Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad – 500 046

Seminar

Exploring Signalling Pathways through Theory and Experiment

Rati Sharma

IISER, Bhopal

The kinetics and timescales associated with chemical reactions have important implications in many scientific fields ranging from chemistry to biology. In particular, all the processes inside a biological system, such as a living cell, are governed by when and in what amounts proteins or RNAs can relay the signal downstream and create new molecular entities. Most of these are non-equilibrium processes, and therefore, the participating entities are in non-equilibrium states. The complexity in these systems then arise both due to their dynamical nature and due to the large network of reactions taking place in the cell.

I will, in this talk, walk through a few examples of signalling pathways that counter the external stressors and restore balance inside a living cell. Specifically, I will focus on the Heat Shock Response (HSR) pathway, a stress-response mechanism important for proteostasis. The HSR pathway works by increasing the number of heat shock proteins (HSPs) in a cell in response to increased levels of unfolded proteins that are created due to some external stress. The newly produced HSPs then act as molecular chaperones and fold back the unfolded proteins. We have been trying to better understand this process through our research. To this end, I will discuss a modelling study from our group where we show that the Heat Shock Transcription Factor and its complex with HSP play a role in reducing the time lag of response to stress and in re-folding all the mis-folded proteins back to their native state. Further, I will also talk about a complementary experimental study on HSR dynamics in the roundworm, C. *elegans*, where we are looking at how the response is affected when genes associated with the thermosensory neuron are knocked out. These studies will help elucidate the role of the neuron and the key players in regulating the dynamics and also provide intuition about the timescales of response, both at the mRNA and the protein level.

Thursday, Aug 3rd 2023

2:30 PM (Tea / Coffee 02.15 PM)

Auditorium, TIFR-H