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The Auditorium (Level 1)
Hosted by: Dr Zhang Dan

Model of Cytokinetic Contractile Ring Assembly: Node-Mediated and Backup Pathways

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Cytokinetic ring assembly in fission yeast is a dynamic process, involving condensation of a network of actin filaments and myosin motors bound to the cell membrane through cortical nodes. Our 3D computational model illustrates how myosin motors, filament crosslinkers and actin turnover cooperate for robust ring formation [Bidone et al. Biophys. J, 2014]. Experiments by D. Zhang (Temasek Life Sciences) show that tethering of the cortical ER to the plasma membrane modulates the speed of node condensation and node clumping. We captured the trend observed in these experiments by changing node drag and initial distribution [Zhang, Bidone, and Vavylonis, Curr. Biol. (2016)]. An outstanding issue is how rings form in *mid1Δ* cells that fail to recruit myosin to nodes. We reproduced observations in *mid1Δ* cells by assuming medial actin filament nucleation and actin-dependent binding of diffusive myosin to the cortex. We predict correlation between width of actin nucleation zone and ring tilt angles, in agreement with experiments by J.-Q. Wu's group (OSU). We suggest that localization of actin nucleators and myosin is an important geometrical cue guiding self-organizing actomyosin towards different functional morphologies.

Dr. Vavylonis received a Physics BSc from the Univ. of Athens and a Physics PhD from Columbia Univ. He worked on actin biophysics as postdoc with Ben O'Shaughnessy and Tom Pollard and joined Lehigh Univ. in 2006. His group focuses on mathematical and computational modeling of the cytoskeleton and related areas of cell biophysics. He had visiting positions at Univ. of Lausanne, AMOLF (Amsterdam) and Kyoto Univ. His work has been supported by NIH and HFSP.

Recent Publications:

1. 1. D. Zhang, T. C. Bidone, **D. Vavylonis**, "ER-PM contacts define actomyosin kinetics for proper contractile ring assembly," Current Biology, 26:647-653 (2016).
2. L. Merlini, B. Khalili, F. O. Bendezú, D. Hurwitz, V. Vincenzetti, **D. Vavylonis**, S. M. Martin, "Local pheromone release from dynamic polarity sites underlies cell-cell pairing during yeast mating," Current Biology 26:1117-1125 (2016).
3. L. M. McMillen and **D. Vavylonis**, "Model of turnover kinetics in the lamellipodium: implications of slow- and fast- diffusing capping protein and Arp2/3 complex," Physical Biology 13:066009 (2016).