Abstract Submitted
for the PSF15 Meeting of
The American Physical Society

Computational model of mechanical forces effects on epithelial cell proliferation ALI NEMATBAKHSH, Postdoctoral Researcher, PAVEL BRODSKIY, PhD student , ZHILIANG XU, Associate Professor, University of Notre Dame, CODY NARCISO, PhD student, JEREMIAH ZARTMAN, Assistant Professor, University of Notre Dame, MARK ALBER, Professor, University of Notre Dame, BIO-MATH COMPLEXITY TEAM, ZARTMAN LAB TEAM[1] — Epithelia are sheets of cells that line the surfaces of organs and carry out important functional and structural roles for the multicellular organisms, including as barriers protecting internal cells from mechanical damage or infection. Understanding the regulation of epithelial cell mechanics is critical in defining the underlying basis of cancer development as well as for wound healing. In computational models, cells are typically approximated as polygons to simplify computation efforts, often resulting in incomplete descriptions of many morphogenetic processes including mitotic rounding during cellular division. Here we have developed a cell-based subcellular element (SCE) computational model implemented on high performance Graphical Processing Units (GPUs) clusters. The model represents mechanical properties of both the internal cytoplasm and outer membrane with subcellular nodes. The numerical results are compared with experimental data obtained from developing Drosophila wing imaginal discs, a genetic model system used to investigate the regulation of epithelial tissue growth. This work provides a computational framework that can be extended toward investigation the underlying mechanics of tissue size control at unprecedented levels of geometric detail.

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Date submitted: 16 Oct 2015 Electronic form version 1.4