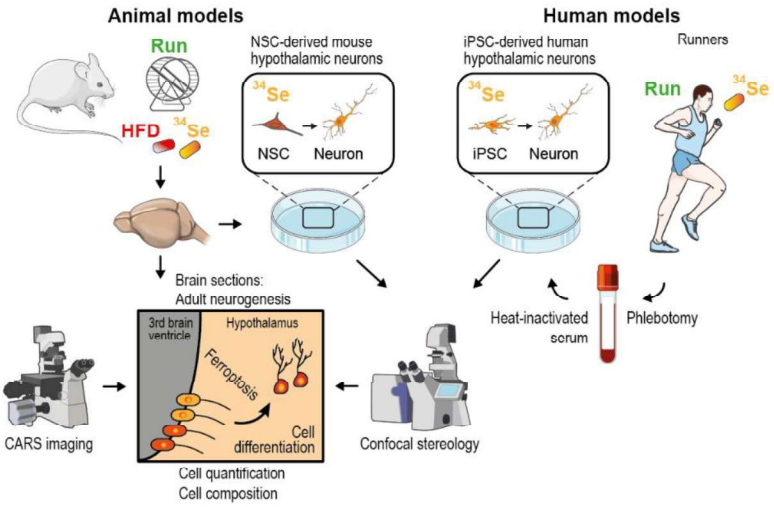
Exercise in a Pill – Investigating Selenium and Brain Stem Cells

Project ID: 3626

Supervisory team

Main supervisor: Dr David Petrik (Cardiff University)
Second supervisor: Prof Paola Borri (Cardiff University)
Other supervisors: Prof Nicholas Allen (Cardiff University), Prof James Betts (University of Bath),
Collaborators: Prof Sandrine Thuret (Kings College London)

Host institution: Cardiff University



Project description: Background: The adult brain can generate new neurons throughout life, a process known as adult neurogenesis, which also occurs in the hypothalamus, a brain region that regulates appetite and energy balance. Our recent research (Jorgensen et al., 2026) showed that voluntary exercise increases the formation of new hypothalamic neurons in mice and protects neurogenesis from the damaging effects of a high-fat diet. We also found that short-term dietary selenium supplementation produces similar benefits, suggesting that selenium can mimic some of the positive effects of exercise on the brain. However, it is not yet known how exercise and selenium produce these effects or whether similar mechanisms operate in humans.Project aims: This project will investigate how exercise and selenium influence the production of new hypothalamic neurons from neural stem cells and how these changes may affect the brain's control of metabolism. The student will use mouse models, samples from human volunteers, and human stem cell-derived neurons to compare the effects of exercise and selenium across different experimental systems. By combining these complementary approaches, the project will identify the cellular mechanisms through which exercise and diet influence brain function.Methods: The student will investigate how exercise and selenium affect the growth, and survival of neural stem cells and differentiation and specification of neurons in the mouse hypothalamus using microscopy and quantitative image analysis. They will also study how these interventions alter the metabolic state of these cells using an advanced imaging technique, Coherent Anti-Stokes Raman Scattering (CARS), which determines the chemical composition of individual cells without the need for fluorescent labels. To assess the relevance of these findings to humans, blood samples will be collected from volunteers before and after exercise and/or selenium supplementation. Human hypothalamic neurons generated from induced pluripotent stem cells (iPSCs) will then be exposed to this serum to determine whether circulating exercise-induced factors influence neuronal development and whether selenium can mimic these effects.Training and impact: The student will receive interdisciplinary training in neuroscience, stem cell biology, microscopy, optical physics, and human physiology across laboratories at Cardiff and Bath. They will gain experience in both animal and human research, advanced imaging, and quantitative data analysis while working in a collaborative, multidisciplinary research environment. This project will improve our understanding of how

exercise and diet influence brain plasticity and metabolic health and may identify new strategies to promote healthy ageing and reduce the risk of obesity and metabolic disease.

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.