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

Students' Annual Seminar

Large scale curvature dependent reorganisation of Endoplasmic Reticulum

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Epithelial cells exhibit coordinated movement of the cells and use either lamellipodial crawling or contractile purse string in order to seal the gaps and wounds in the tissue. Cooperation between these dual modes of migration is fundamental to re-establish tissue integrity and is shown to depend on various factors. Geometry of the gap has been shown to influence these collective mechanisms. However, very little is known about how the cells respond to the large scale geometrical cues. In our study, we show that cells polarise differently while migrating at different curvatures, aligning the microtubules perpendicular to the wound at the positive curvature and parallel to the wound in a bundle at the negative curvature in an epithelial monolayer as well as in mouse embryonic skin. Endoplasmic reticulum, the largest cell organelle, also undergoes a drastic reorganisation showing more tubular structure at the positive curvature during lamellipodial crawling and dense sheet-like morphology at the negative curvature during purse string closure. Interestingly modulating cellular forces using pharmacological inhibitors and optogenetic tools alters microtubule alignment and ER structure suggesting that cells respond to the protrusive and contractile forces at different geometries by polarising differently. Tipping the sheet/tubule balance of the ER structure using genetic manipulation affects the cells' choice of migration where the sheet overexpressing cells form more actin bundles and tubule overexpressing cells form more lamellipodia. In addition ER structure can alter the orientation and stability of focal adhesions at different curvature thereby promoting a particular mode of migration. Finally, we propose a forward feedback loop whereby initial protrusive forces at positive curvature and contractile forces at negative curvature lead to drastic structural changes in the ER which are necessary for promoting lamellipodial crawling and purse string closure respectively.

Friday, June 30th 2023

2:00 PM (Tea / Coffee 01.45 PM)

Seminar Hall, TIFR-H