Run, sleep, repeat: Regular exercise for good health and longevity

Project ID: 3717

Supervisory team

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Project description: Regularity in our daily routine is popularly held to be key to a happy and long life. Lifestyle factors such as diet and regular exercise underpin this and together they act to stabilise our body's internal 24h or circadian rhythms. Our body clock controls 24h variation across molecular, cellular, and whole animal levels including gene expression, brain cell activity, sleep, heart rate, metabolism, and cognition. As we age, our body clock and the rhythms it controls, such as the sleep-wake cycle, deteriorate, elevating the risk of developing obesity, cardiovascular diseases, cancer, and poor mental health. The brain's hypothalamus contains the body clock as well as the centres that regulate how much we eat and sleep and current evidence in rodents indicates that daily change in molecular and neuronal activities in the hypothalamus declines with age. Here, the student will investigate if and how early and later life improvements in physical activity influence hypothalamic rhythms and markers of healthy ageing.In this project, the short- and long-term effects of providing mice of different ages with the opportunity to voluntarily exercise in a running-wheel on molecular, brain and body rhythms. Specifically, the utility of voluntary exercise in strengthening the molecular clock cells will be investigated using mice with bioluminescent reporters of the molecular clock, while their neuronal activity will be recorded using multielectrode arrays. Complementary assessments will be made of behavioural and metabolic rhythms along with measures body weight and body fat. This intervention of scheduled physical exercise will be examined in young and old mice. These studies will be augmented by investigation of publicly available datasets of mouse and human (UKBioBank) parameters of daily gene expression, sleep and wake, body weight, cognitive abilities, and longevity. Here relationships between timing and levels of physical activity and general health and well-being will be assessed across the lifespan. The central hypothesis to be tested is is that both early and later life routines in physical exercise bolster good health and longevity.

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.