JACK HUGHES, University of British Columbia

Travelling waves and wave pinning (polarity): Switching between random and directional cell motility

We derive a simple model of actin waves consisting of three partial differential equations (PDEs) for active and inactive GTPase promoting growth of filamentous actin (F-actin, F). The F-actin feeds back to inactivate the GTPase at rate sF, where $s \geq 0$ is a "negative feedback" parameter. In contrast to previous models for actin waves, the simplicity of this model and its geometry (1D periodic cell perimeter) permits a local and global PDE bifurcation analysis. Based on a combination of continuation methods, linear stability analysis, and PDE simulations, we explore the existence, stability, interactions, and transitions between homogeneous steady states (resting cells), wave-pinning (polar cells), and travelling waves (cells with ruffling protrusions). We show that the value of s and the size of the cell can affect the existence, coexistence, and stability of the patterns, as well as the dominance of one or another cell state. Implications to motile cells are discussed.