Revealing the Ancestral Circadian Clock – to start October 2019

Christine Desty Scholarship, fully-funded (Home/EU fees £4630 plus stipend of £15,009) for an MSc by Dissertation (MSD) in the School of Biological Sciences, University of Essex

Circadian clocks are the underlying cause of jetlag, but they also play vital roles in metabolism and physiology in animals, plants, and bacteria. Despite being essential for correct cellular functions (the scientists who defined the molecular clock were awarded the Nobel prize in 2017), we do not understand the nature of the ancestral circadian system. Intriguingly, although ubiquitous in nature there is limited conservation of circadian clock components between kingdoms, demonstrating that these aspects of the circadian system have evolved independently in different lineages. As a consequence we still do not understand how the ancestral clockwork functioned, nor whether these functions have been retained.

We have previously identified a highly conserved metalloprotein, JMJD5, that plays an interchangeable role in the timing mechanisms of plants and humans despite their highly divergent evolutionary paths (Jones *et al.*, 2010, Jones *et al.,* 2019). A comparable circadian defect has been identified in flies lacking *JMJD5*. Such conservation strongly suggests that JMDJ5 forms part of the ancestral circadian system, but its molecular function remains controversial. Enzymatically, human JMJD5 (HsJMJD5) was initially demonstrated to have histone demethylase activity *in vitro*. However, recent studies have discounted this initial work and instead used a multi-disciplinary approach to demonstrate arginyl hydroxylase activity upon ribosomal subunits- the first eukaryotic arginyl hydroxylase identified (Wilkins *et al.*, 2018).

In bacteria arginyl hydroxylases restrict cell division by regulating the efficiency of translation. This project will explore the structure of JMJD5 and its role in post-translational modification of ribosomal subunits. This will allow us to better understand the ancestral circadian system.

The aims of this projects are:

1) Purify and crystallise *Arabidopsis thaliana* JMJD5 (AtJMJD5). Construct will be designed based on the structure of human JMJD5.
2) Confirm AtJMJD5 substrate, using recombinant GST-tag AtJMJD5 against candidate peptides.
3) Examine the circadian pattern of ribosomal subunit phosphorylation in *jmjd5* plants using existing antibodies.

Training

This project provides the opportunity for a student to gain molecular biology and protein chemistry skills (cloning, protein expression, crystallization, enzyme assays, immunoblotting), along with opportunities to work with model eukaryotic organisms and receive bioinformatic training. The student will work alongside students and postdocs in the Jones and Prischi labs on a project with synergistic benefits to existing research projects, with opportunities to present their work at internal seminar series. The student will also attend the BCA crystallography school 2019 and Diamond Light Source BAG-training.

Entry requirements and application procedures
Highly motivated applicants with, or expecting, a good degree in the broad area of Life Sciences are encouraged to apply.
Applications should be submitted electronically by **24th April 2019** see here for details https://www.essex.ac.uk/pgapply/enter.aspx

You are encouraged to contact the supervisor before application: matthew.jones@essex.ac.uk and fprischi@essex.ac.uk If you have any queries with the online application process, please contact ecrix@essex.ac.uk

For general information about the School of Biological Sciences at the University please visit our webpages http://www.essex.ac.uk/bs/.

The University of Essex
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