

College/University PhD Studentship in Genome Science

Studentship Number: **MBSP-12/05**

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Project title: **Genome-Wide Screen for Genes Involved in Insect Seasonal Timing**

This project is aimed at identifying the genes and brain neurons that constitute the photoperiodic clock, an elusive circuit that allows animals to measure the annual change in day-length. The photoperiodic clock is the basis for seasonal timing, which is a key process for the successful survival and reproduction of many organisms. Despite intensive study of the photoperiodic clock at the phenotypic level over the last 80 years, the underlying molecular mechanism is still unknown.

The jewel wasp *Nasonia vitripennis* whose photoperiodic response is well-characterised is an emerging powerful model system. The complete genome of *Nasonia* has been recently sequenced, and gene knock-down by RNA interference (RNAi) can be accomplished. The fact that *Nasonia* is increasingly amenable to genetic and molecular analysis, makes it an ideal system for dissecting the molecular basis of the photoperiodic clock.

Nasonia parasitises the pupae of large fly species. The wasp larvae hatch and then consume the fly pupa, before pupating and emerging from the host. Short day-lengths experienced by wasp females in late summer induce diapause (dormancy) in their larval progeny. This is a typical photoperiodic response, which means the *Nasonia* model will be relevant to many other insect species including pests and service providers.

We will use chemical mutagenesis to identify genetic variants that affect photoperiodic timing, by mating chemically treated males to genetically marked females. F1 females will be kept in short days, and the progeny of each female will be tested for reduced levels of diapause. Separately, F1 males will be tested for their circadian behaviour, and putative mutants with aberrant rhythmicity will be isolated (males are haploid, so recessive mutations are immediately apparent). In the second phase of the project we will use linkage analysis to map the mutations. By taking advantage of the strains that have been recently sequenced and recent SNP mapping protocols developed for *Drosophila*, mapping can be completed within ~6 months. In the third phase of the project we will characterise the various mutations by dissecting their role in circadian and photoperiodic control, studying the expression of the corresponding genes by *in-situ* hybridisation and their functional analysis by dsRNAi knockdown.

References

- Pegoraro, M & Tauber, E. 2011. Animal clocks: a multitude of molecular mechanisms for circadian timekeeping. *Wiley Interdisciplinary Reviews RNA*. 2: 312-320.
- Tauber, E. & Kyriacou, C.P. 2001. Insect photoperiodism and circadian clocks: models and mechanisms. *Journal of Biological Rhythms* 16: 381-390.