Do gut derived metabolites underpin ergogenic effects of prebiotics: metabolic fate of short chain fatty acid oxidation

Supervisory team:
Main supervisor: Dr Luciana Torquati (University of Exeter)
Second supervisor: Prof Javier Gonzalez (University of Bath)
Prof Jo Bowtell (University of Exeter), Prof Dylan Thompson (University of Bath)

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

Project description:
Emerging evidence suggests association between gut microbiome composition and exercise capacity and performance. It is thought that bacterial fermentation of prebiotic fibre generates metabolites that could fuel exercise; however confirmatory mechanistic studies in humans are lacking. Increasing exercise capacity though modulation of gut microbial composition could represent a novel untapped approach to enhance exercise tolerance and thus improve exercise uptake and adherence by less or in-active people, with the commensurate health benefits. The aims of this PhD are to enhance understanding of the influence of gut microbial composition and diversity on exercise capacity and tolerance, and whether this can be modified through prebiotic supplementation. Specifically, we want to know if fermentation of particular types of dietary fibre are used by gut bacteria to generate metabolites (short-chain fatty acids) that are used to fuel exercise. Since the most plentiful short-chain fatty acid (acetate) is produced by both the human liver and by bacterial fermentation in the gut, their relative contribution to muscle metabolism is unclear.

To answer this question, you will undertake 3 studies in this PhD programme involving acute and chronic supplementation with inulin, a type of fibre that is fermented by gut bacteria. Study 1: secondary analysis of data from a completed study examining effects of prebiotic supplementation on exercise capacity and gut microbiome to develop data analysis skills and develop hypotheses to be tested in your subsequent studies. Study 2: compare the effects of acute supplementation and gut microbiome metabolite changes vs chronic supplementation and metabolite/gut microbiome changes on exercise capacity/performance. Study 3: acute supplementation study with 13-C labelled inulin, to trace the metabolic fate of 13C metabolites to confirm whether these are used as fuel by muscles during exercise.

During this PhD you will develop clinical and wet lab skills, including blood sampling collection, stable isotope techniques, performing exercise trials, measuring physiological outcomes, and extracting and sequencing DNA material. Analytical skills that will be developed include bioinformatics, data science and statistical analysis.
The supervisory team and research facilities are well positioned to support you in developing the above skills. We will provide you with individual training and opportunities to practice data collection with your research group peers and use of existing data bases to train and develop your analytical skills, before applying this to your own data. The facilities at Exeter and Bath university are long established and already set-up for the proposed studies in this PhD.

Our aim as the SWBio DTP is to support students from a range of backgrounds and circumstances. Where needed, we will work with you to take into consideration reasonable project adaptations (for example to support caring responsibilities, disabilities, other significant personal circumstances) as well as flexible working and part-time study requests, to enable greater access to a PhD. All our supervisors support us with this aim, so please feel comfortable in discussing further with the listed PhD project supervisor to see what is feasible.