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Title of project: Investigating Seasonal Rhythms in Energy Metabolism

ABSTRACT

There is a strong link between circadian and diurnal cycles and the metabolism of mammals and disrupting these cycles can have a profound effect on metabolic parameters. Investigations into the interplay between energy metabolism and circadian rhythms in mice normally use a 12:12 hour light:dark cycle which mimics a day close to the equinox. However, in many countries that are not close to the equator, such as Denmark, seasonal variation in light hours can dramatically change during summer and winter. Over half of the world's population live at latitudes at which there is at least a difference of 4 hours of daylight per day between summer and winter. Seasonal variations in metabolic health in humans may have substantial implications on the timing and effectiveness of treatment, however the relationship between seasonal rhythms and energy metabolism is still not well understood. We hypothesise that altering the light:dark cycle will effect both circadian periodicity of specific tissue clocks as well as processes involved in energy storage and utilisation. We will examine this hypothesis by investigating energy metabolism and the expression of tissue clock genes in mice housed at one of three photoperiods: a summer period, a winter period and an equinox period. We will perform metabolic testing in the mice over the course of 12 weeks and then examine the expression of circadian clock genes in metabolically important tissues over several timepoints. In a second cohort of mice, the photoperiod will be incrementally shortened or lengthened and markers of metabolic health will be tested at baseline and over the course of 16 weeks. The metabolic and circadian data will then be integrated to determine the effect of seasonal photoperiods on circadian and diurnal cycles and metabolic health. If we can determine the time of year in which humans are the most prone to metabolic disease we could alter medication regimens to reflect this or stress the importance of exercise and diet for particular seasons.