Dynamical processes in cells and tissues

Jonathan E. Dawson

Max Planck Institute for Dynamics and Self-organization

Göttingen

I will present two examples of dynamics and self-organization in living systems. At the cellular level, network of endosomes organizes the sorting and processing of cargo molecules internalized into the cell. Endosomes are intracellular vesicular objects, which move stochastically in a process mediated by molecular motors and interact with each other via highly regulated fusion and fission processes. I will present a general theoretical framework that captures the interactions of distinct endosomes and quantitatively describes the experimentally observed cargo distributions in an endosomal network. Experimental distributions display scaling behavior, indicating that specific interactions between individual endosomes play a key role in cargo trafficking.

At the tissue level, leaf vein morphogenesis and patterning involves cell shape changes and is under the regulation of plant growth hormone auxin. How auxin coordinates the developmental regulation of leaf vein is not well understood. I will present a cell based physical model that captures the interplay between key biochemical processes and cell mechanics in a growing tissue of leaf primordia. Cell auxin concentration based dynamic modulation of cell mechanical properties results in non-trivial strain and force distributions and describes auxin distribution, cell shape changes and vascular branching in leaf lamina in early stages of development.