

Science and Technology Group Annual Report FY2017

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1 Introduction

The past year has seen progress towards completion of single-cell RNA-seq work in *Ciona* and completion of a collaborative pilot in *Oikopleura dioica*. Future work will focus on the development of computational methods and analysis of cellular resolution data in *Drosophila* and other public data.

2 Activities and Findings

1. Single-cell measurements in *Ciona*

It is important to have measurements of transcription factor levels and gene outputs at single-cell resolution. Spatially averaging transcription factor measurements obscures cellular state and hence limits the effectiveness of statistical studies of the regulatory inputs and outputs in the cell. Therefore, to understand gene regulation, it is crucial to develop approaches for measuring gene expression at the single-cell level.

Previously, we generated a complete dataset of single-cell expression data at the 16-cell embryo stage in *Ciona robusta*, a marine chordate. Experimental validation and analysis was completed in 2017 and the relevant manuscript submitted. We are currently addressing reviewers' comments.

2. Completion of an *Oikopleura dioica* pilot

Previously, in collaboration with the Luscombe unit, we established a culturing facility of *Oikopleura dioica* at OIST. During 2017, we piloted the feasibility of specific experimental techniques for transgenic and synthetic enhancer work, including microscopy, microinjection techniques and CRISPR. At the end of the pilot, we decided not to take this collaborative project forward, but instead the Luscombe unit will focus on developing other projects for which *Oikopleura dioica* is well suited.

3. Analysis of synthetic enhancer work

In preparation for potential future work, I analysed previously published synthetic enhancer work. This work was published as part of a review paper in collaboration with Justin Crocker at the EMBL.

4. Supervision of interns

During 2017, I co-supervised two interns, from France and the USA, who came to learn about the computational and experimental work done at OIST and in the Luscombe unit.

3 Collaborations

Theme: Measuring gene expression with single-cell RNA-seq

Type of collaboration: Joint Research

Researchers: Luscombe Unit (OIST)

Theme: Making sense of synthetic enhancer results

Type of collaboration: Joint Research

Researchers: Justin Crocker (EMBL)

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4 Publications and other output

Crocker, J. & Ilsley, G. R. Using synthetic biology to study gene regulatory evolution. *Current Opinion in Genetics & Development* **47**, 91–101 (2017).

Blue Seminar at EMBL, Heidelberg. Reasoning with simple models of enhancers in the early *Drosophila* embryo. February 2018.