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Assembly Mechanism of the Contractile Ring for Cytokinesis by Fission Yeast DIMITRIOS VAVYLONIS, Lehigh University, JIAN-QIU WU, Ohio State University, XIAOLEI HUANG, Lehigh University, BEN O'SHAUGHNESSY, Columbia University, THOMAS POLLARD, Yale University — Animals and fungi assemble a contractile ring of actin filaments and the motor protein myosin to separate into individual daughter cells during cytokinesis. We studied the mechanism of contractile ring assembly in fission yeast with high time resolution confocal microscopy, computational image analysis methods, and numerical simulations. Approximately 63 nodes containing myosin, broadly distributed around the cell equator, assembled into a ring through stochastic motions, making many starts, stops, and changes of direction as they condense into a ring. Estimates of node friction coefficients from the mean square displacement of stationary nodes imply forces for node movement are greater than ~ 4 pN, similarly to forces by a few molecular motors. Skeletonization and topology analysis of images of cells expressing fluorescent actin filament markers showed transient linear elements extending in all directions from myosin nodes and establishing connections among them. We propose a model with traction between nodes depending on transient connections established by stochastic search and capture ("search, capture, pull and release"). Numerical simulations of the model using parameter values obtained from experiment succesfully condense nodes into a continuous ring.

Dimitrios Vavylonis
Lehigh University

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