BBSRC Strategic Research Priority
Molecules, Cells and Systems

- Clock Systems

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PhD project title:

  Network interactions shape the circadian clock in Drosophila melanogaster

University of Registration: Leicester

Project outline

1. Project outline describing the scientific rationale of the project (max 4,000 characters incl. spaces and returns)

   The circadian clock is an endogenous mechanism that synchronizes almost all behaviour and physiology with the Earth’s 24 hour environmental cycles. Predictably, the circadian clock has a huge impact on health and quality of life. Dysfunction of the clock not only generates temporal disorientation and sleep problems, but also is involved in pathologies such as obesity, mental illness, cardiovascular disease and cancer. Clearly, it is extremely important to achieve a comprehensive understanding of how the circadian clock works [reviewed in 1].

   The fruitfly Drosophila melanogaster is an ideal organism for the study of circadian rhythms, its clock shares its design and molecular components with that of mammals but it is much easier to manipulate.

   In a recent breakthrough, we discovered that different clock neurons in the fly tend to cycle with different speeds and that only their mutual synchronization keeps the fly running with a common 24 h cycle [2]. Consequently, we cannot understand the oscillator by focusing only on the regulation of genes and molecules in single neurons but we must investigate the organization of the clock network as a whole.

   This proposal aims to study the circadian clock in terms of network organization. We will use a combination of classic and original approaches. We will analyse the cycling of clock proteins in different neurons, but we will also develop novel markers of neuronal activity that are better suited than available tools to circadian experiments. Moreover, we will study classic mutants and widely used mosaics (GAL4/UAS lines) but we will also develop our own mutants and mosaics, for instance using CRISPR/CAS9 a state-of-the-art genome-editing tool. We envisage that our work will provide a new framework for a fuller comprehension of the biology of the circadian
clock of *Drosophila*, but will also generate novel tools that will be useful for studying circadian clocks in general.

**References**


**Techniques that will be undertaken during the project**

*Drosophila* genetics and behaviour, imaging techniques, molecular biology, biosensors, advanced statistics and bioinformatics. Imaging techniques and advanced statistics and bioinformatics are recognised by the BBSRC as new ways of working.