Influence of actin dynamics on speed and persistence of immune cells

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The actin cytoskeleton plays a crucial role in motility of living cells. We investigated the role of different actin associated proteins (e.g. Arp2/3, formin) in the one dimensional movement of neutrophil precursor cells in microfluidic channels. Stochastic simulations were performed to fit the data to a persistent random walk. We observed that inhibition of actin associated proteins alters intrinsic properties of the process. It could be shown that another important factor in the cell's movement is its probability of stopping which could be altered with specific drugs affecting the actin cytoskeleton (CK666, SMIFH2, Y27632). Also they altered persistence time and length, as well as speed. Further, we performed high resolution experiments in a TIRF microscope and recorded the actin dynamics. The data showed that actin polymerization waves at the cell's front were present and could be altered by inhibiting actin associated proteins. A special focus laid on the actin cytoskeleton during the directional change of a cell. We investigated the hypothesis that as long as no polymerization waves were present the two sides of the cell competed until one side formed polymerization waves which caused the cell to move into the corresponding direction.