Mathematical Biology Seminar

Monday, December 6, 2021
3 pm – 457 CAB (in person)

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Intracellular transport of intermediate filaments

Intermediate filaments are one of the components of the cytoskeleton; they are involved in cell mechanics, signaling and migration. The organization of intermediate filaments in networks is the major determinant of their functions in cells. Their spatial-temporal organization results from the interplay between assembly/disassembly processes and different types of transport.

Intermediate filaments, which are long elastic fibers, are transported in cells along microtubules by antagonistic motor proteins. How elastic filaments are efficiently transported by antagonistic motors is not well understood and is difficult to measure with current experimental techniques. Adapting the tug-of-war paradigm for vesicle-like cargos, a mathematical model is developed to describe the motion of an elastic filament punctually bound to antagonistic motors. Combining stochastic and deterministic dynamical simulations and qualitative analysis, the asymptotic behaviour of the model, which defines the mode of transport of filaments, is investigated. The effects of initial conditions, reflecting the intracellular context, model parameters and functionals, describing motors and filament properties, and noise are characterized.

Work in collaboration with J. Dallon (BYU, Provo, Utah, USA), C. Leduc (Institut Jacques Monod, Paris, France) and S. Etienne-Manneville (Institut Pasteur, Paris, France)