Nottingham Trent University

Graduate School

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Graduate School

School of Science and Technology

PhD Projects – 2016

Broad area of research – Sport Science

Welcome to the Nottingham Trent University Graduate School

The Graduate School provides a supportive environment and a thriving research culture that encourages you to reach your full potential as a research degree student.

Valuing ideas, enriching society

We encourage new ideas and new ways of thinking across the whole University through a culture of discovery and innovation. We believe our research has the potential to impact the world we live in and change lives.

Research excellence

Our research is recognised across the world. In the most recent Research Excellence Framework (Ref 2014) most of our research was considered internationally-excellent or world-leading.

The University is committed to developing and expanding its activity to increase the scope, quality and impact of our research.

Be part of our research

With MPhil, PhD and Professional Doctorate research degree opportunities across each of our academic schools, we support students conducting research in a diverse range of areas. Our research students form an important part of our research community and make a significant contribution to our activity.

We offer full-time, part-time and distance learning research degree opportunities.

Our Professional Doctorates offer you the opportunity to contribute to research in your profession while attaining a research qualification.

A supportive community

We are committed to supporting and developing our research students.

You will have academic, administrative and personal support throughout your studies and access to dedicated workspace and exceptional facilities.

Excellent support throughout your studies

The Graduate School aims to provide excellent personal and practical assistance for our research students creating a supportive and pro-active environment.

Support and guidance

Your main source of advice and support will be your own doctoral supervisory team, which will include a director of studies and at least one other supervisor. This team will be selected based on their experience in your chosen area of study or their background in relevant practice.

The Graduate School Team will be available throughout your studies. Our dedicated team will offer advice and guidance for your initial enquiry and application and introduce you to the University and to your supervisory team.

Outstanding facilities

As a research student at NTU you will have access to a wealth of facilities and resources to aid and enhance your studies. The University is committed to providing the best possible facilities for all its students and we are constantly investing in new facilities and learning environments.

Dedicated study areas

All our research students are able to use study and writing areas giving you access to desks, laboratories and IT facilities when you need it.

Learning resources

Students at Nottingham Trent University have access to a wealth of library materials including over 480,000 books and 1,300 printed journals, as well as an extensive audio-visual collection of DVDs, videos and slides.

Electronic library resources are an increasingly important part of the support offered to research students, and more than 290 databases and 17,000 eJournals are accessible from any networked PC within NTU, or from your home or off-campus PC.

Our experienced and knowledgeable library staff will help guide you to the most useful sources of information.

Developing the next generation of researchers

We aim to nurture research talent and help our students thrive through their research degrees and into their future careers.

Researcher Development Programme

All research students are expected to participate in a rolling programme of professional development. You will have the opportunity to attend a range of workshops and developmental activities mapped to the Vitae Researcher Development Framework (RDF).

Our Research Development Programme empowers you – in discussion with your supervisory team – to create an individualized package of activities to support your career development as a researcher.

A range of core activities will support your journey from enrolment at NTU as a research student, through to final submission of your thesis. These activities will be complemented by a series of electives that you will choose to pursue, depending upon your developmental needs as you progress in your research work.

Developing your career

We pride ourselves on equipping our students with knowledge and skills and encouraging initiative, innovation and excellence.

Our research students are encouraged to take part in conferences, seminars and external networks. These are an excellent opportunity for you to share your work, meet other researchers and build a network of contacts.

Our own research conferences and seminars offer you the opportunity to present and discuss your work among the NTU research community.

You may also have the opportunity to teach undergraduate students or supervise laboratory work.

School of Science and Technology

Research in the School of Science and Technology is rich and diverse, with staff conducting internationally recognised and world-leading research. Research is clustered in Research Centres and units, providing a focus for different themes with their underpinning platforms:

• **Biomedical Sciences and the John Van Geest Cancer Research Centre**

Internationally excellent research environment – Our Biomedical Research is world-leading and involves staff with broad academic backgrounds, including Biochemistry, Bioinformatics and Biomathematics, Analytical/Synthetic Medicinal Chemistry, Immunology, Microbiology and Pharmacology. In the recent REF2014 assessment (http://www.ref.ac.uk/) of University research quality the Biomedical Sciences Research Unit's submission (to UoA A03) was highly rated, having 86% of overall activity at the highest 3* (internationally excellent) and 4* (world-leading) grades. This included achieving 100% of its impact at 3* and 4* levels.

• **Materials and Engineering**

Internationally excellent research environment – Our multidisciplinary Materials and Engineering Research is extremely strong in terms of high quality outputs, income generation, and international impact. In the recent REF2014 assessment of University research quality our Materials and Engineering Unit's submission (to UoA B15) was highly rated, having 84% of overall activity at the highest 3* (internationally excellent) and 4* (world-leading) grades. This included achieving a joint 7th rank out of 62 submitted UK institutions for the quality of our publications, which were judged as attaining 94.6% at 3* and 4* levels.

• **Computing and Informatics**

Internationally excellent research impact- The multi-disciplinary research is directed to address important questions and is clustered under three themes: Interactive Systems for cognitive and physical rehabilitation and mental wellbeing; Computational Intelligence and Applications for computationally intelligent methods and techniques; and Intelligent simulation, modelling and networking. In the recent REF2014 assessment of University research quality the Computing and Informatics Research Unit's submission (to UoA B11) was highly rated achieving 80% of its impact at 4* and 3* levels.

• **Sport, Health and Performance Enhancement (SHAPE) Research Centre**

Internationally excellent research outputs- In the recent REF2014 assessment (http://www.ref.ac.uk/) of University research quality the Sport Sciences Research Unit's submission (to UoA C26) was highly rated, having 94% of the outputs rated at the 3* (internationally excellent) and 2* (internationally recognised) grades. Our Sports Science research is multi-disciplinary and is clustered under a number of themes, driven by the Musculoskeletal Physiology, Sports Performance, Exercise and Health and Sport in Society Research Groups.

Research themes and areas

These research units promote the research excellence and facilities within the School, and stimulate knowledge transfer, innovation and exploitation. They provide strategic direction in research planning and portfolio development, and ensure that mechanisms are in place to nurture research.

List of available projects and a summary description of them are provided in the following research categories.

- Biomedical Sciences and the John Van Geest Cancer Research Centre
- Computing and Informatics
- Materials and Engineering
- Sport, Health and Performance Enhancement Research Centre

Or they can be searched based on the following academic Departments.

- Biomedical and Biological Sciences
- Chemistry and Forensic Sciences
- Computing and Technology
- Physics and Mathematics, and
- Sport Science

Project Titles (descriptions below)

1. Dr. Cleveland Barnett - Gait and Balance in Lower Limb Amputees: Improving Function, Reducing Injury

2. Dr. Richard Foster - Biomechanical Biomarkers for the Diagnosis and Monitoring of Disease: The Bio-Diamond Project

3. Dr. Michael Johnson - Targeting inflammation in COPD using dietary supplementation with prebiotic and probiotic

4. Dr. Michael Johnson - Dietary supplementation strategies to alleviate exercise-induced asthma

5. Dr. Michael Johnson - Resolving the mechanisms by which inspiratory muscle training improves exercise tolerance

6. Dr. Michael Johnson - Inspiratory muscle training and inflammation in patients with COPD

7. Dr. Martin Lewis - Biomechanical biomarkers to improve Injury diagnosis and Rehabilitation: The Bio-In-Rehab Project

8. Dr. John Morris - Effects of increased physical activity on health, cognitive and educational outcomes in boys

9. Prof. Craig Sale - The biological role of the histidine containing dipeptide carnosine in muscle

10. Prof. Craig Sale - The parathyroid hormone response to high-intensity exercise: a means to improve bone health

11. Dr. Mustafa Sarkar - The further development and validation of the Sport Resilience Scale (SRS)

12. Dr. Ian Varley - Genetic associations with changes in bone characteristics

1.
GAIT AND BALANCE IN LOWER LIMB AMPUTEES: IMPROVING FUNCTION, REDUCING INJURY

Amputation of the lower limb results in the loss of musculoskeletal structures that are vital for movement. The functions of these anatomical structures are partially replaced with prosthetic componentry. Despite a number of advances in prosthetic componentry, lower limb amputees have reduced joint mobility and strength. These issues are likely to have an adverse effect on amputees' ability to complete activities of daily living (ADL), such as walking, climbing stairs and maintaining balance on a moving bus. Around 20% of amputees fall during rehabilitation and around half of all community-living amputees reported to have fallen in the previous 12 months. Prosthesis users also have an increased fear of falling and reduced social participation as a result. This clearly highlights the significant impact amputation has on the individual. Previous research has tended to describe specific differences in selected biomechanical variables when comparing able-bodied individuals to lower limb amputees and state how amputees respond to artificial perturbations, varying prosthetic components and various movement tasks. However, the current project aims to use advanced biomechanical data acquisition and reduction processes to assess a wide array of biomechanical data within prospective study designs. This will allow us to uncover the most pertinent aspects of lower limb amputee gait and balance that result in increased function and/or reduced risk of injury due to instability and falls. By achieving this, targeted prosthetic and therapeutic interventions will be more effective, leading to reduced healthcare costs and improved patient satisfaction.

References

- Barnett, C. T., Vanicek, N and Rusaw, D. F. (2015). Does postural control predict falling and the fear of falling in lower limb amputees? Prosthetics and Orthotics International, 39(1S), 0313.
- Barnett, C. T., Polman, R. C. J. and Vanicek, N. (2014). Longitudinal changes in transtibial amputee gait characteristics when negotiating a change in surface height during continuous gait. Clinical Biomechanics, 29(7), 787-793.

Supervisor: Dr. Cleveland Barnett

Supervisor biogs

Prospective students will be supervised by Dr. Cleveland Barnett within the biomechanics group at NTU. Dr. Barnett collaborates with a number of colleagues in academia, clinical practice and industry on a wide range of projects related to lower limb amputee gait and balance. Dr. Barnett is currently supervising several postgraduate students, including four Ph.D students (two as DoS) and two M.Res students. Dr Barnett is a member of the biomechanics group, who have expertise in the assessment of clinical and sporting populations using both experimental and computational methods. The biomechanics group are housed in the biomechanics lab which is equipped with a 13-camera motion capture system, 5 force plates, wireless EMG, isokinetic dynamometer alongside various data acquisition and processing software programs such as Motion Genesis and Visual 3D.

Entry requirements
In order to be eligible to apply, you must hold, or expect to obtain, a UK Master's degree (or UK equivalent according to NARIC) with a minimum of a merit, and/or a UK 1st Class/2.1 Bachelor's degree (or UK equivalent according to NARIC) in **Biomechanics/Bioengineering or a related discipline.**

Contact: Cleveland.barnett@ntu.ac.uk for informal discussions.

2.
BIOMECHANICAL BIOMARKERS FOR THE DIAGNOSIS AND MONITORING OF DISEASE: THE BIO-DIAMOND PROJECT

Biomarkers have long been used to characterise the status of cells, organs and whole organisms. Using biomarkers to quantitatively assess and predict changes in the status of these structures is a powerful tool and allows for greater insight into their functioning. When applied to humans and their movement, biomarkers have the potential to significantly impact on prognosis, diagnosis and treatment strategies for improving healthcare. The presence and severity of physical and mental diseases, such as Parkinson's, dementia and stroke have been acutely reflected in biomechanical data recorded as individuals attempt to complete activities of daily living such as walking, climbing stairs and grasping objects (Salbach et al., 2001; Albert et al., 2012; Novak and Brouwer, 2012). This suggests that advanced biomechanical assessment tools and data reduction procedures are sufficiently sensitive to distinguish between and within disease states. Through performance-based investigations, biomechanical data may be able to diagnose the presence of previously undetected disease and/or track the progression of disease and subsequent treatment effects. Also, using this advanced biomechanical data to validate more freely available data from widely available, cheap and accessible devices, such as iPhones, would allow for 'online' healthcare monitoring. This technological approach to healthcare would speed up the diagnosis and treatment strategies of disease, improving patients' welfare as well as the efficiency of healthcare services. The World Health Organisation has identified the need for this assistive technology approach to healthcare with its Global Cooperation on Assistive Technology (GATE) initiative. The GATE initiative aims to improve access to essential, high-quality, safe, effective and affordable assistive technology and medical products, and the proposed project will help to achieve this goal.

References

- Albert, F., Diemayr, D., McIsaac, T.L., & Gordon, A.M. (2010). Coordination of grasping and walking in Parkinson's disease. Experimental Brain Research, 202 (3), 709-721.
- Salbach, N.M., Mayo, N.E., Higgins, J., Ahmed, S., Finch, L.E., & Richards, C.L. (2001). Responsiveness and predictability of gait speed and other disability measures in acute stroke. Archives of physical medicine and rehabilitation, 82 (9), 1204-1212.
- Novak, A.C., & Brouwer, B. (2012). Strength and Aerobic Requirements During Stair Ambulation in Persons With Chronic Stroke and Healthy Adults. Archives of Physical Medicine and Rehabilitation, 93 (4), 683–689.

Supervisors: Dr. Richard Foster

Supervisor biogs

Prospective students will be supervised by members of the biomechanics group at NTU, who are currently supervising a number of postgraduate students including 4 Ph.D students and three M.Res students. The biomechanics group have expertise in the assessment of clinical and sporting populations using both experimental and

computational methods. The biomechanics group undertake research from their excellent biomechanics laboratory which is equipped with a 13-camera motion capture system, 5 force plates, wireless EMG, isokinetic dynamometer alongside various data acquisition and processing software programs such as MatLab, Motion Genesis, Visual 3D and OpenSim. As a prospective student you will will receive extensive training and support and will be expected to present work of international relevance through peer reviewed publications and presentation at international conferences.

Entry requirements
In order to be eligible to apply, you must hold, or expect to obtain, a UK Master's degree (or UK equivalent according to NARIC) with a minimum of a merit, and/or a UK 1st Class/2.1 Bachelor's degree (or UK equivalent according to NARIC) in **Biomechanics/Bioengineering or a related discipline.**

Contact: Richard.foster@ntu.ac.uk for informal discussions.

3.
TARGETING INFLAMMATION IN COPD USING DIETARY SUPPLEMENTATION WITH PREBIOTIC AND PROBIOTIC

Chronic obstructive pulmonary disease (COPD) is responsible for early mortality, high death rates, low quality of life and significant socioeconomic burden, and predictions indicate that in 2020 COPD will be the third leading cause of death worldwide (from sixth in 1990) (Raherison and Girodet 2009). Inflammation is a predominant feature of COPD that underpins the progressive nature of the disease (Caramori et al. 2014) and, therefore, interventions that target the underlying inflammation and immune function are of utmost importance. There is growing evidence that the intestinal microbiota has a significant impact on systemic immune function and inflammation (Hormannsperger et al. 2012). Modifying the gut microbiota through dietary supplementation (e.g. prebiotic / probiotic / symbiotic ingestion) thus represents a promising non-pharmacological approach to improve immune function and attenuate the inflammation that underpins COPD. This is especially important to COPD patients that receive frequent antibiotic therapy, which causes a marked detrimental disturbance in the intestinal microbiota (Koning et al. 2010). Recent work in our laboratory (presented at the 2014 European Respiratory Society Lung Science Conference; full manuscript in preparation) has demonstrated an attenuated inflammatory response to a breathing challenge, and improved lung function, in adults with asthma after prebiotic supplementation. It is thus also attractive to hypothesise that dietary modification of the intestinal microbiota may improve immune function and attenuate the systemic inflammation that underpins COPD. This project will explore the effects of modifying the intestinal microbiota, using prebiotic / probiotic / symbiotic ingestion, on immune function and systemic inflammation in COPD.

References

- Mills DE et al. (2014). Influence of oxidative stress, diaphragm fatigue and inspiratory muscle training on the plasma cytokine response to maximum sustainable voluntary ventilation. Journal of Applied Physiology, 116, 970-979
- Mills DE et al. (2013). The effects of inspiratory muscle training on plasma interleukin-6 concentration during cycling exercise and a volitional mimic of the exercise hyperpnea. Journal of Applied Physiology, 115, 1163-1172
- Walton GE et al. (2010) Prebiotics and probiotics: potential strategies for reducing travellers' diarrhoea in athletes competing abroad. Food Science and Technology Bulletin: Functional Foods, 6, 105-114.

Supervisors: Dr. Michael Johnson

Supervisor biogs

Drs Johnson and Sharpe are respiratory physiologists and Dr Hunter has expertise in nutrition in health and disease. The team has a proven track record of presenting their research at international conferences and publishing in peer-reviewed journals. Collectively the team has a 100% success rate for PhD supervisions with 6 completions thus far, which to date have generated 12 peer-reviewed publications; 4 further manuscripts are currently in preparation. The team has successfully supervised a PhD

focused on the effects of dietary supplementation using prebiotic and fish oils on exercise-induced bronchoconstriction and inflammation in asthma.

Entry requirements
In order to be eligible to apply, you must hold, or expect to obtain, a UK Master's degree (or UK equivalent according to NARIC) with a minimum of a merit, and/or a UK 1st Class/2.1 Bachelor's degree (or UK equivalent according to NARIC) in **Nutrition, Physiology, or related discipline/science.**

Contact: michael.johnson@ntu.ac.uk for informal discussions.

4.
DIETARY SUPPLEMENTATION STRATEGIES TO ALLEVIATE EXERCISE-INDUCED ASTHMA

Asthma affects 5-10% of the population in developed countries (Wenzel 2012) and can be a life-threatening condition. Although current therapy for asthma with inhaled corticosteroids and β_2-agonists is effective, it is not curative and there are concerns regarding the long-term side effects of corticosteroids (Barnes 2010). Novel non-pharmacological therapies are therefore needed to target the underlying inflammation and immune response. Two such therapies are prebiotics and fish oils (omega-3), which may, respectively, impact positively on the intestinal microbiota and thereby systemic immune function and inflammation, and attenuate the production of arachidonic acid metabolites that mediate inflammation.

In two separate studies (Williams et al. 2013, 2014; see section 4) our research group has demonstrated reduced systemic inflammation and improved lung function after a bronchoprovocation challenge in adults with asthma after prebiotic and omega-3 supplementation. However, it remains unknown whether changes due to prebiotic supplementation are associated with positive shifts in faecal bacteria and short chain fatty acid profiles (indicators of gut health) and immune function. Furthermore, given the distinct putative mechanisms by which prebiotic and omega-3 supplementation may attenuate inflammation, it is attractive to hypothesise that combination therapy would provide additive benefits that exceed those achieved with each therapy individually. This project will examine: (1) the individual and combined effects of dietary supplementation with prebiotic and omega-3 on inflammatory responses to a breathing challenge in adults with asthma; and (2) the effects of prebiotic supplementation on faecal bacteria profile and short chain fatty acid concentration, and peripheral blood T cell profiles.

References

- Mills DE et al. (2014). Influence of oxidative stress, diaphragm fatigue and inspiratory muscle training on the plasma cytokine response to maximum sustainable voluntary ventilation. Journal of Applied Physiology, 116, 970-979
- Walton GE et al. (2010) Prebiotics and probiotics: potential strategies for reducing travellers' diarrhoea in athletes competing abroad. Food Science and Technology Bulletin: Functional Foods, 6, 105-114.
- Williams NC et al. (2014). Supplementation of prebiotic galactooligosaccharide reduces severity of exercise induced asthma (EIA) in physically active asthmatics – a pilot study. European Respiratory Society Lung Science Conference.
- Williams NC et al. (2013). A randomised placebo controlled trial to compare the effects of two dosages of omega-3 PUFA on exercise-induced bronchoconstriction. British Journal of Sports Medicine, 47, e4.

Supervisors: Dr. Michael Johnson

Supervisor biogs

Drs Johnson and Sharpe are respiratory physiologists and Dr Hunter has expertise in nutrition in health and disease. The team has a proven track record of presenting their research at international conferences and publishing in peer-reviewed journals.

Collectively the team has a 100% success rate for PhD supervisions with 6 completions thus far, which to date have generated 12 peer-reviewed publications; 4 further manuscripts are currently in preparation. The team has successfully supervised a PhD focused on the effects of dietary supplementation using prebiotic and fish oils on exercise-induced bronchoconstriction and inflammation in asthma.

Entry requirements
In order to be eligible to apply, you must hold, or expect to obtain, a UK Master's degree (or UK equivalent according to NARIC) with a minimum of a merit, and/or a UK 1st Class/2.1 Bachelor's degree (or UK equivalent according to NARIC) in **Nutrition, Physiology, or related discipline/science.**

Contact: michael.johnson@ntu.ac.uk for informal discussions.

5.
RESOLVING THE MECHANISMS BY WHICH INSPIRATORY MUSCLE TRAINING IMPROVES EXERCISE TOLERANCE

Our laboratory has demonstrated numerous benefits from inspiratory muscle training (IMT), including improved cycling time-trial performance (Johnson et al. 2007), reduced systemic inflammation (Mills et al. 2013) and blood lactate concentration during exercise (Brown et al. 2010; Brown et al. 2012; Mills et al. 2013) and volitional hyperpnoea (Brown et al. 2008), and accelerated oxygen uptake kinetics at the onset of exercise (Brown et al. 2012). We have also shown increased diaphragm thickness after IMT in older adults (Mills et al. In press). It is suggested that IMT improves exercise tolerance by attenuating inspiratory muscle (e.g. diaphragm) fatigue and maintaining leg blood flow, which therefore delays/reduces the development of leg muscle fatigue. However, objective measures of exercise-induced diaphragm and leg muscle fatigue before and after IMT have yet to be performed. Furthermore, the perception of effort during exercise is reduced after IMT, which may indicate a reduction in central fatigue (i.e. fatigue caused by reduced neural drive from the brain). However, objective measures of central fatigue before and after IMT have also not been performed. The aim of this project is to therefore shed light on the mechanisms by which IMT improves exercise tolerance. The project will evaluate the effects of IMT on exercise tolerance and associated changes in exercise-induced diaphragm fatigue using gastric and oesophageal pressure measures and bilateral magnetic stimulation of the phrenic nerves, leg muscle fatigue using magnetic stimulation of the femoral nerve, and central fatigue using transcranial magnetic stimulation over the motor cortex.

References

- Brown PI, Johnson MA, Sharpe GR (2014). Determinants of inspiratory muscle strength in healthy humans. Respiratory Physiology and Neurobiology, 196, 50-55
- Brown PI, Sharpe GR, Johnson MA (2008). Inspiratory muscle training reduces blood lactate concentration during volitional hyperpnoea. European Journal of Applied Physiology, 104, 111-117
- Brown PI, Sharpe GR, Johnson MA (2010). Loading of trained inspiratory muscles speeds lactate recovery kinetics. Medicine and Science in Sports and Exercise, 42, 1103-1112
- Brown PI, Sharpe GR, Johnson MA (2012). Inspiratory muscle training abolishes the blood lactate increase associated with volitional hyperpnoea superimposed on exercise and accelerates lactate and oxygen uptake kinetics at the onset of exercise. European Journal of Applied Physiology, 112, 2117-2129

Supervisors: Dr. Michael Johnson

Supervisor biogs

Drs Johnson, Sharpe, and Williams are respiratory physiologists and have extensive experience undertaking IMT research (8 publications) and measuring diaphragm and limb muscle fatigue. The department also has the expertise and facilities to perform transcranial magnetic stimulation to evaluate central fatigue. Dr Sharpe played a pivotal role in the development of the PowerBreathe IMT device that is now commercially

available. They have a proven track record of presenting their research at international conferences and publishing in peer-reviewed journals. They have a 100% success rate for 4 PhD completions, which thus far have generated 11 peer-reviewed publications, with 4 further manuscripts currently in preparation. The research team also has strong collaborative links with respiratory physiologists at other UK universities.

Entry requirements
In order to be eligible to apply, you must hold, or expect to obtain, a UK Master's degree (or UK equivalent according to NARIC) with a minimum of a merit, and/or a UK 1st Class/2.1 Bachelor's degree (or UK equivalent according to NARIC) in **Exercise Science, Physiology, or related discipline.**

Contact: michael.johnson@ntu.ac.uk for informal discussions.

6.
INSPIRATORY MUSCLE TRAINING AND INFLAMMATION IN PATIENTS WITH COPD

Chronic obstructive pulmonary disease (COPD) is responsible for early mortality, high death rates and significant socioeconomic burden, and predictions indicate that in 2020 COPD will be the third leading cause of death worldwide (from sixth in 1990) (Raherison and Girodet 2009). COPD patients have breathing difficulties due to narrowing of the airways, which increases respiratory muscle work. This effect is compounded by the respiratory muscle weakness observed in COPD, which contributes to dyspnoea, arterial desaturation, and reduced physical activity and quality of life. Inflammation is a predominant feature of COPD that underpins the progressive nature of the disease (Caramori et al. 2014) and, therefore, interventions that target the underlying inflammation are of utmost importance.

Inspiratory muscle training (IMT) can improve inspiratory muscle strength and exercise tolerance, and reduce dyspnoea in COPD patients (Gosselibnk et al. 2011). However, the effects of IMT on systemic inflammation in COPD remains unknown. We showed that IMT in healthy adults reduces the systemic inflammation associated with whole-body exercise (Mills et al. 2013) and volitional increases in respiratory muscle work (Mills et al. 2014). These data suggest that the respiratory muscles may directly contribute to systemic inflammation in COPD when the work of breathing is increased. It is also attractive to hypothesise that IMT may attenuate the systemic inflammation that underpins COPD. This project will explore the effects of IMT on systemic inflammation in COPD patients, and whether changes relate to improvements in exercise tolerance and respiratory muscle function/structure, dyspnoea, arterial saturation and quality of life.

References

- Mills DE et al. (2015). The effects of inspiratory muscle training in older adults. Medicine and Science in Sports and Exercise. In Press.
- Mills DE et al. (2014). Influence of oxidative stress, diaphragm fatigue and inspiratory muscle training on the plasma cytokine response to maximum sustainable voluntary ventilation. Journal of Applied Physiology, 116, 970-979
- Mills DE et al. (2013). The effects of inspiratory muscle training on plasma interleukin-6 concentration during cycling exercise and a volitional mimic of the exercise hyperpnea. Journal of Applied Physiology, 115, 1163-1172

Supervisors: Dr. Michael Johnson

Supervisor biogs

Drs Johnson and Sharpe are respiratory physiologists and have extensive experience conducting IMT research (8 publications). Dr Sharpe played a pivotal role in the development of the PowerBreathe IMT device that is now commercially available. They have a proven track record of presenting their research at international conferences and publishing in peer-reviewed journals. They have a 100% success rate for 4 PhD completions, which thus far have generated 11 peer-reviewed publications, with 4 further manuscripts currently in preparation. Dr Williams has extensive research experience focused on inflammatory responses to increased respiratory muscle work in

asthma sufferers. The research team also has strong collaborative links with respiratory physiologists at other UK universities, local GP's and respiratory consultants, and the exceptionally well-equipped John van Geest Cancer Research Centre at NTU, which provides extensive expertise in immunology.

Entry requirements
In order to be eligible to apply, you must hold, or expect to obtain, a UK Master's degree (or UK equivalent according to NARIC) with a minimum of a merit, and/or a UK 1st Class/2.1 Bachelor's degree (or UK equivalent according to NARIC) in **Exercise Science, Physiology, or related discipline.**

Contact: michael.johnson@ntu.ac.uk for informal discussions.

7.
BIOMECHANICAL BIOMARKERS TO IMPROVE INJURY DIAGNOSIS AND REHABILITATION: THE BIO-IN-REHAB PROJECT

Biomarkers have long been used to characterise the status of cells, organs and whole organisms. Using biomarkers to quantitatively assess and predict changes in the status of these structures is a powerful tool and allows for greater insight into their functioning. When applied to sports people and their movement, this process has the potential to have a significant impact on how injuries are diagnosed and treated. The presence and severity of concussions and musculoskeletal injuries continue to be of real relevance and have been shown to present observable biomechanical biomarkers relating to the likelihood of serious long term complications and/or increased risk of injury recurrence (Brooks et al., 2016; Subbian et al., 2016). Sensitive biomechanical assessments and computational techniques managing large data sets offer new possibilities for better prediction of injury risk and identification of disease progression (Quatman et al., 2009). Methods such as machine learning have the potential to diagnose the presence of neuromotor impairments, sensitively track recovery from or progression of injuries, and predict individuals with increased risk of injury. Such techniques offer novel possibilities for the advanced use of biomechanical data and validation of widely available and low cost devices such as mobile in-game technology, and worn gyroscopic accelerometer and GPS units, to enable 'online' injury reduction and monitoring. This technological approach to assessment and rehabilitation would expedite diagnosis and enable more targeted interventions to reduce injury risk and decrease the time spent by athletes recuperating from injury. The recent high profile focus on head injuries and concussion in both Rugby Union and American Football highlight the need to both assess the acute effects of injury, whilst also tackling the issue of preventing or reducing the impact of such injuries; the proposed projects will help to achieve these goals.

References

- Brooks, M.A., Peterson, K., Biese, K., Sanfilippo, J., Heiderscheit, B.C., Bell, D.R. (2016). Concussion Increases Odds of Sustaining a Lower Extremity Musculoskeletal Injury After Return to Play Among Collegiate Athletes. American Journal of Sports Medicine, E-published ahead of print.
- Quatman, C.E., Quatman, C.C., Hewett, T.E. (2009). Prediction and prevention of musculoskeletal injury: a paradigm shift in methodology. British Journal of Sports Medicine, 43(14), 1100-1107.
- Subbian, V., Ratcliff, J.J., Korfhagen, J.J., Hart KW, Meunier JM, Shaw, G.J., Lindsell, C.J., Beyette, F.R. (2016). A Novel Tool for Evaluation of Mild Traumatic Brain Injury Patients in the Emergency Department: Does Robotic Assessment of Neuromotor Performance following Injury Predict the Presence of Post-Concussion Symptoms at Follow-up? Academic Emergency Medicine, E-published ahead of print.

Supervisors: Dr. Martin Lewis

Supervisor biogs

Prospective students will be supervised by members of the biomechanics group at NTU, who are currently supervising a number of postgraduate students including 4 Ph.D students and three M.Res students. The biomechanics group have expertise in the assessment of clinical and sporting populations using both experimental and computational methods. The biomechanics group undertake research from their excellent biomechanics laboratory which is equipped with a 13-camera motion capture system, 5 force plates, wireless EMG, isokinetic dynamometer alongside various data acquisition and processing software programs such as MatLab, Motion Genesis, Visual 3D and OpenSim. As a prospective student you will receive extensive training and support and will be expected to present work of international relevance through peer reviewed publications and presentation at international conferences.

Entry requirements

In order to be eligible to apply, you must hold, or expect to obtain, a UK Master's degree (or UK equivalent according to NARIC) with a minimum of a merit, and/or a UK 1st Class/2.1 Bachelor's degree (or UK equivalent according to NARIC) in **Biomechanics/Bioengineering, Sports Science or a related discipline.**

Contact: martin.lewis@ntu.ac.uk for informal discussions.

8.
EFFECTS OF INCREASED PHYSICAL ACTIVITY ON HEALTH, COGNITIVE AND EDUCATIONAL OUTCOMES IN BOYS

Overweight and obesity is a major public health problem in the UK, particularly in some ethnic minority groups (Gatineau and Mathrani, 2011). Overweight and obesity is initiated in childhood and an estimated 14% and 20% of UK 11-15 year olds are overweight and obese respectively (Townsend et al., 2012). Our research group has previously shown that a school and community-based physical activity intervention can slow the rate of increase in body mass and waist circumference in a largely white primary school-aged population, but the effect of increased physical activity on a wider range of markers of cardiovascular health and educational outcomes, particularly in specific ethnic minority groups, has not been systematically examined. Furthermore some schools are reluctant to increase the allocation of school physical education and sport because of concerns about the impact on educational outcomes.

In these proposed PhD programmes, ~400 primary school children (100 intervention white, 100 intervention ethnic minority* and 200 controls) from different schools will have their school-based allocation of physical education and sport doubled for a one year period (from 2 to 4 hours per week). Measures will be made pre-, 12 weeks, one year and 6 months post-intervention and will include:

- Physical activity - via pedometers, accelerometers and GPS
- Diet - via 24 hour food recall
- Health outcomes - BMI, waist and hip circumference, skinfolds, blood lipids, markers of inflammation (via a finger prick blood sample)
- Cardiorespiratory fitness - via a multi-stage fitness test
- Cognitive function – via computer-based tests
- Educational outcomes – via standard school tests
- Focus groups - to investigate the physical activity patterns of the children and to identify ways in which their activity levels could be increased.

References

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- Townsend N, Wickramasinghe K, Bhatnagar P, Smolina K, Nichols M, Leal J, Luengo-Fernandez R, Rayner M (2012). Coronary heart disease statistics: 2012 edition. British Heart Foundation: London.

Supervisors: Dr. John Morris

Entry Requirements
In order to be eligible to apply, you must hold, or expect to obtain, a UK Master's degree (or UK equivalent according to NARIC) with a minimum of a merit, and/or a UK 1st Class/2.1 Bachelor's degree (or UK equivalent according to NARIC) in **Sports Science, Physiology or related discipline / science.**

Contact: john.morris@ntu.ac.uk for informal discussions.

9.
THE BIOLOGICAL ROLE OF THE HISTIDINE CONTAINING DIPEPTIDE CARNOSINE IN MUSCLE

Carnosine was first discovered in skeletal muscle, where its concentration is higher than in any other tissue. There has been extensive research in the last decade on the use of carnosine as an ergogenic aid for sporting performance, with the research group from NTU being acknowledged as a world-leading group in this area. There is, however, a paucity of research on the potential clinical uses of carnosine. Carnosine is considered a natural scavenger/suppressor of reactive oxygen species, advanced glycation end products, and reactive aldehydes; and might also improve calcium handling within the skeletal muscle. Such properties might potentially confer therapeutic benefits in those conditions characterised by exacerbated oxidative stress or a significant loss of muscle functionality; including neurodegenerative diseases, cancer, diabetes and ageing. However, the mechanisms by which the purported therapeutic effects of carnosine could occur in skeletal muscle remain unclear and the current project will include work on cell cultures, human muscle tissue or animal models to identify the range of potential therapeutic effects of carnosine in skeletal muscle.

Supervisors: Prof. Craig Sale

Supervisor biogs

This project fits within an integrated programme of ongoing and historical projects at Nottingham Trent University that are under the leadership of Dr. Craig Sale, Associate Professor in Applied Physiology. Expertise in molecular biology will be provided by the co-supervisor Dr. Mark Turner, Associate Professor in Biomedical Molecular Biosciences.Expertise in biological oxidation and mitochondrial dysfunction will be provided by the co-supervisor Dr. Luigi De Girolamo, Senior Lecturer in Molecular Biology.

Between them the supervisors have supervised >20 students to successful PhD award. The supervisory team also have a track record of successful grant capture from numerous external funding bodies (e.g. Diabetes UK, NovoNordisk UK Research Foundation, The Royal Society, English Institute of Sport, Ministry of Defence, Natural Alternatives International) and regularly publish in leading international biomedical journals.

Entry requirements
In order to be eligible to apply, you must hold, or expect to obtain, a UK Master's degree (or UK equivalent according to NARIC) with a minimum of a merit, and/or a UK 1st Class/2.1 Bachelor's degree (or UK equivalent according to NARIC) in **biosciences, physiology or related discipline.**

Contact: craig.sale@ntu.ac.uk for informal discussions.

10.
THE PARATHYROID HORMONE RESPONSE TO HIGH-INTENSITY EXERCISE: A MEANS TO IMPROVE BONE HEALTH.

Parathyroid hormone (PTH) concentrations in human blood increase during prolonged, moderate or strenuous exercise, but there seems to be some effect of the intensity of this exercise. Importantly, PTH concentrations also decrease after the cessation of exercise with this response suggested to be anabolic rather than catabolic for the bone. However, the mechanisms underlying these changes remains to be fully elucidated.

At rest, the concentration of calcium in the serum is responsible for the release of PTH but during and after exercise other factors might mitigate the PTH response. The lack of information about the time course of changes in PTH, Ca and PO4 currently limits our understanding of this mechanism, so regular measurements during exercise and recovery are required to help answer this question.

The proposed research programme will investigate the PTH responses to high-intensity intermittent exercise in order to determine the potential influence on bone health.

References

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- Scott, J.P.R., Sale, C., Greeves, J.P., Casey, A., Dutton, J. and Fraser, W.D. (2012). Bone, 51, 990-999. DOI: 10.1016/j.bone.2012.08.128.
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Supervisors: Prof. Craig Sale

Supervisor biogs

This project fits within an integrated programme of ongoing research at Nottingham Trent University that are under the leadership of Prof. Craig Sale, Professor of Human Physiology in the Musculoskeletal Physiology Research Group and supported by Dr Ian Varley and Dr Kirsty Elliott-Sale.

The supervisory team has a track record of successful grant capture from numerous external funding bodies in this area (e.g. English Institute of Sport, Ministry of Defence, GlaxoSmithKline) and regularly publish in leading international journals.

Entry requirements

In order to be eligible to apply, you must hold, or expect to obtain, a UK Master's degree (or UK equivalent according to NARIC) with a minimum of a merit, and/or a UK 1st

Class/2.1 Bachelor's degree (or UK equivalent according to NARIC) in **Exercise physiology, biochemistry, physiology, biology, molecular biology.**

Contact: craig.sale@ntu.ac.uk for informal discussions.

11.
THE FURTHER DEVELOPMENT AND VALIDATION OF THE SPORT RESILIENCE SCALE (SRS).

Why is it that some athletes are able to withstand the pressures of competitive sport and attain peak performances, whereas others succumb to the demands and under-perform? It is the study of psychological resilience that aims to address this question.

Although much is known about psychological resilience in sport performers (see, for a review, Sarkar & Fletcher, 2014), only recently has a valid and reliable measure to comprehensively assess this desirable construct been developed. This measure, the Sport Resilience Scale (SRS; Sarkar, Fletcher, Stride, & Munir, 2016), assesses the three components of psychological resilience (viz. stressors, protective factors, and positive adaptation) via nine subscales. Evidence has been provided for the content, factorial, concurrent, and discriminant validity of the SRS, as well as its internal consistency (Sarkar et al., 2016); however, the purpose of this doctoral programme of research will be to further develop and validate the scale, and advance the measurement of psychological resilience.

References

- Fletcher, D., & Sarkar, M. (2012). A grounded theory of psychological resilience in Olympic champions. Psychology of Sport and Exercise, 13, 669-678.
- Fletcher, D., & Sarkar, M. (2013). Psychological resilience: A review and critique of definitions, concepts and theory. European Psychologist, 18, 12-23.
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- Sarkar, M., Fletcher, D., Stride, C., & Munir, F. (2016). Development and validation of the Sport Resilience Scale. Manuscript in preparation.

Supervisors: Dr. Mustafa Sarkar

Supervisor biogs

Mustafa Sarkar is a Lecturer in Sport and Exercise Psychology at Nottingham Trent University. His research focuses on the psychology of sporting excellence in the areas of resilience in high achievers and its assessment in sport performers.

Dr Sarkar's research has been published in numerous peer-reviewed scientific journals and presented at various national and international conferences. In recognition of his work, Dr Sarkar's PhD research on resilience was recently recognized by the British Psychological Society for being exceptional and innovative.

Entry requirements

In order to be eligible to apply, you must hold, or expect to obtain, a UK Master's degree (or UK equivalent according to NARIC) with a minimum of a merit, and/or a UK 1st

Class/2.1 Bachelor's degree (or UK equivalent according to NARIC) in **Sport and Exercise Psychology.**

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12.
GENETIC ASSOCIATIONS WITH CHANGES IN BONE CHARACTERISTICS

It is well established that genetic elements influence several bone phenotypes and are important in bone disorders, including osteoporosis (Paternoster et al., 2010) and Paget's disease (Albagha et al., 2010). Many genes and SNPs are candidates for influencing bone characteristics due to previously published literature on genetic associations with fracture, BMD and biochemical markers of bone turnover.

It has been shown that changes in bone geometry, thought to be as a result of increases in bone remodelling, are significantly associated with genotype in military recruits following 10 week basic training (Dhamrait et al 2003). Furthermore, genetic associations with stress related bone injuries have recently been shown in elite athletes (Varley et al., 2015) and military recruits (Varley et al., 2016).

The proposed research programme will investigate the mechanisms by which genetic factors are associated with bone characteristics in order to further elucidate how genetics influences bone health.

References

- Varley I, et al., (2016). Functional polymorphisms in the P2X7 receptor gene are associated with stress fracture injury. Purinergic Signalling, DOI: 10.1007/s11302-016-9495-6
- Varley I, Hughes DH, Sale, C et al. (2015) RANK/RANKL/OPG Pathway: Genetic associations with stress fracture incidence in elite athletes. Bone, 71, 131-136.DOI: 10.1016/j.bone.2014.10.004.

Supervisors: Dr. Ian Varley

Supervisor biogs

This project fits within an integrated programme of ongoing research at Nottingham Trent University supported Dr Ian Varley, Prof. Craig Sale and Dr David Hughes.

The supervisory team has a track record of successful grant capture from numerous external funding bodies in this area (e.g. English Institute of Sport, Ministry of Defence, GlaxoSmithKline) and regularly publish in leading international journals.

Entry requirements

In order to be eligible to apply, you must hold, or expect to obtain, a UK Master's degree (or UK equivalent according to NARIC) with a minimum of a merit, and/or a UK 1st Class/2.1 Bachelor's degree (or UK equivalent according to NARIC) in **Bioscience; Sport Science, Sport Medicine.**

Contact: ian.varley@ntu.ac.uk for informal discussions.