COMPUTATIONAL BIOLOGY WEBINAR @ IMSc

PERCOLATION IN PLANAR CELL POLARITY

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Epithelial cells, like those on our skin or in the wings of a fly, are polarized, with an asymmetric distribution of molecules and structures inside a cell. In Planar Cell Polarity (PCP), all epithelial cells in a particular region get polarized along the proximal-distal axis. PCP is an example of self-organization through local and global interactions between cells. Inspired by the similarity between PCP and other self-organizing phenomena, we have used a lattice-based spin model for PCP that mimics the alignment of cells through local interactions. In this model, the segregation of protein-complexes within a cell is equivalent to spin-exchange, and interaction between neighboring cells through protein complexes is equivalent to spin-spin interactions. We investigated the equilibrium behavior of this model. In this model, the alignment of cells leads to the formation of clusters of aligned cells, and such clustering exhibits a percolation transition. Even though the alignment of a cell in this model depends upon its neighbors, finite-size scaling analysis shows that this model belongs to the universality class of simple 2-dimensional random percolation. In this webinar, I will discuss various behaviors of this toy model and would try to illustrate that if we remove the bells and whistles, many complicated biological phenomena can be equated with simple physical models.

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