Abstract Submitted
for the 4CF17 Meeting of
The American Physical Society

Quantifying randomness of cellular distributions using light sheet microscopy. WARREN COLOMB, Department of Physics, Colorado School of Mines, MATTHEW OSMOND, Department of Chemical Biological Engineering, Colorado School of Mines, CHARLES DURFEE, Department of Physics, Colorado School of Mines, MELISSA KREBS, Department of Chemical Biological Engineering, Colorado School of Mines, SUSANTA SARKAR, Department of Physics, Colorado School of Mines — The absence of quantitative in vitro cell-extracellular matrix models represents an important bottleneck for basic research and human health. Randomness of cellular distributions provides an opportunity for the development of a quantitative in vitro model. However, quantification of the randomness and deviations from perfectly random cell distributions due to underlying interactions is still lacking. In this paper, we have imaged cellular distributions in an alginate matrix using a multiview light-sheet microscope and quantified the randomness by modeling it as a Poisson process, a process that has constant probability of occurring in space or time. Our light-sheet microscope can image more than 5 mm thick optically clear samples with depth-resolution. We applied our method to image fluorescently labeled human mesenchymal stem cells (hMSCs) embedded in an alginate matrix. Simulated randomness agrees well with the experiments. Quantification of distributions and validation by simulations will enable quantitative study of cell-matrix interactions in tissue models.

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Date submitted: 20 Sep 2017 Electronic form version 1.4