham@ntu.ac.uk

Medical research strategies such as tissue engineering and regenerative medicine aim to generate functional tissue analogues for therapeutic use. In order to fully reproduce the complexity of biological systems such implants require the reconstruction of biological complexity at high and low length-scales. The majority of such strategies focus on bulk macroscopic structure but can be limited in their ability to effectively reproduce cellular microenvironments. We have developed a novel technique which utilises laser capture technology to pattern individual cells and structural elements in 3D enabling the study of biology at a length scale that has previously been unachievable (Kirkham GR et al "Precision Assembly of Complex Cellular Microenvironments using Holographic Optical Tweezers". *Scientific Reports, 5 (2015)*).

This project will use this system to study the interactions between cells of the bone marrow stem cell niche and their physical environment. This will involve an analysis of the interactions between these cells and components of the extracellular matrix using the 3D micromodel system as well as bespoke 2D models. This multidisciplinary work will be developed in collaboration with the Universities of Nottingham and Glasgow and this project will be conducted both at NTU and with Dr Lee Buttery at the University of Nottingham.

Entry Criteria
UK First-class or 2:1 degree (or UK equivalent according to NARIC) in Biological/Biomedical Sciences, Biochemistry, Cell Biology, Biotechnology or a closely related discipline and/or a Masters degree with a minimum of a merit/commendation (or UK equivalent according to NARIC) in a relevant subject.

The **closing date** for receipt of completed application forms for this studentship is **5pm (UK time) on 31st March 2017.** This deadline will be strictly adhered to. Application by CV only or incomplete applications will **not** be accepted.

3. Professor Sergio Rutella - Use of high-throughput digital technologies for immune profiling and identification of predictive outcome biomarkers in haematological malignancies

For informal discussion regarding the project, please contact: sergio.rutella@ntu.ac.uk

The phenotype of a tumour is dictated not only by the tumour cell component but also by the tumour microenvironment (TME), which includes the inflammatory infiltrate. The analysis of the location, density and functional orientation of the different immune cells, i.e., the 'immune contexture', has been instrumental to the identification of immune components that are beneficial or deleterious to patients with solid tumours. These studies led to the definition of an 'immunoscore', which has been validated in patients with colorectal cancer (CRC) and reflects the density of $CD3^+CD45RO^+$ and $CD3^+CD8^+$ or $CD8^+CD45RO^+$ cells, both in the core of the tumour and in the invasive margins.

This collaborative project focuses on acute myeloid leukaemia (AML), which is characterised by clonal expansion of poorly differentiated myeloid precursors and results in impaired haematopoiesis and often bone marrow failure. AML is only cured in 35 to 40% of patients <60 years of age and in 5 to 15% of patients >60 years of age. Refractory disease is common and relapse represents a major cause of treatment failure. In children, AML accounts for approximately 20% of leukaemias, occurring with an incidence of 7 cases per million children younger than 15 years. Although intensive multi-agent chemotherapy in conjunction with improved supportive care has increased survival rates to 70%, approximately 30-40% of children with AML relapse and only one-third of them will survive to adulthood. Investigation of new molecularly-targeted agents for high-risk AML remains a high priority, both in children and in adults, and is being actively pursued.

The microenvironment of AML is inherently immunosuppressive and equipped to subvert the host immune response. The successful PhD student will benefit from being part of a multi-disciplinary team of scientists (cancer biologists, immunologists, bioinformatics experts) with a track record of high-quality publications. He/she will also have the unique opportunity to use state-of-the-art gene expression profiling platforms and multi-colour flow cytometry equipment to identify biomarkers of patient outcome. Specific proteins of interest will be validated and quantitated using Clinical Proteomics. Polychromatic flow cytometry will be used to enumerate cells of the innate and adaptive immune response. All data analytic and interpretation activities will be supported by advanced Bioinformatics and Computational Intelligence expertise.

Entry Criteria
UK First-class or 2:1 degree (or UK equivalent according to NARIC) in Biological/Biomedical Sciences, Molecular Cell Biology, Biotechnology or a closely related discipline, plus research experience and/or a Masters degree with a minimum of a merit/commendation (or UK equivalent according to NARIC) in a relevant subject.

The **closing date** for receipt of completed application forms for this studentship is **5pm (UK time) on 24th March 2017.** This deadline will be strictly adhered to. Application by CV only or incomplete applications will **not** be accepted.

4. Professor Paul Evans – High-speed material specific X-ray imaging

For informal discussion regarding the project, please contact: paul.evans@ntu.ac.uk

Material specific imaging for security screening places significant technical and socioeconomic demands upon contemporary analytical approaches. Conventional X-ray diffraction techniques, while possessing the required high specificity and sensitivity in a lab environment, are totally unsuitable for the high-speed inspection of extended objects. In response to this problem we propose to combine two disruptive technologies namely; focal construct geometry (FCG) X-ray diffraction and pixelated energy resolving sensing. This integrated approach is conceived to realise 'real-time', tuneable detection capability. X-ray diffraction identifies materials from their atomic spacing (not 'average' atomic number and density like current scanners). Therefore, the project aim is to develop detection principles and techniques that are applicable to a wide range of contraband including explosives/precursors, narcotics, alcohol, fruit, ivory, hardwoods. The work will also address the issue of identifying contraband within cluttered luggage or packages, without manual searches or handling the items.

The project will provide an original contribution to knowledge at a number of different levels in terms of X-ray collection methods, processing and analysis. The experiment work will employ the state-of-the-art X-ray facilities contained within the RFB Superlab at Nottingham Trent University. In addition, work will also be undertaken at collaborating institutions including government labs, industry and other research intensive universities. This exciting multidisciplinary project would suit a highly motivated individual interested in X-ray physics/sensing/imaging, computational imaging, signal analysis/PCA, modelling/maths and simulation and or material science.

The successful candidate will benefit from being part of a highly experienced team of researchers, with a track record of world leading innovation in the field of X-ray security imaging. This work has attracted around £5 million research funding from UK and US governments over recent years. The group produces 4* journal papers and significant Patents and intellectual property. Examples of recent high quality publications (top 5% of subject category) can be downloaded from the *Optics Express* website at http://www.opticsinfobase.org/ (by entering a search under "annular x-ray").

Entry Criteria
UK 1st Class/2:1 Bachelor's degree (or UK equivalent according to NARIC) with minimum of 2:1 BSc (Hons) Physics or Engineering.

The **closing date** for receipt of completed application forms for this studentship is **5pm (UK time) on 31st March 2017.** This deadline will be strictly adhered to. Application by CV only or incomplete applications will **not** be accepted.

5. Professor Haida Liang - Remote laser spectroscopy at standoff distances

For informal discussion regarding the project, please contact: haida.liang@ntu.ac.uk

Remote laser spectroscopy at standoff distances (of order of 10m) for the analysis of solids has mainly been used in planetary science. There has been increased research activity in the terrestrial applications of remote laser induced spectroscopy such as laser induced fluorescence, Raman spectroscopy and Laser Induced Breakdown (LIBS) Spectroscopy. Raman spectroscopy gives very specific molecular identification, including the ability to distinguish between crystalline polymorphs as long as the material does not produce significant fluorescence. Laser induced breakdown spectroscopy (LIBS) detects the emission from plumes emitted through laser ablation. It is micro-destructive, as the ablated crater size is typically less than 1 mm in diameter. LIBS is sensitive to all elements and it can identify the elemental content of materials in layers through successive pulse induced ablation. In this project, we will develop a combined remote LIBS/Raman spectroscopy system to complement our existing PRISMS remote 3D spectral imaging system for the remote material identification and monitoring of the degradation and corrosion of objects at hard to reach places at stand-off distances. An automatic data analysis process will also be developed to combine the multimodal data for material identification. The areas of application include archaeological sites, historical buildings and monitoring of industrial sites. The project will suit an individual who is competent in optical system development as well as having interest in signal processing algorithms, material characterization and interdisciplinary research. The successful candidate will have the benefit of being part of a world leading team in imaging and sensing for archaeology, art history and conservation (ISAAC). The optical instruments developed in the team has recently attracted significant funding in spin off industrial applications as well.

Entry Criteria
UK 1st Class / 2.1 Bachelor's degree (or UK equivalent according to NARIC) and/or UK Master's degree with a minimum of a merit (or UK equivalent according to NARIC) in Physics (or in a related subject).

The **closing date** for receipt of completed application forms for this studentship is **5pm (UK time) on 24th March 2017.** This deadline will be strictly adhered to. Application by CV only or incomplete applications will **not** be accepted.