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

Students' Annual Seminar

In-silico modelling of collective dynamics of bacteria and bacterial cytoplasmic organelles

Palash Bera

Growth, division, and organisation in a variety of collective states are the salient features of bacterial lifestyle. Each bacterial cell grows and splits into a pair of daughter cells by segregating its DNA and self-organises itself. Bacterial cytoplasm encases with the cell wall, is a highly crowded environment with numerous polydisperse membrane-less moieties/organelles with moieties sizes varying from a few nanometres (small protein, ribosomes, metabolites etc.) to micrometres (DNA, polysomes, large proteins etc.). Furthermore, these organelles display the characteristics of glassy dynamics. It was found that metabolic activities in living cells can suppress the glassy nature of these macromolecules, enabling the cell to maintain its fluidity, which is critical for its maintenance and proliferation. Here, we propose a novel hypothesis, by means of computer simulations, that protein synthesis in living cells can contribute to the metabolism-dependent fluidisation of the cytoplasm in a size-dependent fashion. On the other hand, most bacteria in the natural environment self-organise into collective phases such as cell clusters, swarms, patterned colonies or biofilms. In the second part of my talk, we will delve into the mechanistic understanding of microcolony morphogenesis. In particular, microcolony shows the coexistence of both motile and sessile aggregates rendering a transition towards biofilm formation.

Monday, Apr 10th 2023

4:00 PM (Tea / Coffee 3.45 PM)

Seminar Hall, TIFR-H