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Using a Rho GTPase based model of cell polarization to explain group advantage in chemotaxis

We model a migrating cell as a 2D elastic polygon, with Rho GTPase biochemistry simulated on the vertices. This biochemistry enables a model cell to polarize and migrate. Intercellular interactions between cells can emerge by allowing them to modulate each others' polarization. In particular, we recapitulate two intercellular interactions observed in neural crest cells (NCCs): 1) contact inhibition of locomotion (CIL), whereby upon making contact, cells re-polarize in order to break contact and disperse, and 2) co-attraction (COA), whereby cells attract each other at a distance. We had previously confirmed a hypothesis that model NCC clusters enjoy enhanced directional motility, compared to a single cell, due to suppression of random protrusions through CIL and COA interactions between cluster cells. Now, we investigate whether this same increase in a cluster's directional motility could also explain the ability of a cluster of NCCs to respond to a chemoattractant gradient too weak for a single cell to interpret.