BioSystems Science and Engineering

SEMINAR

4:00 pm, November 13, 2017
MRDG Seminar Hall

Computational systems biology of epithelial-hybrid-mesenchymal transitions: can theory help understand cancer biology?

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Metastasis causes above 90% of all cancer-related deaths. It is often driven by epithelial cells losing cell-cell adhesion and gaining the mesenchymal traits of migration and invasion – a process known as Epithelial-Mesenchymal Transition (EMT). EMT and its reverse MET have been largely considered as binary; any hybrid epithelial/mesenchymal (E/M) phenotypes have been tacitly assumed as transient.

Our integrated theoretical-experimental work suggests that a hybrid E/M phenotype can be stably maintained by cells, and can be more aggressive than purely epithelial or mesenchymal phenotype. I have developed novel mechanism-based mathematical models of intracellular and intercellular signalling networks regulating EMT or MET that predict that cells in a clonal population can attain multiple phenotypes – epithelial, mesenchymal and hybrid E/M – due to systems-level emergent behaviour of these networks. Moreover, these models predict that hybrid E/M cells are likely to form many more metastases as compared to fully E or fully M cells, and have identified certain 'phenotypic stability factors' that can both stabilize a hybrid E/M phenotype and associate with poor patient outcome. These predictions have been validated experimentally in H1975 lung cancer cells.

Collectively, my work highlights how an iterative crosstalk between mathematical modelling and experiments can both generate novel insights into the dynamics of cellular plasticity and uncover previously unknown accelerators of metastasis.

About the Speaker

Mohit Kumar Jolly obtained his B. Tech. and M. Tech. in Biological Sciences and Bioengineering from IIT Kanpur in 2010 and 2012 respectively. He received his Ph.D. in Bioengineering from Rice University in 2016 working at the interface of systems biology and cancer biology. He currently holds an independent postdoctoral fellowship in Computational Cancer Biology sponsored by Gulf Coast Consortia Houston. His current work focuses on integrating mechanistic mathematical models with experiments and clinical data to elucidate the mechanisms of metastasis. His work has been featured on the cover of the journal Molecular and Cellular Biology. Also, he won the 2016 iBiology Young Scientist Seminar Series – a coveted award for communicating one's research to diverse audience.