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

Seminar

The role of dynamical forces in symmetry-breaking during embryonic development

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A fundamental question in developmental biology is how organisms robustly control the morphology of large-scale tissues and organs, given that information for such structures is ultimately encoded at the scale of molecules. Mechanical forces can help to provide such a control mechanism; however, due to the slow motion of tissues, many studies have assumed a state of local force balance. This talk will explore how dynamical forces—those generated by the movement of cells and tissues at finite rates during embryonic development—shape the morphology of organs. Using a combination of 3D vertex models, hydrodynamic simulations, and in vivo experiments, this study examines the development of Kupffer's vesicle (KV), a small organ in the zebrafish embryo that establishes the left-right (LR) body axis. Modelling indicates that dynamical forces from tissue movements drive the shape changes observed in KV during development. Laser ablations in the zebrafish embryo that disrupt these forces result in altered organ shapes matching model predictions. These highlight that even slow tissue movements can generate significant forces when tissue relaxation timescales are similarly prolonged, suggesting that dynamical forces likely play a crucial role in shaping tissue morphology across various developmental processes.

Thursday, Dec 19th 2024

11:30 Hrs (Tea / Coffee 11:15 Hrs)

Auditorium, TIFR-H