Centre for Experimental Medicine

<table>
<tr><td>Project Title</td><td colspan="4">Analysis of Lung Clearance Index data in bronchiectasis MRC Bronch-UK Clinimetrics study</td></tr>
<tr><td>Supervisor(s)</td><td colspan="4">1. Prof Judy Bradley Judy.bradley@qub.ac.uk
2. Dr Katherine O'Neill k.oneill@qub.ac.uk</td></tr>
<tr><td>School / Centre</td><td colspan="4">Clinical Research Facility, Centre for Experimental Medicine, School of Medicine, Dentistry and Biomedical Science</td></tr>
<tr><td>Principal Supervisor's Contact Details</td><td colspan="2">Email: k.oneill@qub.ac.uk</td><td colspan="2">Tel:</td></tr>
<tr><td rowspan="3">Degree Pathway for which project is suitable (✓)</td><td>Medical Science</td><td>X</td><td colspan="2" rowspan="3"></td></tr>
<tr><td>Biochemistry</td><td></td></tr>
<tr><td>Microbiology</td><td></td></tr>
<tr><td>Is project of suitable standard / subject for studentship application? (✓)</td><td>General awards

Wolfson Foundation

Jean Shanks Foundation</td><td></td><td>Subject-specific awards

British Assoc Dermatologists

Digestive Disorders Foundation

Pathological Society

Other ……</td><td></td></tr>
<tr><td>Background information:</td><td colspan="4">Lung clearance index is an emerging outcome measure that is increasingly being used in respiratory clinical trials and also in some clinical sites to explore early lung disease.

The supervisors on this project have LCI from a multicentre trial of up to 600 datasets in total. This full dataset will be available for analysis in Sept 2019.

A recent paper Jensen et al 2016 PLOS ONE 11(6), 1-9, have developed a checklist and stepwise approach to facilitate the review of each lung clearance index trial. These approaches include assessment of quantitative criteria as well as qualitative criteria. A proportion of this LCI dataset has been assessed for qualitative and quantitative quality in an interim analysis. This project will involve summarises the qualitative and quantitative quality for the whole dataset and also involve making comparisons with the interim data analysis.

This project has the potential to have an abstract output.</td></tr>
<tr><td>Aims / objectives</td><td colspan="4">The aim of this project will be to:
a. Become familiarised with the steps included in the qualitative and quantitative criteria as detailed by Jensen et al 2016.
b. Analyse the full MRC project dataset according to Jensen criteria.
c. Compare the Jensen quality assessment to the current quality assessment procedure used.
d. Compare the qualitative and quantitative quality for the whole dataset to the interim data analysis.</td></tr>
</table>

Techniques employed:	1. The student will have the opportunity to work on a MRC funded study and exposure to studies conducted within the clinical trial research facility. 2. The student will become familiarised with lung clearance index which is a novel lung function measurement and increasingly being used as an important outcome in clinical trials. 3. The student will gain experience of how data is collected in multicentre clinical trials and transferred electronically to central sites. 4. The student will use a range of statistical techniques to summarise relevant data

<table>
<tr><td>Project Title</td><td colspan="4">Exploring the links between oral bacteria and cardiovascular disease</td></tr>
<tr><td>Supervisor(s)</td><td colspan="4">1. Dr Ikhlas EL karim
2. Professor Tim Curtis</td></tr>
<tr><td>School / Centre</td><td colspan="4">Centre for Experimental Medicine</td></tr>
<tr><td>Principal Supervisor's Contact Details</td><td colspan="2">Email: i.elkarim@qub.ac.uk;
t.curtis@qub.ac.uk</td><td colspan="2">Tel: Tel: 02890976026</td></tr>
<tr><td rowspan="3">Degree Pathway for which project is suitable (✓)</td><td>Medical Science</td><td>y</td><td colspan="2" rowspan="3"></td></tr>
<tr><td>Biochemistry</td><td>y</td></tr>
<tr><td>Microbiology</td><td>y</td></tr>
<tr><td>Is project of suitable standard / subject for studentship application? (✓)</td><td>General awards

Wolfson Foundation</td><td></td><td>Subject-specific awards

British Assoc Dermatologists

Digestive Disorders Foundation

Pathological Society

Other ……</td><td></td></tr>
<tr><td>Background information:</td><td colspan="4">Bacteria are the primary cause of infectious diseases; however, emerging evidence suggests that these organisms are also indirectly responsible for several non-infectious conditions including cardiovascular diseases. A strong body of evidence from epidemiological studies demonstrated a link between oral viridans group streptococci and cardiovascular diseases. These bacteria are shown to be associated with infective endocarditis, they are frequently detected in human atheromatous plaques and can invade vascular endothelium, but the mechanisms by which they contribute to the development of cardiovascular disease are not known. We hypothesis that oral streptococci possess the potential to cause inflammation involving endothelial cells and thereby contribute to the development of atherosclerosis.</td></tr>
<tr><td>Aims / objectives</td><td colspan="4">The aim of this project is to investigate the effects of streptococci infection on coronary endothelial cell inflammatory responses.</td></tr>
<tr><td>Techniques employed:</td><td colspan="4">Cultured human coronary endothelial cells will be infected with streptococci at different multiplicities of infection and inflammatory responses determined by inflammatory cytokines release and response of endothelial cells to their agonists in presence/absence of infection. The successful student will have the opportunity to learn a range of skills including, cell culture, ELISA assays and calcium imaging. The project capitalises on the expertise of the supervisors in dentistry and cardiovascular research and is expected to generate new insights into how oral health affects the cardiovascular system.</td></tr>
</table>

<table>
<tr><td>Project Title</td><td colspan="4">INVESTIGATING THE INFLUENCE OF OXIDATIVE STRESS ON ENDOTHELIAL PROGENITOR CELL FUNCTION</td></tr>
<tr><td>Supervisor(s)</td><td colspan="4">1. Dr David Grieve
2. Dr Karla O'Neill</td></tr>
<tr><td>School / Centre</td><td colspan="4">SMDBS / Centre for Experimental Medicine</td></tr>
<tr><td>Principal Supervisor's Contact Details</td><td colspan="2">Email: d.grieve@qub.ac.uk</td><td colspan="2">Tel: 028 9097 6468</td></tr>
<tr><td rowspan="3">Degree Pathway for which project is suitable (✓)</td><td>Medical Science</td><td>✓</td><td colspan="2" rowspan="3"></td></tr>
<tr><td>Biochemistry</td><td></td></tr>
<tr><td>Microbiology</td><td></td></tr>
<tr><td>Is project of suitable standard / subject for studentship application? (✓)</td><td>General awards

Wolfson Foundation

Jean Shanks Foundation</td><td>

✓

✓</td><td>Subject-specific awards

British Assoc Dermatologists

Digestive Disorders Foundation

Pathological Society

Other ……</td><td></td></tr>
<tr><td>Background information:</td><td colspan="4">Impaired angiogenesis is known to influence the progression of ischaemic cardiovascular disease. 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 outgrowth endothelial colony-forming cells (ECFCs), with well-defined endothelial progenitor properties which promote new blood vessel formation in both health and disease. Oxidative stress, and specifically NADPH oxidases, are known to play a key role in cardiovascular disease and emerging evidence suggests that they may also regulate EPC function. Interestingly, we have shown that ECFCs are influenced by oxidative stress, display differential gene expression compared to mature endothelial cells, and are modulated by hypoxia which is a characteristic feature of the ischaemic microenvironment.</td></tr>
<tr><td>Aims / objectives</td><td colspan="4">This project therefore aims to investigate the specific influence of oxidative stress and NADPH oxidases on in vitro ECFC function. It is hoped that the results will identify key pathways which may become dysregulated in disease and could represent potential targets to enhance the reparative capacity of these cells and their clear potential for the treatment of ischaemic cardiovascular disease.</td></tr>
<tr><td>Techniques employed:</td><td colspan="4">In order to characterise the effects of oxidative stress and NADPH oxidases on ECFC function, studies will be undertaken in cultured cells treated with pro-oxidant compounds in the presence or absence of specific inhibitors of candidate pathways or after genetic manipulation. Expression of key signalling genes will be quantified by real-time RT-PCR and/or western blot and in vitro ECFC migration and proliferation assays will be performed to assess functional effects.</td></tr>
</table>

<table>
<tr><td>Project Title</td><td colspan="4">Identifying phenotypes of delirium in the critically ill based on biomarkers of inflammation</td></tr>
<tr><td>Supervisor(s)</td><td colspan="4">1. Danny McAuley

2. Cecilia O’Kane</td></tr>
<tr><td>School / Centre</td><td colspan="4">CEM</td></tr>
<tr><td>Principal Supervisor’s Contact Details</td><td colspan="2">Email:
d.f.mcauley@qub.ac.uk</td><td colspan="2">Tel:6385</td></tr>
<tr><td rowspan="3">Degree Pathway for which project is suitable (✓)</td><td>Medical Science</td><td>X</td><td colspan="2" rowspan="3"></td></tr>
<tr><td>Biochemistry</td><td>X</td></tr>
<tr><td>Microbiology</td><td></td></tr>
<tr><td>Is project of suitable standard / subject for studentship application? (✓)</td><td>General awards

Wolfson Foundation</td><td>X</td><td>Subject-specific awards

British Assoc Dermatologists

Digestive Disorders Foundation

Pathological Society

Other ……</td><td></td></tr>
<tr><td>Background information:</td><td colspan="4">Delirium in critically ill patients is associated with poor clinical outcomes. Neuroinflammation might be an important mechanism in the pathogenesis of delirium. Since simvastatin has anti-inflammatory properties it might reduce delirium. Therefore we undertook a randomized controlled trial (MoDUS) to investigate if simvastatin modifies duration of delirium in critically ill patients. Overall, compared to placebo, simvastatin did not reduce delirium (Lancet Respiratory Medicine 2017;5:727-737.).

Interestingly, previous studies in critically ill patients with the Acute Respiratory Distress Syndrome, many of who develop delirium (Lancet Respir Med 2014;2: 611–20) have identified two sub-phenotypes – a hyperinflammatory cohort and a less inflamed cohort – based on 3 variables: IL-6, sTNFr1 and need for vasopressors These cohorts had a differential response to simvastatin, with the hyper-inflamed cohort showing lower mortality with simvastatin (Lancet Respiratory Medicine 2018;6:691-698), a finding not seen in the less inflamed cohort.</td></tr>
<tr><td>Aims / objectives</td><td colspan="4">Using samples collected from the MoDUS trial, the aim of this project is to test the hypothesis that these two distinct sub-phenotypes are present in a critically ill population with delirium, and to assess the impact of simvastatin on the two cohorts in terms of the incidence and duration of delirium. This will be the first time this phenotyping has been applied to a cohort of critically ill patients with delirium.</td></tr>
<tr><td>Techniques employed:</td><td colspan="4">Clinical trials
Human blood and urine sample handling and processing
ELISA</td></tr>
</table>

<table>
<tr><td>Project Title</td><td colspan="4">Investigating the antimicrobial efficacy of Mesencyhmal Stromal cells on Mycobacterium abscessus</td></tr>
<tr><td>Supervisor(s)</td><td colspan="4">1. Cecilia O’Kane
2. Anna Krasnodembskaya
3. Tim Shaw</td></tr>
<tr><td>School / Centre</td><td colspan="4">Centre for Experimental Medicine, SMDBS</td></tr>
<tr><td>Principal Supervisor’s Contact Details</td><td colspan="2">Email:
c.okane@qub.ac.uk</td><td colspan="2">Tel:
02890976384</td></tr>
<tr><td rowspan="3">Degree Pathway for which project is suitable (✓)</td><td>Medical Science</td><td>✓</td><td colspan="2" rowspan="3"></td></tr>
<tr><td>Biochemistry</td><td></td></tr>
<tr><td>Microbiology</td><td>✓</td></tr>
<tr><td>Is project of suitable standard / subject for studentship application? (✓)</td><td>General awards

Wolfson Foundation</td><td>✓</td><td>Subject-specific awards

British Assoc Dermatologists

Digestive Disorders Foundation

Pathological Society

Other ……</td><td></td></tr>
<tr><td>Background information:</td><td colspan="4">Mesenchymal Stromal Cells (MSCs) are a type of “stem” cell derived from mature (not embryonic or fetal) tissue, that have been shown to have profound immunomodulatory and pro-reparative effects. This group is currently testing MSCs in a clinical trial for patients with pulmonary inflammation in the ICU setting. Recently MSCs have been shown to have potent anti-microbial activity against common Gram positive and negative organisms, but new data form this lab have shown they also direct kill and can enhance a human host’s own defence against mycobacteria particularly the non-tuberculous mycobacteria (NTM). Mycobacterium abscessus (M abscessus) is a multidrug resistant organism that causes chronic fatal infection in patients with structural lung disease. It is currently incurable. Mycobacteria can infect macrophages and inhibit the normal mechanisms by which a macrophage kills intracellular pathogens (including by preventing ROS generation and by inhibiting phagosome-lysosome fusion or acidification). Exciting data form this group indicate MSCs have some direct anti-M abscessus killing activity, and that MSCs enhance the killing of other intracellular mycobacteria. This project will investigate this direct killing effect further, confirming it with clinical isolates, but also assess the ability of MSCs to kill M abscessus that has been phagocytosed by macrophages. This work will therefore explore the therapeutic potential of MSCs as a treatment for M abscessus lung infection.</td></tr>
<tr><td>Aims / objectives</td><td colspan="4">1. Investigate direct killing effect of MSCs on M abscessus
2. Investigate the effect of MSC and their secretome on intracellular and extracellular bacterial counts, upon incubation of MSCs with infected Macrophages
3. Investigate the effect of microvesicles from MScs on M abscessus survival within infected macrophages
4. If time permits, explore the mechanisms of effect on intracellular pathogens by inhibiting mitochondrial transfer and exploring macrophage bioenergetics.</td></tr>
</table>

Techniques employed:	Macrophage isolation and culture Mycobacterial culture and quantification Microvesicle preparation Imaging (confocal) Seahorse technology for cellular respiration measures

<table>
<tr><td>Project Title</td><td colspan="4">LCI and shortened LCI as an outcome measure in exacerbations in bronchiectasis</td></tr>
<tr><td>Supervisor(s)</td><td colspan="4">1. Dr Katherine O'Neill
2. Prof. Judy Bradley</td></tr>
<tr><td>School / Centre</td><td colspan="4">CEM</td></tr>
<tr><td>Principal Supervisor's Contact Details</td><td colspan="2">Email:
k.oneill@qub.ac.uk</td><td colspan="2">Tel:
02890972082</td></tr>
<tr><td rowspan="3">Degree Pathway for which project is suitable (✓)</td><td>Medical Science</td><td>x</td><td colspan="2" rowspan="3"></td></tr>
<tr><td>Biochemistry</td><td></td></tr>
<tr><td>Microbiology</td><td></td></tr>
<tr><td>Is project of suitable standard / subject for studentship application? (✓)</td><td>General awards

Wolfson Foundation

Unclear but happy to be considered</td><td></td><td>Subject-specific awards

British Assoc Dermatologists

Digestive Disorders Foundation

Pathological Society

Other ……</td><td></td></tr>
<tr><td>Background information:</td><td colspan="4">A large dataset (n=50 at least) of lung function results using a novel outcome measure (lung clearance index) has been collected from patients with one specific respiratory condition (Bronchiectasis) during an exacerbation. Lung clearance index has been shown to be a reliable measure of lung disease severity in people with bronchiectasis however, there is less data on its responsiveness to IV antibiotics.

Implementation of this tool into clinical trials is challenging due to the length of time it takes to carry out. Further assessment of this dataset to determine the lung clearance index at an earlier time point in the test (i.e. shortened lung clearance index) and analysis to determine the comparative sensitivity of the shortened result compared to standard result over exacerbations. This data would yield an insight into the utility of this measure in monitoring these patients and in translating the measure from research into clinical practice. Analysis results would be suitable for abstract submission.</td></tr>
<tr><td>Aims / objectives</td><td colspan="4">To compare the responsiveness of LCI (LCI and shortened LCI) to spirometry during IV antibiotic therapy for an acute exacerbation of bronchiectasis.
To compare the responsiveness of LCI and shortened LCI to IV antibiotic therapy for an acute exacerbation of bronchiectasis.</td></tr>
<tr><td>Techniques employed:</td><td colspan="4">Observation of lung function and LCI
Analysis of LCI data
Excell database use and input and analysis of data
SPSS database use and data interpretation
Working in Clinical research facility environment
Abstract preparation
Working alongside Postdoc CEM and PI CEM</td></tr>
</table>

<table>
<tr><td>Project Title</td><td colspan="4">Intercellular communication in Cystic Fibrosis airways disease via exosomes</td></tr>
<tr><td>Supervisor(s)</td><td colspan="4">1. Dr BC Schock
2. Prof F Lundy</td></tr>
<tr><td>School / Centre</td><td colspan="4">Centre for Experimental Medicine</td></tr>
<tr><td>Principal Supervisor's Contact Details</td><td colspan="2">Email:
b.schock@qub.ac.uk</td><td colspan="2">Tel:
02890 972258</td></tr>
<tr><td rowspan="3">Degree Pathway for which project is suitable (✓)</td><td>Medical Science</td><td>✓</td><td colspan="2" rowspan="3"></td></tr>
<tr><td>Biochemistry</td><td>✓</td></tr>
<tr><td>Microbiology</td><td></td></tr>
<tr><td>Is project of suitable standard / subject for studentship application? (✓)</td><td>General awards

Wolfson Foundation</td><td>✓</td><td>Subject-specific awards
British Assoc Dermatologists
Digestive Disorders Foundation
Pathological Society
Other ……</td><td></td></tr>
<tr><td>Background information:</td><td colspan="4">Cystic Fibrosis (CF) lung disease is characterised by chronic hyper-activation of the innate immune response. Structure and function of the epithelium can be altered by local inflammatory/immune signals (epithelial remodelling) and we are particularly interested in the regulation for the NF-kB signalling pathway by the regulatory protein A20. A20 negatively regulates NF-kB signalling through inactivation of TRAF6 and RIPK1, but in CF epithelial cells, a lack of A20 contributes to the increased innate inflammatory response of the cells (Kelly et al. Eur Respir J 2013). Furthermore, miR125 has been found to reduce A20 expression and our preliminary data indicate a high miR125b expression in CF airway epithelial cell.
Cells do not only respond to environmental / exogenous stimuli, but also to intercellular communication. Exosomes are nano-vesicles that can be secreted and internalized by cells to transport cellular cargo, such as proteins, lipids, and miRNA (Gupta et al. AJRCMB 2018). However, the contribution of such cell communication system to the overall phenotype of the airway epithelium has not been investigated.</td></tr>
<tr><td>Aims / objectives</td><td colspan="4">We wish to investigate the content and function of exosomes from CF and non-CF airway epithelium, especially factors that can regulate inflammation.
a. Characterisation of exosome content after stimulation of LPS
b. Characterisation of exosome function by adding CF exosomes to non-CF cells (and vis versa) and determine their inflammatory response to LPS</td></tr>
<tr><td>Techniques employed:</td><td colspan="4">Using epithelial cells (cell lines) with and without a CFTR mutation, we will use the following techniques:
- Tissue culture and sterile working techniques
- Quantitative RT-PCR
- Isolation of exosomes by centrifugation
- Transferable skills (presentations/communication skills, organisation of work, working alone and in a team).</td></tr>
</table>

<table>
<tr><td>Project Title</td><td colspan="4">Regulation of inflammatory cells in the lung lining fluid: role of microRNA125</td></tr>
<tr><td>Supervisor(s)</td><td colspan="4">1. Dr BC Schock
2. Dr M Shyamsundar
3. Dr F Furlong (School of Pharmacy)</td></tr>
<tr><td>School / Centre</td><td colspan="4">Centre for Experimental Medicine</td></tr>
<tr><td>Principal Supervisor's Contact Details</td><td colspan="2">Email:
b.schock@qub.ac.uk</td><td colspan="2">Tel:
02890 972258</td></tr>
<tr><td rowspan="3">Degree Pathway for which project is suitable (✓)</td><td>Medical Science</td><td>✓</td><td colspan="2" rowspan="3"></td></tr>
<tr><td>Biochemistry</td><td>✓</td></tr>
<tr><td>Microbiology</td><td></td></tr>
<tr><td>Is project of suitable standard / subject for studentship application? (✓)</td><td>General awards

Wolfson Foundation</td><td>✓</td><td>Subject-specific awards
British Assoc Dermatologists
Digestive Disorders Foundation
Pathological Society
Other ……</td><td></td></tr>
<tr><td>Background information:</td><td colspan="4">Lung immune cells in the airway lining fluid are highly responsive to inhaled pathogens and irritants such as cigarette smoke. Such exposures leads to the activation of the innate immune response via pro-inflammatory NF-kB signalling and the NLRP3 inflammasome. The ubiquitination protein A20 is an important negative regulator of both these pathways, but A20, normally rapidly induced, but is reduced in many chronic inflammatory airways diseases and in patienst with chronic obstructive airway diseases (COPD).
Micro RNAs are small non-coding RNAs involved in the regulation of gene expression at posttranscriptional level. MiRs degrade their target mRNAs and/or inhibiting their translation. MiR125b is known to regulate A20 expression, but the content of miR125b in pulmonary immune cells is not known. Here, we wish to investigate bronchoalveolar lavage cells from Smokers and non-smokers exposed to bacterial LPS (to mimic acute airway inflammation.</td></tr>
<tr><td>Aims / objectives</td><td colspan="4">Here, we wish to investigate the expression of miR125b and A20 mRNA in bronchoalveolar lavage cells from smokers and non-smokers exposed to bacterial LPS (to mimic acute airway inflammation).</td></tr>
<tr><td>Techniques employed:</td><td colspan="4">Using bronchoalveolar lavage cells from smokers and non-smokers exposed to bacterial LPS the student will employ the following techniques:
- Isolation of total RNA (TriZol)
- Quantitative RT-PCR for A20 and miR125b
- Transferable skills (presentations/communication skills, organisation of work, working alone and in a team).</td></tr>
</table>

Centre for Public Health

<table>
<tr><td>Project Title</td><td colspan="4">Evaluation of antioxidant status with renal function in the Prospective Study of Myocardial Infarction (PRIME)</td></tr>
<tr><td>Supervisor(s)</td><td colspan="4">1.Dr Gareth McKay
2. Professor Jayne Woodside</td></tr>
<tr><td>School / Centre</td><td colspan="4">Centre for Public Health</td></tr>
<tr><td>Principal Supervisor's Contact Details</td><td colspan="2">Email: g.j.mckay@qub.ac.uk</td><td colspan="2">Tel: 028 9097 8958</td></tr>
<tr><td rowspan="3">Degree Pathway for which project is suitable (✓)</td><td>Medical Science</td><td>✓</td><td colspan="2" rowspan="3"></td></tr>
<tr><td>Biochemistry</td><td>✓</td></tr>
<tr><td>Microbiology</td><td>✓</td></tr>
<tr><td>Is project of suitable standard / subject for studentship application? (✓)</td><td colspan="2">General awards

Wolfson Foundation</td><td colspan="2">Subject-specific awards

British Assoc Dermatologists

Digestive Disorders Foundation

Pathological Society

Other ……</td></tr>
<tr><td>Background information:</td><td colspan="4">The PRIME study included 10,600 men aged 50–59 years examined in 1991–1994 in Northern Ireland (NI) and France and followed annually for deaths and cardiovascular events for 10 years. Chronic kidney disease (CKD) progression is associated with increasing oxidative stress. However, the majority of studies have investigated endogenous antioxidants in the later stages of disease. High performance liquid chromatography was used to quantify serum levels of vitamin C, retinol, α-tocopherol, γ-tocopherol and six carotenoids (α-carotene, β-carotene, β-cryptoxanthin, lutein, lycopene and zeaxanthin) in participants of the PRIME study. Measures of renal (Cystatin C) and liver (Bilirubin) function were also obtained in a sub-group of 1000 study participants. This project will evaluate antioxidant levels in study participants with respect to their renal function to determine whether lower antioxidant levels are associated with poorer kidney function with adjustment for potential confounding factors. Measures of liver function, where many antioxidants are metabolised, will be considered within the analysis to determine if liver function can modify antioxidant influences.</td></tr>
<tr><td>Aims / objectives</td><td colspan="4">The objective of this study is to evaluate serum dietary antioxidants and their association with renal and liver function in a nested cross-sectional analysis of the PRIME study participants.</td></tr>
<tr><td>Techniques employed:</td><td colspan="4">This project will require a literature review and an understanding of the subject area.
Appropriate statistical approaches will be used to evaluate associations while adjusting for potential confounders. This will necessitate an understanding of the statistical package SPSS. Syntax codes are available.
A manuscript outlining the key study findings will be submitted for publication.</td></tr>
</table>

Centre for Biomedical Science Education and RISUS (Rugby Injury Surveillance in Ulster Schools) Project

(Note; 2 projects available under general description below)

<table>
<tr><td>Project Description

Title</td><td colspan="4">Prevalence of concussive injuries in schoolboy rugby players, with a view to identifying and modifying the link between previous concussion and increased musculoskeletal injury risk/neuromuscular and attentional deficit

Reducing musculoskeletal injury and concussion risk in schoolboy rugby players with a comprehensive neuromuscular control rehabilitation return to play protocol</td></tr>
<tr><td>Supervisor(s)</td><td colspan="4">1. Mr. Pooler Archbold (RISUS (Rugby Injury Surveillance in Ulster Schools) Group)
2. Dr. Sean Roe (Centre for Biomedical Sciences Education QUB)</td></tr>
<tr><td>School / Centre</td><td colspan="4">Centre for Biomedical Sciences Education/Ulster University</td></tr>
<tr><td>Principal Supervisor's Contact Details</td><td colspan="2">Email: poolerarchbold@aol.com
s.roe@qub.ac.uk</td><td colspan="2">Tel: 02890972640</td></tr>
<tr><td rowspan="3">Degree Pathway for which project is suitable (✓)</td><td>Medical Science</td><td></td><td colspan="2" rowspan="3"></td></tr>
<tr><td>Biochemistry</td><td></td></tr>
<tr><td>Microbiology</td><td></td></tr>
<tr><td>Is project of suitable standard / subject for studentship application? (✓)</td><td>General awards

Wolfson Foundation

Jean Shanks Foundation</td><td></td><td>Subject-specific awards

British Assoc Dermatologists

Digestive Disorders Foundation

Pathological Society

Other ……</td><td></td></tr>
<tr><td>Background information:</td><td colspan="4">Recent systematic review evidence suggests athletes who sustain a concussion appear more to likely to sustain a subsequent musculoskeletal injury in the subsequent year. Whilst the underlying mechanisms are unknown, one contributing factor could be the persistence of neuromuscular control deficits post-concussion despite players passing standard clinical concussions test.

International consensus on concussion in sport advocate gait and balance assessments should be included as part of a detailed neurological examination of concussion. One such standard assessment is the Balance Error Scoring System (BESS) that forms part of the sport concussion assessment tool fifth edition (SCAT5). Most athletes are able to achieve their baseline BESS values within 3–5 days post-concussion, more often with the continued presence of other concussion-related symptoms. Such assessment tools and balance tasks may impose far less challenging neuromuscular demands than what is likely required during most athletic activities. As such, athletes who continue to have subtle deficits that are not detected by traditional clinical neurocognitive and static balance tests of neuromuscular control may be returned to play under standard clinical guidelines. Recent studies with rigorous methods have continued to show sub-clinical deficits post-concussion, even at the point of or after athletes are allowed to resume full athletic participation. These persistent deficits have the potential to be exacerbated in a dynamic and cognitively challenging environment, in sports such as rugby.</td></tr>
</table>

	Rugby players must properly distribute their attention across various stimuli, select appropriate motor responses, coordinate their response to those stimuli and rapidly perform, assess and regulate the implementation of their response. These rapid sequences must be performed while allocating attentional focus among rapidly evolving phases on the field during play all the while being exposed to high impact forces. Recent studies utilising computerized tests have identify deficits in abilities such as task switching and conflict resolution post-concussion. Several studies reported that during dual-task conditions, gait performance variables continued to show significant deficits relative to controls for a longer period of time than other clinical measures, such as symptom resolution. Other studies suggest concussion negatively affects attentional distribution abilities that are necessary during dual tasks, such that one or both tasks will notably deteriorate. Thus the cognitive challenges posed on the field may result in detrimental effects on an athlete's neuromuscular control due to the athlete's inability to effectively divide their attention between different types of stimuli. Neuromuscular control can modulate the risk of experiencing a musculoskeletal injury among athletes independent of a concussion. A study on adolescent athletes found that those who returned to play post concussion displayed deteriorating ability to maintain dynamic stability during dual-task gait, despite no increase in other symptoms. Among collegiate and elite athletes, those who sustained a concussion displayed persistent gait deficits even after being evaluated and determined by a physician to be fully recovered from the injury based on symptom report and neurocognitive testing. Evidence suggests those sustained a concussed and return to play once cleared rates were 2.48-3.39 times greater risk of sustaining a lower extremity injury over a 90-day period compared to control athletes. Thus the presence and persistence of neuromuscular control deficits after a concussion may be associated with an increased injury risk, and potentially subsequent concussions. Whilst studies investigating dual-task gait tests have highlighted deficits, instrumented assessments of gait or neuromuscular control are not used in a widespread fashion. This could be due to a variety of factors, such as instrument cost, access, space, or personnel necessary to operate such protocols. There is a need to develop and test feasible and applicable dual-task tests (cognitive and neuromuscular control challenges) to help clinicians identify those who are at risk for another injury after a concussion. Such tests need to simulate the dynamic nature of a sports environment, such as rugby and include measures of functional movement and musculoskeletal injury risk.
Aims/objectives	The aims of this project are to (i) develop a standardised battery of feasible dual-task assessment tools to supplement the current SCAT5, (ii) investigate if neuromuscular control and attentional deficits are present in those who have suffered a previous concussion compared to those who haven't in adolescent rugby players prior to commencement of their playing season, (iii) monitor school boy rugby teams for a

	season for the occurrence of concussion and musculoskeletal injuries, and (iv) evaluate the recovery of neuromuscular and attentional systems in those who sustain a concussion during the playing season.
Experiments	The role as medical students involves gathering data relating to injury incidence by travelling to schools across Ulster and surveying adolescent players about their injury history and therefore we are an essential part in data capture for the completion of the project. Once the data has been gathered from the various schools involved, you will be involved in collating raw data together and integrating the writing up process, bringing together data and interpreting the meaning behind the results with regards to injury prevention.