Investigating the time course of vitamin D storage in human adipose and skeletal muscle and the relationship to skeletal muscle protein synthesis

Supervisory team:
Main supervisor: Dr Raquel Revuelta Iniesta (University of Exeter)
Second supervisor: Prof Francis Stephens (University of Exeter)
Prof Dylan Thompson (University of Bath)

Collaborators: Dr Benjamin Wall (University of Exeter), Dr Marlou Dirks (University of Exeter), Dr Andrew Murton (University of Texas Medical Branch)

Host institution: University of Exeter (St Luke's)

Project description:

Healthy adults maintain muscle tissue by continuously building up and breaking down muscle proteins throughout the day. This happens due to the daily influences of nutrition and physical activity. Specifically, recent studies have shown that vitamin D is essential for maintaining muscle mass by activating anabolic pathways (in response to anabolic stimuli) involved in muscle protein synthesis (MPS). Although, various candidate molecules and physiological pathways have been identified in vitro and animal models, it is unclear whether these findings translate into in vivo human models. The main storage site for vitamin D in humans is adipose tissue and we (Prof Thompson) have preliminary data demonstrating that it can be released upon exercise, which is another anabolic stimulus for skeletal muscle. Interestingly, animal studies indicate that up to 20% of vitamin D is also stored in human skeletal cells and epidemiological data from the UK suggest that despite insufficient sunlight in winter to synthesise vitamin D in the skin, a significant proportion of a population resident in Scotland, maintained blood vitamin D concentration above 50 nmol/L (sufficiency).

The PhD student will test the hypothesis that vitamin D supplementation increases the human MPS response to anabolic stimuli (feeding and exercise) by stimulating the mTOR pathway. Furthermore, the PhD student will also investigate the temporal nature of vitamin D storage in human adipose and skeletal muscle during vitamin D supplementation and whether vitamin D released from adipose tissue is taken up by skeletal muscle.

This research project will be conducted within the University of Exeter Nutritional Physiology Group (http://sshs.exeter.ac.uk/research/integrativephysiology/nutritionalphysiology/) and spend a period of time at the University of Bath, Department for Health, learning necessary skills for investigating adipose tissue vitamin D turnover. This project will provide the student with an excellent cross-disciplinary skill set utilising techniques such in vivo nutritional physiology techniques necessary to address the hypothesis of this study. These include, direct measures of MPS using stable isotope, muscle and adipose biopsy sampling, arterio-venous balance, and ex vivo sample analysis including gene array and protein signalling.