replacing MAR16-2015-002039 Abstract Submitted

for the MAR16 Meeting of
The American Physical Society

Asymmetric Nano/Microtopography Biases Cytoskeletal Dynamics and Promotes Unidirectional Cell Guidance XIAOYU SUN, MEGHAN DRISCOLL, CAN GUVEN, SATARUPA DAS, Univ of Maryland-College Park, CAROLE PARENT, National Institute of Health, JOHN FOURKAS, WOLFGANG LOSERT, Univ of Maryland-College Park — Many biological and physiological processes depend upon directed migration of cells, which is typically mediated by chemical or physical gradients or by signal relay. Here we show that cells can be guided in a single preferred direction based solely on local asymmetries in nano/microtopography on subcellular scales. These asymmetries can be repeated, and thereby provide directional guidance, over arbitrarily large areas. The direction and strength of the guidance is sensitive to the details of the nano/microtopography, suggesting that this phenomenon plays a context-dependent role in vivo. We demonstrate that asymmetric nano/microtopography guides the direction of internal actin polymerization waves (esotaxis), and that cells move in the same direction as these waves (microthigmotaxis). This phenomenon is observed both for the pseudopod-dominated migration of the amoeboid Dictyostelium discoideum and for the lamellipod-driven migration of human neutrophils. The conservation of this mechanism across cell types and the asymmetric shape of many natural scaffolds suggests that actin-wave-based guidance is important in biology and physiology.

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Date submitted: 04 Nov 2015 Electronic form version 1.4