Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad - 500107

Internal Seminar

Deciphering the dynamics of differentiation and proliferation through mathematical and computational modeling

Dola Sengupta

IIT-B, Mumbai

Cell fate decision making during differentiation goes through a sequence of events during embryonic development. In this regard, the differentiation dynamics of neural stem cells (NSCs) is highly complicated, as these cells, like other stem cells are capable of self-renewal through active proliferation mechanism. An ideal way to investigate the differentiation dynamics of the NSCs will be to make an extensive experimental data-driven mathematical and computational model of neuronal differentiation by using which one can investigate the interplays between the proliferation propensity, stemness maintenance and the onset of differentiation within a neural stem cell. Analysing such a comprehensive model would definitely allow us to decipher the underlying control mechanism that regulates the NSCs to differentiate in a context dependent manner. Keeping this in mind, first, we concentrate on performing mathematical and computational modelling studies of the differentiation dynamics of NSCs in both central and peripheral nervous systems. Our intention was to understand how the differentiation dynamics of the NSCs depend on different external signalling factors (Such as BMP2), expression levels of microRNAs, and importantly, on the fluctuations present in and around the cellular environment. Later, we focus on building up a basic mass-action kinetics based mathematical model for the G_1/S transition regulation in mammalian cells to understand the crucial decision making process that ultimately controls the proliferation commitment in such cells. This definitely creates a scope of making an extensive cell cycle model in future to study the differentiation and proliferation signalling simultaneously in NSCs, and paves the way to form an integrative modelling framework that will enable us to ask important questions related to differentiation dynamics of NSCs, which are otherwise impossible to address by only probing these systems through experiments. Our ultimate goal is to have a comprehensive mammalian cell cycle model and later couple it with the differentiation network prevailed in the NSCs to have a better understanding of the differentiation dynamics in future.

Monday, Oct 8th 2018

10:00 AM (Tea/Coffee at 9:30 AM)

Seminar Hall, TIFR-H