PGTA Project Proposal

Discipline:	Biomechanics
Project Title:	Wearable technology and associated metrics for prescription and monitoring of impact-related physical activity and exercise for osteoporosis
Supervisory Team:	Dr Stuart McErlain-Naylor Dr Katherine Brooke-Wavell
Summary of proposed project:	Currently, recommendations for exercise to promote bone strength in people with osteoporosis include guidelines for the frequency and quantity of moderate impact exercise (*e.g.*, stamping, jogging, low-level jumping, hopping). However, monitoring the intensity of these impacts has typically been limited to metrics based on measurement or estimation of ground reaction forces and/or external surface accelerations. These have been proposed to quantify the overall stimulus using the number and intensity of loading cycles but are not always strongly associated with the internal contact forces important for stimulating site-specific adaptation. This project aims to investigate relationships between commercially available activity measures, estimates of bone contact forces, and post-exercise-intervention changes in bone properties. First, musculoskeletal modelling will be used to estimate site-specific contact forces during moderate impact activities. Secondly, models and experimental data will be used to assess the relationship between contact forces and a number of candidate external measurements at different positions on the body. Finally, the evaluated technology and metrics may be applied to monitor longitudinal physical activity interventions and/or daily living, which will be assessed in relation to changes in scan outcomes (*e.g.*, pQCT / DXA / CT). Findings can contribute to recommendations regarding the prescription and monitoring of such impact activities.
Required skills, experience, and/or education:	This project would suit those with good inter-personal skills and a background in biomechanics or related areas (biology, engineering, physics). A relevant Master's degree and/or experience in one or more of the following will be helpful but not essential: 3D motion capture (Vicon/Qualisys, *etc.*); musculoskeletal modelling (*e.g.*, OpenSim); and MATLAB, Python, or similar programming language. Experience in teaching will also be an advantage.
Link to School research theme:	Lifestyle for Health and Wellbeing