**BU PhD STUDENTSHIPS 2018**

**PROJECT DESCRIPTION**

## PROJECT DETAILS

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<th>Project Title</th>
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<td>Adaptive functional electrical stimulation to aid walking for people with neurological dysfunction</td>
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<th>Project Summary</th>
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<td>Functional Electrical Stimulation (FES) is a means of producing movement in paralysed muscles and using it to produce or assist practical activity. It is most commonly used to assist walking for people who have dropped foot (the inability to lift the foot as it is brought forward while walking) following stroke, multiple sclerosis, Parkinson's disease and other neurological conditions. In this application, the common peroneal nerve is stimulated using a pair of self-adhesive electrodes placed on the side of the leg. The technique, while not invented at Salisbury District Hospital, was developed into a practical clinical system called the Odstock Dropped Foot Stimulator (Pace) (ODFS Pace). Odstock Medical Limited (OML) was set up in a joint venture by the University and Salisbury NHS Foundation Trust to continue the development and commercialisation of the devices.</td>
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Current Functional Electrical Stimulation (FES) devices used for walking use fixed timing and stimulation parameters that are set up by clinicians to suit each individual as they present in clinic. These parameters determine exactly when and how much stimulation is delivered to the user. However, it is known that gait style of FES users will change depending on context and also over time. It is common to adjust parameters at follow up appointments by clinicians, typically to allow for increased walking speed or deteriorating medical condition. This means that the device user may have less than optimal FES settings for a period leading up to their FES clinic appointment, reducing the efficiency and safety of their walking. It has also been observed that device users may benefit from different stimulation parameters for different activities, for example walking upstairs, walking on rough ground or, for the more able, jogging or other sports application. The effectiveness may also be improved by stimulating additional muscles, for example to improve the flexion or extension of the knee, hip or ankle. Studies have shown improved walking speed and efficiency by stimulating the gluteal muscles through the stance phase of gait. Hamstring stimulation can improve Knee flexion and ground clearance and stimulation of the gastrocnemius muscle can help accelerate the body forward at the end of stance. While studies have demonstrated the feasibility and basic efficacy of these approaches, further work is needed to optimise these applications and make them adaptive to changes in gait in response to environmental challenges. |

OML is currently developing a new two-channel stimulator for walking assistance. This device will be able to stimulate the additional muscles and also will have the capability to interface with multiple sensors including footswitches and inertial movement sensors (IMU). This device will be used as the development platform for this project. |

We propose an investigation into how FES used for lower limb mobility can be adapted to walking speed, specific tasks and the state of the device user, improving the utility, efficiency and safety of FES devices. This will require an investigation of suitable sensors, developing control algorithms and an in-vivo evaluation. |

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<th>Academic Impact</th>
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<td>This project will make a significant addition to the growing evidence for the clinical application of FES and the control of FES systems. The project will lead to identifying the state of the art sensors and develop their application for gait events detection. Results will be reported at IFESS (international FES Society) meeting and it’s UK and Ireland chapter IFESSUKI and will be reported in peer reviewed journals such as RATE and Med Eng and Technology.</td>
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**Societal Impact**

The aim of this research is to improve the mobility and hence participation of people with neurological injury or medical condition. This will lead to improved quality of life, less dependence on others for activities of daily living and more choices for people with disabilities of how they can live their daily lives. This greater independence may lead to reduced dependency on services and reduced burden on their cares and family. Improvements in safety may lead to reduced incidence of falls and hence reduced costs to the NHS.

**Training Opportunities**

The PhD studentship will be suitable for someone who wishes to pursue a career in Biomedical Engineering and its application in clinical research, either in the academic and health sector or in industry. The candidate will learn about:


**SUPERVISORY TEAM**

<table>
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<th>First Supervisor</th>
<th>Prof Ian Swain</th>
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<tr>
<td>Additional Supervisors</td>
<td>Prof Paul Taylor, Dr Choukri Mecheraoui</td>
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**Recent publications by supervisors relevant to this project**


INFORMAL ENQUIRIES

To discuss this opportunity further, please contact Prof Ian Swain via email: iswain@bournemouth.ac.uk

ELIGIBILITY CRITERIA

The PhD Studentships are open to UK, EU and International students. Candidates for a PhD Studentship should demonstrate outstanding qualities and be motivated to complete a PhD in 4 years and must demonstrate:

• outstanding academic potential as measured by either a 1st class honours degree or a Master’s degree with distinction or equivalent Grade Point Average (GPA)
• an IELTS (Academic) score of 6.5 minimum (with a minimum 6.0 in each component) for candidates for whom English is not their first language

In addition to satisfying minimum entry criteria, BU will look closely at the qualities, skills and background of each candidate and what they can bring to their chosen research project in order to ensure successful completion.

Applicants will be asked to submit an online application form and a proposal (c. 1500 words) outlining their understanding of the project for which they are applying, the approach they would envisage taking and what qualities they will bring to the research community.

Please note:

• Current BU Doctoral students are not eligible to apply for a Studentship
• Current MRes/MPhil students can apply, subject to satisfactory completion of their Research Degree prior to being able to take up the award
• PhD Studentships cannot be used to support BU staff to complete doctoral programmes

Additional Eligibility

We are looking for a dynamic, inventive PhD student. They should have a good first degree (First or Upper Second) in Electronic/Electrical/Computer/Biomedical Engineering and ideally some experience of control systems, sensors and embedded electronics. An interest in the application of engineering to medicine and some knowledge of neurological disability would also be useful.

HOW TO APPLY

Please complete the online application form by Sunday 17 June 2018. Further information on the application process can be found at: www.bournemouth.ac.uk/studentships