Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Physical mechanisms of collective expansion in confluent tissues in an Active Vertex Model[1] MICHAEL CZAJKOWSKI, Syracuse University, DAPENG BI, Northeastern University, XINGBO YANG, Northwestern University, MATTHIAS MERKEL, M. LISA MANNING, M. CRISTINA MARCHETTI, Syracuse University — Living tissues form many novel patterns due to the active forces exerted by the constituent cells. How these forces combine with proliferation (changing number density) and boundary conditions to control the resultant patterns is an interesting open question. This question arises naturally for in vitro wound healing experiments, where an initially confined monolayer is allowed to expand freely. As the cells interact, proliferate and advance laterally, a characteristic pattern of traction stresses is formed on the substrate. We have developed an Active Vertex Model to make predictions about active confluent tissues with free boundaries. The model incorporates active forces, flocking interactions, and simple rules for cell division within the vertex model geometry. It also exhibits a fluid-solid transition, with qualitatively distinct stress profiles in the solid and in the liquid. Furthermore, under the assumption that cells proliferate more when stretched, we find that polar alignment interactions strongly enhance cell proliferation. Our model suggests that wound healing assays may provide a useful rheological tool for tissues, as well as a novel system for studying the connection between proliferation and flocking.

[1]We acknowledge support from NSF-DGE-1068780 and The Simons Foundation for the Investigator Award in MMLS as well as the Targeted Grant in the Mathematical Modeling of Living Systems Number: 342354.

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Date submitted: 29 Nov 2016 Electronic form version 1.4