

Seminar

The interplay between ‘cell cycle’ and ‘gene expression’

Kedar Nath Natarajan

Wellcome Trust Sanger Institute, Cambridge

Cell cycle is an evolutionarily conserved, fundamental process wherein single cells duplicate their DNA and faithfully divide into two daughter cells. During development, cell cycle controls required cell numbers at different stages to regulate proper cell state and fate acquisition. Across an organism, the tightly controlled cell cycle process interplays with gene expression to direct individual cell-state, cell-fate decisions, responses to environment and ultimately cellular identity. Pluripotent embryonic stem cells (ESCs) self-renew and differentiate into all lineages of the embryo and adult organism. ESCs have a distinct cell cycle structure and a coordinate gene expression program that governs their state, differentiation and cell-fate decisions. Single-cell transcriptomics approaches have emerged as a powerful tool for profiling individual cells within populations and has greatly impacted our understanding of diverse biological processes.

I will present our work, where we utilize single-cell RNA-sequencing (scRNA-seq) on mouse ESCs and immune cells to study the cell cycle control of gene expression. In the first part, I will describe how our single-cell efforts have uncovered new biological insights in ESCs, during neuronal differentiation and immune cells. In the second part, I will briefly highlight our computational approaches for bulk and single-cell data analysis. In the third part, I will describe a new transgenic system (FUCCI-Cas9), which I developed to capture spatio-temporal cell cycle dynamics upon CRISPR-mediated candidate gene knockout (KO). This approach aims to identify and validate new cell cycle and essential developmental regulators. Lastly, I will present an outline for proposed multidisciplinary work as an independent faculty to elucidate the functional interplay between cell cycle and gene expression.

In summary, the proposed work will provide new insights of cell cycle control at single-cell level for developmental biology and future clinical avenues for dysregulated cell cycle in disease.

Thursday, Jan 4th 2018

4:00 PM (Tea/Coffee at 3:30 PM)

Seminar Hall, TIFR-H