Host Institution:	University College Dublin (UCD)
Location:	Belfield, Dublin 4, Ireland
Website:	http://www.ucd.ie/
College/Company:	Engineering & Architecture
School/Unit:	Electrical & Electronic Engineering
Project Lead	Professor Madeleine Lowery
Email contact:	madeleine.lowery@ucd.ie
Website:	http://www.ucd.ie/eece/

Project Title:
Investigation of Dyskinetic Gait in Parkinson's disease using Electroencephalography and Electromyography.

Brief Project Description:
Parkinson's disease (PD) is a neurodegenerative disease that affects at least 1% of people over 65 years of age. Characterised by symptoms such as muscle rigidity, dyskinetic gait, and severe tremor, PD inhibits people from initiating movements critical to many basics tasks of daily life. In order to help individuals with PD to overcome these challenges, it is important to understand the neural mechanisms contributing to the onset of these symptoms.

It has been reported that disturbances of β-band cortical rhythms are linked to anti-kinetic movements. Similarly, recent studies at the Neuromuscular Systems Research Group in UCD have shown enhanced β-band intermuscular coherence in the leg muscles of individuals with PD during isometric leg extension tasks. Expanding on this research, this project proposes to record the electrical activity of the brain and leg muscles using electroencephalography (EEG) and electromyography (EMG) respectively, during specific walking tasks. Employing advanced signal processing techniques to analyse EEG & EMG, it is hypothesized that the neural mechanisms underlying dyskinetic gait in PD can be better understood. This study will be conducted at the Neuromuscular Systems Research Group at UCD, and the patient day care facility at the Royal Hospital Donnybrook.

Project Dates:
From the end of May to August (specific dates can be agreed between the PI and the student directly over a 10-week period).

Candidate requirements:
Successful applicants should have a background in biomedical or electrical engineering or a related discipline, and an interest in neural engineering. Ideally students will have completed a course in basic signal processing and will be proficient in MatLab or a similar programming language.

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School/Unit:	Electrical & Electronic Engineering
Project Lead	Professor John Sheridan
Email contact:	john.sheridan@ucd.ie
Website:	http://www.ucd.ie/eece/

Project Title:
Optical Engineering/lighting/imaging

Brief Project Description:
Bio-optimized lighting to improve agricultural animal health, and performance.
Development of controlled LED based lighting (varying spectrum, intensity and time variation) to improve animal welfare and conditions in order to better performance. Examples are in the thoroughbred horse industry (see www.equilume.com).

Project Dates:
From the end of May to August (specific dates can be agreed between the PI and the student directly over a 10-week period).

Candidate requirements:
This project is at the interface of engineering technology, biology and animal husbandry.
An engineer who is interested in biology/farm animals or someone with a biology background who is willing to learn some engineering. Enthusiasm and flexibility is essential.

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Location:	Belfield, Dublin 4, Ireland
Website:	http://www.ucd.ie/
College/Company:	Engineering & Architecture
School/Unit:	Electrical & Electronic Engineering
Project Lead	Dr Hamed Ahmadi
Email contact:	hamed.ahmadi@ucd.ie
Website:	http://www.ucd.ie/eece/

Project Title:
Wireless communications, 5G, Internet of things.

Brief Project Description:
In massive multiple-input and multiple-output (MIMO) systems, a large number of antennas are considered at the base stations (BSs). The number of BS antennas is assumed to be much larger than the number of scheduled users in a cell. Given perfect knowledge of the channel state information (CSI), as the number of antenna elements at the BS tends to infinity, the effects of noise as well as multiuser interference fade away. Hence, the capacity of such networks can be increased without bound by increasing the number of BS antennas. However, noisy channel estimates can limit the capacity of these networks.

The channel gains between the mobile terminals (MTs) and the BS antennas in each cell are estimated through training pilots transmitted during the uplink phase. The MTs in each cell transmit pilots from a set of mutually orthogonal pilot sequences which allows the BS to distinguish between the channel impulse responses of different MTs in the channel estimation stage.

It is not efficient (and not possible in many cases) to use orthogonal pilot sequences for all MTs of neighbouring cells. Therefore, in time division duplexing (TDD) multicellular massive MIMO networks, some MTs in neighbouring cells use the same pilot sequences to enable channel estimation at the BS. Using the same pilot sequences in neighbouring cells will adversely affect the channel estimates at the BS. This is due to the fact that the channel estimate of a user having the same pilot sequence as MTs of its adjacent cells include some parts of those MTs' channels. This effect is called pilot contamination.

Different methods for pilot decontamination and pilot contamination avoidance have been widely studied in literature. These approaches can be combined to achieve better data rate. Knowing that each massive MIMO base station has to share some of its selected pilots with its neighbouring cells, we will investigate maximum tolerable shared-to-total pilot's ratio. We consider different scenarios for a cell that guarantees an average and minimum rate to its attached mobile stations.

Project Dates:
From the end of May to August (specific dates can be agreed between the PI and the student directly over a 10-week period).

Application Criteria:
Any application criteria: Postgrad or senior undergrad EEE or computer science student.

Host Institution:	University College Dublin (UCD)
Location:	Belfield, Dublin 4, Ireland
Website:	http://www.ucd.ie/
College/Company:	Engineering & Architecture
School/Unit:	Mechanical & Materials Engineering
Project Lead	Dr Eoin O'Cearbhaill
Email contact:	eoin.ocearbhaill@ucd.ie
Website:	http://www.ucd.ie/mecheng/

Project Title:
Medical Devices.

Brief Project Description:
Additive Manufacturing of Medical Devices
We are developing novel additive manufacturing processes to create implantable medical devices, including polymeric stents. This project will involve prototyping and testing the mechanical and functional performance of these devices in bench top models.

Project Dates:
From the end of May to August (specific dates can be agreed between the PI and the student directly over a 10-week period).

Candidate requirements:
The Project would suit students from a biomedical / mechanical / chemical engineering background.

Host Institution:	University College Dublin (UCD)
Location:	Belfield, Dublin 4, Ireland
Website:	http://www.ucd.ie/
College/Company:	Engineering & Architecture
School/Unit:	Mechanical & Materials Engineering
Project Lead	Dr Aisling Ni Annaidh
Email contact:	aisling.niannaidh@ucd.ie
Website:	http://www.ucd.ie/mecheng/

Project Title:
Tissue Biomechanics.

Brief Project Description:
Design of experiment to determine the coefficient of friction of skin in a helmeted impact. The coefficient of friction (COF) of skin is important for a number of applications such as dermatology, medical device design and biomechanics and is fundamental to the development of bed sores, the insertion of needles and the design of smart fabrics. This student will work alongside a PhD student who is working on improving helmet designs in sports. In this context, the impact force transmitted to the head during an accident or fall depends on the COF between the skin and the helmet liner. The aim of this project will be to design and build an experimental test rig to determine the COF of the skin in a controlled and repeatable manner at different speeds and using different loads.

Project Dates:
From the end of May to August (specific dates can be agreed between the PI and the student directly over a 10-week period).

Candidate requirements:
Mechanical / Biomedical Engineering student with talent for experimental design.