

RNA binding proteins and mRNA localisation in *Drosophila*

Supervisory team:

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Project description:

mRNA localisation to specific sub-cellular regions is a widespread phenomenon in polarised cells and is critical both during development (eg for patterning) and in differentiated cell types (eg for long term memory). Sub-cellularly localised mRNAs must interact with specific RNA-binding proteins to ensure their normal localisation/ anchoring. Typically they are also under translational controls, to ensure they are only translated when at the target location. These phenomena have been studied in several systems, most notably in developmental patterning, cell migration and neurons. However many sub-cellularly localised mRNAs have been discovered through high-throughput studies, and the mechanisms underlying their localisation and translation have not been investigated.

We have discovered a set of localised mRNAs, which are found specifically at the growing ends of *Drosophila* spermatids, in patterns resembling comets or cups. We also discovered a set of known RNA-binding proteins that also localise to this region. In this project you will investigate potential roles of the RNA-binding proteins in localising these specific mRNAs. RNA localisation and translation will be investigated in RNA-binding protein mutants. Protein-RNA interactions will be assayed in vitro with both purified components and extracts (to allow ternary complex formation). You will also determine whether, and how, mutations in the localised mRNAs and RNA-binding proteins affect the intricate structure of developing spermatid tail tips.

This will provide the basis for a further analysis of this novel and virtually uncharacterised set of localised mRNAs. For example, systems biology and mathematical modelling approaches can be applied once the basic parameters of localisations, using super-resolution methods, and interactions at the biochemical and functional levels have been determined.

Objectives

- To describe and compare the comet and cup mRNAs', and RNA-binding proteins', localisations at the growing ends of spermatids.
- To determine whether the known RNA-binding proteins are important for localisation of any comet and cup mRNAs.
- To identify and characterise direct (or indirect) protein-RNA binding interactions between the localised mRNAs and the RNA-binding proteins.
- To investigate whether mutations in comet and cup genes, and the RNA-binding proteins, cause defects in the cellular structure at the growing ends of elongating spermatids.
- To uncover the relationship between "comet" and "cup" transcript localisation patterns.
- To determine whether the known RNA-binding proteins regulate comet and cup mRNA translation.

[Hear more about the project from Prof Helen White-Cooper directly >>](#)