**Available Projects for Intercalated BSc (iBSc) in Medical Science**

**2023-2024**

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**Projects Hosted by the Wellcome-Wolfson Institute For Experimental Medicine**

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| **Project Title** | **Detection of GREM1 levels in lung disease-a novel biomarker of damage?** | | | |
| **Supervisor(s)** | 1. Dr. Derek Brazil   2. Prof. Cecilia O’ Kane | | | |
| **School / Centre** | SMDBS/WWIEM | | | |
| **Principal Supervisor’s Contact Details** | Email: d.brazil@qub.ac.uk | | Tel: 6469 | |
| **Degree Pathway for which project is suitable (**✓**)** | Medical Science | x |  | |
| Biochemistry | x |
| Microbiology |  |
| **Is project of suitable standard / subject for studentship application? (**✓**)** | *General awards*  Wolfson Foundation Award | x | *Subject-specific awards*  British Assoc Dermatologists  Digestive Disorders Foundation  Pathological Society  Sir Colin Dollery Clinical Pharmacology Award  Other (Please specify) | x |
| **Background information:** | Gremlin1 (Grem1) is a secreted protein that binds to and antagonizes the action of bone morphogenetic proteins (BMPs). Grem1 binding to BMPs is essential for the normal development of limbs, kidneys and other tissues. Apart from its developmental role, Grem1 is an important protein in a range of human diseases including lung fibrosis, diabetic kidney disease and cancer. Patients with pulmonary artery hypertension and idiopathic pulmonary fibrosis express high levels of GREM1 mRNA in their alveolar epithelial cells. Higher levels of GREM1 mRNA correlate with poor patient prognosis in PAH. We and others hypothesise that GREM1 protein will be secreted from alveolar epithelial cells and be concentrated in the bronchoalveolar lavage fluid in injured lungs. We will test this hypothesis in this project using distal lung epithlelial cells cultured in vitro, bronchoalveolar lavage (BAL) samples from ex vivo injured human lungs and BAL samples from healthy controls and patients with acute respiratory distress syndrome (ARDS). Successful completion of this project will be the first demonstration that GREM1 is a potential biomarker for alveolar epithelial damage and ARDS. | | | |
| **Aims / objectives** | 1. Use GREM1 ELISA assay to determine if GREM1 protein detectable in cell-culture models of lung disease 2. Screen BAL samples from human lungs injured ex vivo for GREM1 protein using ELISA 3. Screen BAL fluid samples from patients with ARDS and healthy controls for GREM1 protein using ELISA | | | |
| **Techniques employed:** | ELISA, Western blotting, data management, statistical analysis.  The student will be supervised by Dr. Brazil and members of his team. They will receive training on the key techniques involved in the project. The student is expected to present at the weekly group meeting and will be supported by key members of the team.  We believe this is an ideal project for an ambitious, hardworking medical intercalated student. The GREM1 ELISA is established in the Brazil laboratory, and most of the experimental samples to be screened are available from Prof. O’ Kane. Successful completion of the aims of this project should allow a research abstract and/or publication for the student. | | | |

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| **Project Title** | **Cardiac biomarker investigation of perioperative right ventricular injury secondary to one lung ventilation** | | | |
| **Supervisor(s)** | 1. Dr Adam Glass  2. Dr Chris Watson  3. Dr Jon Silversides | | | |
| **School / Centre** | Wellcome-Wolfson Institute for Experimental Medicine | | | |
| **Principal Supervisor’s Contact Details** | Email: a.glass@qub.ac.uk | | Tel: 07817292826 | |
| **Degree Pathway for which project is suitable (**✓**)** | Medical Science | ✓ |  | |
| Biochemistry |  |
| Microbiology |  |
| **Is project of suitable standard / subject for studentship application? (**✓**)** | *General awards*  Wolfson Foundation Award | ✓  ✓ | *Subject-specific awards*  British Assoc Dermatologists  Digestive Disorders Foundation  Pathological Society  Sir Colin Dollery Clinical Pharmacology Award  Other (Please specify) |  |
| **Background information:** | Lung resection has been shown to cause right ventricular injury. This injury may be caused by (a) the anaesthetic technique used (ventilation of one lung), (b) the removal of lung tissue or (c) the effects of major surgery.  Patients undergoing both lung resection surgery and oesophagectomy have in common that the same anaesthetic technique (one lung ventilation) is used. Patients undergoing gastrectomy do not have this anaesthetic technique used but potentially have a similar general surgical insult. Comparing these three groups will help to determine the relative impact of ventilation of one lung, the removal of lung tissue, and/or major surgery towards perioperative right heart injury. | | | |
| **Aims / objectives** | To compare cardiac biomarker evidence of right ventricular injury between patients undergoing   * + 1. lung resection surgery,     2. oesophagectomy,     3. gastrectomy | | | |
| **Techniques employed:** | The student will be supported to:   * Perform a literature review * Recruit and consent surgical patients to an observational trial * Assist with data collection and interpretation * Undertake laboratory analysis, including immuno-assays, ELISAs, sample prep for mass spectrometry and associated downstream bioinformatics analysis. * Disseminate the work via conferences and published paper(s) | | | |
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| **Project Title** | **Exploring the relationship between retinal oxygen saturation as measured by oximetry and the progression of retinal ischaemia in patients with diabetic retinopathy** | | | |
| **Supervisor(s)** | 1. Professor Noemi Lois 2. Miss Jennifer Perais | | | |
| **School / Centre** | Wellcome-Wolfson Institute for Experimental Medicine | | | |
| **Principal Supervisor’s Contact Details** | Email: n.lois@qub.ac.uk | | Tel: 028 9097 6462 | |
| **Degree Pathway for which project is suitable (**✓**)** | Medical Science | ✓ |  | |
| Biochemistry | ✓ |
| Microbiology |  |
| **Is project of suitable standard / subject for studentship application? (**✓**)** | *General awards*  Wolfson Foundation Award | ✓ | *Subject-specific awards*  British Assoc Dermatologists  Digestive Disorders Foundation  Pathological Society  Sir Colin Dollery Clinical Pharmacology Award  Other (Please specify) |  |
| **Background information:** | Hyperglycaemia in diabetes leads to neurovascular degeneration which manifests as diabetic retinopathy in the retina (DR). DR is categorised into two main stages based on the development of increasingly severe microvascular lesions: non-proliferative DR (NPDR) and proliferative, sight-threatening, DR (PDR). The transition from NPDR to PDR is indicated by the development of new abnormal blood vessels at the optic nerve head or in its surroundings, called new vessels in the disc (NVD), or in the retina, the so-called new vessels elsewhere in the retina (NVE). The growth of new vessels is believed to be triggered by the presence of retinal ischaemia which occurs when damaged retinal capillaries close and drop out. The ischaemic retina then induces the release of growth factors, including vascular endothelial growth factor (VEGF), which promote new vessel growth in a futile attempt to restore vascular supply. In severe cases, fibrovascular membranes grow and contract over the retinal surface leading to tractional retinal detachment (TRD). Even following successful retinal re-attachment, sight loss can occur as a result of a TRD. Although most, if not all, individuals with diabetes will develop DR if they survive long enough, only some will progress to the PDR stage, and it is unclear why this is the case.  Retinal oximetry is a non-invasive imaging technique designed to measure relative oxygen saturation of haemoglobin in retinal arterioles and venules. Cross-sectional studies have found increases in retinal arteriolar and venular oxygen saturation to be independently associated with increasing severity of DR. In venules, the saturation level of oxygen reflects the amount of oxygen remaining in the blood vessels after passaging through the retinal microcirculation.Therefore, it may be an indicator of the degree of capillary closure present (i.e. the more capillary closure the less access of oxygen to the retina and the subsequent reduced consumption of oxygen, with higher levels of oxygen in the veins as a result)**.** Longitudinal studies are, however, required to determine whether retinal oxygen saturation (in arterioles and/or venules) is predictive of the development of DR or its progression to PDR.  The first stage of this project will involve the undertaking of a thorough review of the literature to determine what exactly is known about the relationship between oxygen saturation in retinal blood vessels, as measured using retinal oximetry, and the presence and progression of retinal ischaemia in patients with DR.  The second part of this project will entail evaluating retinal oximetry data already obtained as part of a prospective longitudinal cohort research study entitled, “Retinal ischaemia and proliferative diabetic retinopathy: Determining risk factors modulating its development and progression“ (REC ref: 14/NI/0076). In this pilot study, forty patients with NPDR or untreated PDR were followed prospectively for a period of two years. Fundus fluorescein angiography, to determine areas of retinal ischaemia was obtained at baseline and at one and two-years follow-up. Similarly, images required to estimate oxygen saturation levels were also obtained at the same time points. For the current project, the Oxymap analyser software will be used to calculate oxygen saturation of retinal arterioles and venules at baseline, and at the one and two-years follow-up data points. Oxygen values will be evaluated statistically for their relationship with the progression of retinal ischaemia over time and the development of new vessels, hallmark of PDR. | | | |
| **Aims / objectives** | To determine exactly what is known about oxygen saturation in retinal blood vessels, as measured using retinal oximetry, in relation to the presence and progression of retinal ischaemia in patients with DR.  To evaluate whether oxygen saturation level of retinal blood vessels can influence progression of retinal ischaemia in patients with DR. | | | |
| **Techniques employed:** | The successful student will learn how to search, summarise, and appraise the literature in a systematic manner, and will also gain experience interpreting retinal images, undertaking image analysis, data analysis and writing a scientific report. | | | |

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| **Project Title** | **DNA METHYLATION AS A KEY DETERMINANT OF ENDOTHELIAL PROGENITOR CELL DYSFUNCTION ASSOCIATED WITH CARDIOVASCULAR DISEASE** | | | |
| **Supervisor(s)** | 1. Professor David Grieve  2. Dr. Karla O’Neill | | | |
| **School / Centre** | SMDBS / Wellcome-Wolfson Institute for Experimental Medicine | | | |
| **Principal Supervisor’s Contact Details** | Email: d.grieve@qub.ac.uk | | Tel: 02890976468 | |
| **Degree Pathway for which project is suitable (**✓**)** | Medical Science | ✓ |  | |
| Biochemistry |  |
| Microbiology |  |
| **Is project of suitable standard / subject for studentship application? (**✓**)** | *General awards*  Wolfson Foundation Award | ✓ | *Subject-specific awards*  British Assoc Dermatologists  Digestive Disorders Foundation  Pathological Society  Sir Colin Dollery Clinical Pharmacology Award  Other (Please specify) |  |
| **Background information:** | Impaired angiogenesis is known to influence the progression of ischaemic cardiovascular disease (CVD), with stresses such as hyperglycaemia and hypoxia (ischaemia) promoting Endothelial Cell (EC) dysfunction. Recent attention has focused on the therapeutic potential of endothelial progenitor cells (EPCs), which are mobilised by ischaemia and are important in vascular homeostasis. Our group has characterised a distinct EPC subtype, termed endothelial colony-forming cells (ECFCs), with well-defined endothelial progenitor properties, which promote new blood vessel formation in both health and disease. Whilst DNA methylation (critical for appropriate gene expression) regulates mature EC homeostasis and stress-induced dysfunction, its role in determining the angiogenic response of ECFCs is not defined. This is critical given their capacity for vascular repair, reported dysfunction in CVD, and therapeutic potential. Importantly, we have recently demonstrated that important stress-induced DNA methylation alterations correlate with reduced angiogenic capacity and therefore hypothesise that this key epigenetic modification is central in driving ECFC dysfunction in CVD and could be targeted to promote therapeutic angiogenesis. | | | |
| **Aims / objectives** | This project therefore aims to investigate the specific role of DNA methylation and associated modifying enzymes (DNMT1 etc.) on *in vitro* ECFC angiogenic function. It is hoped that the results will identify both key adverse DNA methylation changes and alterations in methylome-linked signalling pathways which 1) may become dysregulated in response to cardiovascular stresses (hyperglycaemia and hypoxia) and 2) could represent potential targets to enhance the reparative capacity of ECFCs given their clear potential for the treatment of ischaemic cardiovascular disease. | | | |
| **Techniques employed:** | In order to characterise the effects of DNA methylation and modifying enzymes on ECFC function, studies will be undertaken in cultured cells (healthy and diseased) post-genetic modification (using siRNA, plasmids) to produce attenuated/augmented levels of proteins critical to maintenance of the methylome (DNMT1, UHRF1 etc.). An inhibitor of DNA methylation (5’AZA; clinically approved drug for treatment of specific disease) will also be utilised in order to examine the role of this gene-regulating modification in the ECFC angiogenic response. Expression of key signalling genes will be quantified by real-time RT-PCR and/or western blot and *in vitro* ECFC tube formation (Matrigel) assays will be performed to assess functional effects.  The student can realistically expect to make an important contribution to ongoing ECFC research which will be acknowledged through manuscript co-authorship. | | | |

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| **Project Title** | **Exploring mechanism of bacterial resistance against last-resort antibiotics** | | | |
| **Supervisor(s)** | 1. Prof. Miguel A. Valvano   2. Amy Anderson, PhD student | | | |
| **School / Centre** | SMDBMS, Wellcome-Wolfson Institute for Experimental Medicine | | | |
| **Principal Supervisor’s Contact Details** | Email: m.valvano@qub.ac.uk | | Tel: 028 9097 6025 | |
| **Degree Pathway for which project is suitable (**✓**)** | Medical Science | X |  | |
| Biochemistry | XX |
| Microbiology | XX |
| **Is project of suitable standard / subject for studentship application? (**✓**)** | *General awards*  Wolfson Foundation Award | X | *Subject-specific awards*  British Assoc Dermatologists  Digestive Disorders Foundation  Pathological Society  Sir Colin Dollery Clinical Pharmacology Award  Other (Please specify) |  |
| **Background information:** | Antibiotics are the greatest success story of modern medicine, but the steady global increase of infections caused by multidrug antibiotic resistant (AMR) bacteria has turned into one of the greatest threats to human health. We investigate *Enterobacter* species, which are identified by the WHO among the most dangerous bacteria. AMR *Enterobacter* clinical isolates can also become resistant to colistin, a last-resort antibiotic, either by horizontal transfer of modifying genes or by the expression of heteroresistance in the bacterial population. Uncovering the molecular basis of intrinsic resistance in *Enterobacter* is paramount to devise control measures. | | | |
| **Aims / objectives** | The aim of this project is to investigate the mechanisms of intrinsic resistance in AMR *Enterobacter cloacae* complex isolates by: (1) testing the virulence potential of the *E. cloacae* complex isolates in the *Galleria mellonella* moth larvae infection model; (2) conducting qRT-PCR assays and global transcriptomics comparing the expression of selective colistin. resistance associated genes and potential regulators in pre- and pots-infection isolates; (3) comparing the lipid a profile of colistin-sensitive and -resistant isolates.; and (4) investigating the role of an *Enterobacter* type VI secretion system in the bacterial competition against gut colonizing bacteria to explain how AMR *Enterobacter* can colonize patients providing a reservoir to transmit superbugs. | | | |
| **Techniques employed:** | The student will learn general microbiology and molecular biology techniques, PCR amplification, infection model in *Galleria mellonella,* and rudiments of mass spectrometry. General techniques of biochemistry and molecular biology will be applied, as well as rigorous hypothesis-driven thinking process to learn scientific method. The student will join a highly accomplished and motivated research team environment and s/he is expected to learn and apply experimental design and execute the experiments with technical proficiency after initial training. Attendance and presentation to weekly lab meetings will complement training, as well as individual meetings with Prof. Valvano to assess progress. To learn more about the Valvano lab ethos please visit: <https://publish.uwo.ca/~mvalvano/> | | | |

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| **Project Title** | **Investigating the effectiveness and safety of high efficacy disease modifying treatments in the treatment of multiple sclerosis.** | | | |
| **Supervisor(s)** | 1. Dr. Yvonne Dombrowski (Senior Lecturer QUB) 2. Dr Rachael Kee (Clinical research fellow, PhD candidate) 3. Dr Gavin McDonnell (Consultant Neurologist, Honorary Senior lecturer QUB). 4. Dr Stella Hughes (Consultant Neurologist, Honorary lecturer QUB). | | | |
| **School / Centre** | Wellcome-Wolfson Institute For Experimental Medicine | | | |
| **Principal Supervisor’s Contact Details** | Email:  y.dombrowski@qub.ac.uk | | Tel: 028 9097 1643 | |
| **Degree Pathway for which project is suitable (**✓**)** | Medical Science | Y |  | |
| Biochemistry |  |
| Microbiology |  |
| **Is project of suitable standard / subject for studentship application? (**✓**)** | General awards  Wolfson Foundation Award |  | Subject-specific awards  British Assoc Dermatologists  Digestive Disorders Foundation  Pathological Society  Sir Colin Dollery Clinical Pharmacology Award  Other (Please specify) |  |
| **Background information:** | Multiple Sclerosis (MS) is a chronic inflammatory demyelinating disease of the Central Nervous System (CNS). There is a wide disease spectrum with some patients developing more active or progressive forms. There are over twelve disease modifying therapies (DMTs) approved for relapsing-remitting MS which vary in efficacy. Higher efficacy DMTs reduce relapse activity by up to 70% however they are associated with increased risk of adverse effect which include some cancers and progressive multifocal leukoencephalopathy (PML). MS DMTs require long term monitoring and monitoring data is collected prospectively by the Belfast MS DMT co-ordinator. This complex treatment landscape is often difficult for patients to navigate and it is important that we undertake mitigation strategies to de-risk these treatments and better inform our patients. | | | |
| **Aims / objectives** | This project aims to determine the effectiveness and safety of high efficacy disease modifying treatments in the treatment of a cohort of multiple sclerosis patients attending the Regional MS clinic in the Belfast City Hospital. Using the Belfast MS DMT database, patients prescribed high efficacy DMTs for at least 12 months will be assessed for annualised relapse rate, disability scale (EDSS), DMT monitoring and any adverse effect associated with the treatment. This work will lead to a better understanding of the efficacy and safety profile of high efficacy DMTs in a local patient population and better inform future strategies to reduce risk. | | | |
| **Techniques employed:** | Literature review, data collection, dataset analysis, statistical analysis, presentation skills and manuscript preparation for publication. | | | |

**Projects Hosted by the Centre for Medical Education**

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| **Project Title** | **A qualitative study into the enablers and barriers for developing interprofessional simulation-based education** | | | |
| **Supervisor(s)** | Davina Carr, Gerry Gormley. Linda Ni Chianain and Alison Smart | | | |
| **School / Centre** | CME and SONM | | | |
| **Principal Supervisor’s Contact Details** | Email: g.gormley@qub.ac.uk | | Tel: | |
| **Degree Pathway for which project is suitable (**✓**)** | Medical Science | x |  | |
| Biochemistry |  |
| Microbiology |  |
| **Is project of suitable standard / subject for studentship application? (**✓**)** | *General awards*  Wolfson Foundation Award | x | *Subject-specific awards*  British Assoc Dermatologists  Digestive Disorders Foundation  Pathological Society  Sir Colin Dollery Clinical Pharmacology Award  Other (Please specify)  **InterSim Bursary** | X |
| **Background information:** | Collaborative practice is fundamental in delivering modern healthcare. However, more often undergraduate curricula are delivered unprofessionally – with limited Interprofessional learning opportunities.  Practical considerations (such as curricular alignment across different degree pathways) are often cited as barriers for developing IPE activities. Despite these practical barriers, many institutions have been able to deliver successful IPE activities for example Interprofessional Simulation based learning activities. We are keen to gain a deeper understanding of the enablers and qualities that permit such IPE – despite the many practical barriers.  A group of women standing around a patient in a hospital bed  Description automatically generated with low confidence | | | |
| **Aims / objectives** | To gain nuanced and practical insight into the enablers and barriers for implements IPE in simulation | | | |
| **Techniques employed:** | In order to address this research question, we will deploy an Interpretive Descriptive (ID) methodology. The successful candidate will receive training in qualitative research methods, how to conduct interviews and thematic analysis. We will conduct a series of qualitative interviews of members of staff (both academic and professional support staff) of successful simulation-based IPE activities at QUB. Interviews will be transcribed and analysed using thematic analysis, guided by an ID approach.  Members of the supervisory team have a track record of successfully supervising Intercalated BSc degree projects – that has resulted in publications, international presentations and prizes.  We invite you to join this innovative project that has the potential to have an impact in developing future Interprofessional simulation-based education activities. | | | |

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| **Project Title** | **Is Virtual Reality Acceptable and Effective as an Educational Tool?** | | | |
| **Supervisor(s)** | 1. Dr Michael Williams   2. | | | |
| **School / Centre** | SMDBMS/ Centre for Medical Education | | | |
| **Principal Supervisor’s Contact Details** | Email: [m.williams@qub.ac.uk](mailto:m.williams@qub.ac.uk) | | Tel: | |
| **Degree Pathway for which project is suitable (**✓**)** | Medical Science | X |  | |
| Biochemistry |  |
| Microbiology |  |
| **Is project of suitable standard / subject for studentship application? (**✓**)** | *General awards*  Wolfson Foundation Award | X | *Subject-specific awards*  British Assoc Dermatologists  Digestive Disorders Foundation  Pathological Society  Sir Colin Dollery Clinical Pharmacology Award  Other (Please specify) |  |
| **Background information:** | Virtual reality (VR) can offer experiences that are immersive, interactive and realistic, to varying degrees. The novelty of VR, and the degree of engagement possible, arouses great interest and excitement amongst new users. However, there is a learning curve about how to use the devices, and travel sickness like symptoms occur in a minority of users. Furthermore, evidence is lacking that VR can be effective as a learning tool.  This project will assess the acceptability and educational effectiveness of a VR app which simulates pupillary examination. A randomised controlled trial will be conducted, comparing traditional methods of learning how to examine pupils vs. learning using the VR app. A sample of healthcare students from various disciplines will be recruited, such as medical, nursing and optometry, and relevant validated outcomes used, such as OSCE stations marked by masked assessors, and questionnaires. The findings will be of interest to all those interested in the impact of technology on learning practices, and provide evidence of relevance for the real world. | | | |
| **Aims / objectives** | To determine the acceptability and effectiveness of virtual reality as an educational tool to learn pupillary examination | | | |
| **Techniques employed:** | Recruitment of participants, teaching use of VR, applying a questionnaire, organising and analysing data, scientific writing. | | | |

**Projects Hosted by the Centre for Public Health**

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| **Project Title** | **A Scoping Review of pregnancy and postpartum, including lactation, policies for cycling** | | | |
| **Supervisor(s)** | 1. Dr Neil Heron  2. | | | |
| **School / Centre** | Centre for Public Health | | | |
| **Principal Supervisor’s Contact Details** | Email: N.Heron@qub.ac.uk | | Tel: | |
| **Degree Pathway for which project is suitable (**✓**)** | Medical Science | x |  | |
| Biochemistry |  |
| Microbiology |  |
| **Is project of suitable standard / subject for studentship application? (**✓**)** | *General awards*  Wolfson Foundation Award | x | *Subject-specific awards*  British Assoc Dermatologists  Digestive Disorders Foundation  Pathological Society  Sir Colin Dollery Clinical Pharmacology Award  Other (Please specify) |  |
| **Background information:** | Exercise is generally safe during your pregnancy. Pregnant women should be aiming to do 150 minutes of moderate intensity exercise each week, including muscle strengthening activities at least twice per week. Cycling is an ideal form of moderate intensity exercise. However, participation in cycling events may pose a risk to both the mother and unborn child(ren). We therefore want to undertake a scoping review of pregnancy and postpartum policies to understand these risks versus benefits and start to guide policy in this area for competitive and recreational cycling. | | | |
| **Aims / objectives** | To undertake a scoping review of policies for competitive and recreational cycling during pregnancy and in the postpartum period to help develop policy in this area. | | | |
| **Techniques employed:** | A scoping review of pregnancy and postpartum policies in competitive and recreational cycling. This scoping review will follow the Arksey and O’ Malley (2005) and Levac (2010) frameworks. | | | |
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| **Project Title** | **A systematic review of concussion assessment in primary care and the community** | | | | |
| **Supervisor(s)** | 1. Dr Neil Heron  2. | | | | |
| **School / Centre** | Centre for Public Health | | | | |
| **Principal Supervisor’s Contact Details** | Email:  N.Heron@qub.ac.uk | | Tel: | | |
| **Degree Pathway for which project is suitable (**✓**)** | Medical Science | x |  | | |
| Biochemistry |  |
| Microbiology |  |
| **Is project of suitable standard / subject for studentship application? (**✓**)** | *General awards*  Wolfson Foundation Award | x | *Subject-specific awards*  British Assoc Dermatologists  Digestive Disorders Foundation  Pathological Society  Sir Colin Dollery Clinical Pharmacology Award  Other (Please specify) |  | |
| **Background information:** | A concussion or sports-related concussion (SRC), referred to as SRC throughout this application, “*is a traumatic brain injury induced by biomechanical forces.”(1)* The term SRC is sometimes used interchangeably with mild traumatic brain injury (mTBI), although SRC is a subset of mTBI. (2) SRCs are common, with one study in Ontario, Canada, reporting an average annual incidence of 1,153 per 100,000 residents (3), with another study reporting an annual 3.8 million mTBIs in the United States of America (4). SRCs can occur without an obvious head injury and are difficult to diagnose, with no exclusive test to make the diagnosis (5).  The Department of Digital, Culture, Sport and Media (DCMS) for the UK government, will be shortly releasing grassroots concussion diagnosis and management guidelines (6). As part of this guidance, doctors, particularly General Practitioners/GPs as frontline staff, will be asked to confirm the diagnosis and initiate appropriate management for concussed athletes. Thus, GPs need to be confident regarding SRC assessment, diagnosis and management, both acute and longer term. However no previous studies have assessed UK GPs’ knowledge of SRCs and previous studies have shown that healthcare professionals generally find this a challenging diagnose and do not feel confident in its management (7-10). Additionally, although SCAT5 (11) is a screening tool used for SRC diagnosis in sport, to be used within 72 hours of the concussive incident, there is no similar currently available tool for GPs to utilise within the office setting. | | | | |
| **Aims / objectives** | 1) To undertake a systematic review of the tools available for General Practitioners and community healthcare professionals to assess and diagnose concussion or sports-related concussion within the office and community setting. | | | | |
| **Techniques employed:** | Systematic review of the literature. | | | | |
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| **Project Title** | **Investigating genetic factors that affect serum antioxidants and influence cognitive outcomes using data from a double-masked randomised control trial of oral antioxidant supplementation.** | | | |
| **Supervisor(s)** | Dr Gareth McKay | | | |
| **School / Centre** | Centre for Public Health | | | |
| **Principal Supervisor’s Contact Details** | Email: g.j.mckay@qub.ac.uk | | Tel: | |
| **Degree Pathway for which project is suitable (**✓**)** | Medical Science | X |  | |
| Biochemistry | X |
| Microbiology |  |
| **Is project of suitable standard / subject for studentship application? (**✓**)** | *General awards*  Wolfson Foundation Award | X  X | *Subject-specific awards*  British Assoc Dermatologists  Digestive Disorders Foundation  Pathological Society  Sir Colin Dollery Clinical Pharmacology Award  Other (Please specify) | X |
| **Background information:** | Antioxidants are molecules that limit free radical-induced tissue damage. Free radicals commonly form during most cellular processes. However excess production can lead to oxidative stress and inflammation, characteristics typically associated with ageing and progression of many chronic diseases.  Serum antioxidants, like lutein (L) and zeaxanthin (Z), have been associated with improved brain and vision health in observational studies. These include antioxidant, anti-inflammatory and cholesterol-lowering activities. However, support from randomised control trials investigating antioxidant supplementation has been less convincing.  Previously, we identified single nucleotide polymorphisms (SNPs) in the *SCARB1* gene associated with serum antioxidants that attenuate levels by as much as 25% per susceptibility allele [1]. Despite the identification of SNPs associated with antioxidant levels, the status of these genetic variants has not been well considered in supplementation trials. Genetic variants related to absorption, and bioavailability post-ingestion, influence antioxidant levels in response to supplementation or dietary intervention, yet remain largely unconsidered, potentially leading to misleading study outcomes. Better-designed investigations that consider genetic variation in study participants will improve our understanding of antioxidant effects on inflammatory and oxidative stress and associated health outcomes, particularly in response to interventions that differ by supplementation type and dosing regimen.  The CARMA trial was a randomized controlled trial of oral supplementation with an antioxidant preparation versus placebo. The study was designed for all participants to have a minimum follow-up period of 1 year. Some participants were followed for up to 3 years. The active preparation consisted of a tablet taken twice daily to deliver a daily dose of 12 mg L, 0.6 mg Z, 15 mg d-α-tocopherol (vitamin E), 150 mg ascorbic acid (vitamin C), 20 mg zinc oxide (Zn), and 0.4 mg copper gluconate. The preparation is commercially available under the trademark Ocuvite (Bausch and Lomb, Berlin, Germany). The placebo consisted of cellulose, lactose, and magnesium stearate and was manufactured to be indistinguishable from the active preparation in size, colour, smell, and taste. Blood samples were acquired at baseline and at each 6 monthly follow-up visit. Serum antioxidant data and DNA was available for 300 study participants divided equally between intervention and placebo arms. Genetic data was not considered in the original study outcomes [2] but is now available.  Separately, the PRIME study [3] prospectively evaluated 2,010 men aged 58-74 years in Northern Ireland for more than 25 years of follow-up. Participants had a broad range of health outcomes measured at study entry, including cognitive assessment, and were follow-up annually. Serum antioxidant measures and SNP data for *SCARB1* and other genes associated with antioxidant concentration are available for study participants. 25 year follow-up cognitive assessment data is also available which will enable identification of associated genetic variants with serum antioxidant levels and declining cognitive function.  The findings from this project will inform future supplementation and dietary intervention studies for multiple disease outcomes, particularly declining cognitive function.  **References**   1. **McKay GJ**, et al. Investigation of genetic variation in scavenger receptor class B, member 1 (SCARB1) and association with serum carotenoids. Ophthalmology. 2013 Aug;120(8):1632-40. 2. Beatty S, et al. Secondary outcomes in a clinical trial of carotenoids with coantioxidants versus placebo in early age-related macular degeneration. Ophthalmology. 2013 Mar;120(3):600-606. 3. **McKay GJ**, et al. Association of low plasma antioxidant levels with all-cause mortality and coronary events in healthy middle-aged men from France and Northern Ireland in the PRIME study. Eur J Nutr. 2021 Aug;60(5):2631-2641. | | | |
| **Aims / objectives** | 1. Identify associations between *SCARB1* SNPs and serum antioxidant levels in supplemented and non-supplemented CARMA study participants. 2. Investigate associations between *SCARB1* SNPs and serum antioxidants with cognitive outcomes in the PRIME study participants using 25 year follow-up data. | | | |
| **Techniques employed:** | 1. Preparation of samples for genotyping. 2. Simple and descriptive statistical testing to investigate associations between genetic variants and serum antioxidant concentration, with adjustment for potential confounding factors using regression analyses. 3. Investigation of serum antioxidant concentration and associated genetic variants with cognitive outcomes using prospective data. | | | |
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| **Project Title** | **Why do kidney transplants fail so early in young people?** | | | |
| **Supervisor(s)** | 1. Dr Gareth McKay1 (Senior Lecturer)  2. Dr Michael Corr1,2 (Clinical Fellow- Nephrology Registrar) | | | |
| **School / Centre** | 1. Centre for Public Health 2. Regional Nephrology and Transplant Centre, Belfast City Hospital | | | |
| **Principal Supervisor’s Contact Details** | Email: g.j.mckay@qub.ac.uk | | Tel: | |
| **Degree Pathway for which project is suitable (**✓**)** | Medical Science | X |  | |
| Biochemistry | X |
| Microbiology | X |
| **Is project of suitable standard / subject for studentship application? (**✓**)** | *General awards*  Wolfson Foundation Award | X | *Subject-specific awards*  British Assoc Dermatologists  Digestive Disorders Foundation  Pathological Society  Sir Colin Dollery Clinical Pharmacology Award  Other (Please specify) |  |
| **Background information:** | Kidney transplantation is the best form of treatment for young people with end stage renal disease (ESRD). Not only does it have a transformative impact on their quality of life, it dramatically reduces morbidity and mortality. In the last 20 years, over 300 young people have received a renal transplant in Northern Ireland (NI). Unfortunately, young recipients often lose their transplant much earlier than expected. Why transplant failure is more common in young people remains unclear.  This study will characterise transplant loss in young renal transplant recipients in NI and assess epidemiological associations with long-term outcomes. Understanding why young recipients lose their transplant at higher rates will inform health services and interventions to prevent early loss of kidney transplants. | | | |
| **Aims / objectives** | 1.) Compare the incidence of transplant graft loss in Adolescent / Young Adult (A/YA) to the wider transplant population in NI.  2.) Identify the disease aetiology of NI A/YA recipients returned to ESRD i.e. acute kidney injury, immunological injury, disease recurrence  3.) Investigate key demographic details with long-term transplant outcomes in this population (such as, age of transplant, age of transition from paediatric to adult care, socioeconomic group etc.) | | | |
| **Techniques employed:** | The study population will be NI renal transplant recipients transplanted before the age of 30 from 2001-2021 inclusive. Data will be extracted from a prospective database of renal transplant recipients which is maintained by clinical staff in the Belfast Health and Social Care Trust (IRAS ID 239344, REC 18/NI/0004). This database contains demographic information such as age of transplantation, HLA matching and details of both donors and recipients. Additional data including subsequent outcomes (graft failure, mortality) will be ascertained from the electronic care record. Simple and descriptive bioinformatics statistical testing will investigate correlations between evidence of immunological injury and graft loss to determine associative links.  Students will be supported to transform their work into academic outputs e.g., poster presentations, oral presentations, and publications. They will benefit from having supervisors from both a scientific and clinical renal background. | | | |

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| **Project Title** | **Are major trauma patients, with a high injury severity score and no radiological evidence of head injury, being adequately followed up and supported by current services?** | | | |
| **Supervisor(s)** | 1. Dr Emma Cunningham (CPH) 2. Mr Owen Diamond (Orthopaedic Surgeon, RVH) | | | |
| **School / Centre** | SMDBS/Centre for Public Health | | | |
| **Principal Supervisor’s Contact Details** | Email:  Emma.cunningham@qub.ac.uk | | Tel: | |
| **Degree Pathway for which project is suitable (**✓**)** | Medical Science | x |  | |
| Biochemistry |  |
| Microbiology |  |
| **Is project of suitable standard / subject for studentship application? (**✓**)** | *General awards*  Wolfson Foundation Award | x | *Subject-specific awards*  British Assoc Dermatologists  Digestive Disorders Foundation  Pathological Society  Sir Colin Dollery Clinical Pharmacology Award  Other (Please specify) |  |
| **Background information:** | **Traumatic Brain Injury in Major Trauma**  Traumatic brain injury (TBI) refers to brain dysfunction as a result of external trauma. TBI accounts for a large proportion of morbidity and mortality associated with major trauma. A large proportion of major trauma involves a blunt force or deceleration injury which indicates high possibility of brain injury occurring. With this type of mechanism, shearing forces act upon the brain which can result in a diffuse injury that is not identified on CT imaging.  Traditionally, TBI with rapid recovery of obvious cognitive symptoms and negative CT imaging has been thought to predict full cognitive recovery. However, in recent years this hypothesis has been subject to increasing scrutiny. A single traumatic event, resulting in a mild traumatic brain injury has been associated with long-term sequelae including headaches, fatigue and cognitive issues, with the incidence of these sequelae increasing for moderate and severe brain injuries. A recent meta-analysis demonstrated approximately half of patients with mild brain injury suffered with long term cognitive impairment. Cognitive dysfunction following traumatic brain injury has also been linked to poor functional outcomes. Patients have greater difficulties in maintaining relationships, finding and maintaining employment and pursing leisure activities. Patients also see higher incidence of depression and anxiety.  When considering the high forces that are often involved in major trauma it is theorised that there is likely to be a subset of patients, who sustain mild, moderate or severe brain injury, but have no evidence of TBI on CT imaging. These patients with CT-negative head injury, are at high risk of cognitive sequelae and currently may not be followed up or given appropriate neurological support by our service. This project would be a Service Evaluation, to identify the proportion of patients not adequately diagnosed and managed by the current standard of care for major trauma patients with CT-negative TBI. | | | |
| **Aims / objectives** | 1. Identify the proportion of major trauma patients, with a high injury severity score and normal brain CT. 2. Identify the proportion of these people who have unrecognised ongoing cognitive and social impairment, 6 months after their injury. 3. Identify within this subset of patients the impact on their quality of life. 4. Establish a process for early identification and support for these patients. | | | |
| **Techniques employed:** | **Methodology**  Patients will be identified from the patient’s admission data compiled by the Major Trauma Service Database at the Royal Victoria Hospital, Belfast, Northern Ireland.  Inclusion criteria:  - Aged 18-65 years old  - Admitted to Royal Victoria Hospital following a major trauma  - Injury severity score >15  - Admitted to ICU/HDU  - CT brain imaging during admission is negative for TBI  - >6 months post-injury  Exclusion criteria:  - Death (either during admission or subsequently)  - Previous or subsequent CT evidence of traumatic brain injury  - Diagnosis of degenerative brain disease  - History of Cerebral Vascular Accident  Once the patient group has been identified, Electronic Care Records (ECR) and IntelliSpace Critical Care & Anaesthesia (ICCA) systems will be used to gather admission data on each patient. Specifically to identify:  - Mechanism of injury  - Injuries sustained  - Surgical and anaesthetic interventions  - Evidence of head trauma (Facial & superficial head injuries)  - Glasgow Coma Scale (GCS) at the scene, arrival in Emergency Department, and any other subsequent episodes of GCS <14 not associated with sedation.  - GCS prior to any intubation  - Length of stay in ICU/HDU  - Length of admission  - Discharge destination  - Whether the patient received any clinical psychology input  - Any litigation or criminal proceedings following the event  If the above data is unavailable via the ECR or ICCA system then paper notes will be requested and used for data collection.  It is intended that this project would form the first, identify and understand, stage of the evaluation cycle proposed by the NHS Evaluation Toolkit. | | | |