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A self-propelled particle model with experimentally quantified cell polarization GIUSEPPE PASSUCCI, MEGAN E. BRASCH, Syracuse University, NICHOLAS O. DEAKIN, CHRISTOPHER E. TURNER, SUNY Upstate Medical, JAMES H. HENDERSON, M. LISA MANNING, Syracuse University —
Self-propelled particle (SPP) models have been used extensively to study collective cell motion, but they do not always accurately capture the long-time behavior observed in experiments. Furthermore, the equation for polarization in these models is not experimentally well-constrained. Therefore we developed a novel method for quantifying polarization in Hs578T breast carcinoma cells in a wound healing geometry. During cell movement, the nucleus orients toward the anterior of a cell while the Golgi body orients towards the posterior; we simultaneously imaged and tracked the Golgi and nuclei and constructed a polarization vector defined by the Golgi-nuclei axis. We find that cells in the bulk are not highly polarized, while those on the edge are highly polarized outward perpendicular to the wound edge. We also study the temporal correlations between a cell's internal polarization determined by the Golgi-nuclei axis and the polarization of its motion determined from nuclei displacements. We incorporate these polarization dynamics into a SPP model, and compare wound healing and long-time diffusion in the model to the experiments. These SPP equations can also be coarse-grained to generate a continuum model.

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