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A Bio-Mechanical Model for Dictyostelium Motility MATHIAS BUENEMANN, HERBERT LEVINE, UC San Diego, LEONARD SANDER, University of Michigan, WOUTER-JAN RAPPEL, UC San Diego — The crawling motion of *Dictyostelium discoideum* consists of a coordinated succession of cell contraction and protrusion. The mechanical forces exerted during this motion have been measured precisely by recent traction force experiments. Based on experimental results, we develop a bio-mechanical model of *dictyostelium* motility with emphasis of the contraction phase and the adhesive properties of the cell-substratum contact. We assume, that the cell contracts at a constant rate and is bound to the substratum by adhesive bridges which are modeled as elastic springs. These bridges are established at a (spatially uniform) rate while detachment occurs at a spatially varying, load-dependent rate. Using Monte-Carlo simulations, we find that the cell speed depends only weakly on its adhesive properties, in agreement with recent experimental results. Varying the parameters that characterize the adhesive properties and contraction of the cell, we are able to make testable predictions, e.g. for mutants with deficient adhesiveness or an impaired contractile machinery. As an extension of our model, we also included the substrate stiffness. We find substratum deformations and traction stresses that are quantitatively in good agreement with experimental data.

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