JUPITER ALGORTA, University of British Columbia

Exploring Cellular Polarization and Motility Through Bulk-Surface Dynamics

Cellular polarization and motility are fundamental processes in biology, underlying phenomena such as tissue development, immune response, and cancer metastasis. These behaviors are tightly regulated by proteins like GTPases, which act as molecular switches to control cellular protrusion. GTPases exhibit dynamic interplay between their active, membrane-bound form and inactive, cytoplasmic form, creating a spatially localized bistable system.

In this talk, I motivate a bulk-surface reaction-diffusion model that captures the coupling between cytoplasmic and membrane-bound GTPase dynamics, and connect it to an evolution law that deforms the domain in response to those dynamics. By integrating the biochemical processes governing GTPase activity with the physical deformation of the cell boundary, this framework provides a unified approach to studying how intracellular signaling drives cellular shape changes and motility.