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Distinguishing cell shoving mechanisms

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Motivated by *in vitro* time-lapse images of ovarian cancer spheroids inducing mesothelial cell clearance, the traditional agent-based model of cell migration, based on simple volume exclusion, was extended to include the possibility that a cell seeking to move into an occupied location may push the resident cell, and any cells neighbouring it, out of the way to occupy that location. In traditional discrete models of motile cells with volume exclusion such a move would be aborted. We introduce a new shoving mechanism which allows cells to choose the direction to shove cells that expends the least amount of shoving effort (to account for the likely resistance of cells to being pushed). We call this motility rule 'smart shoving'. We examine whether agent-based simulations of different shoving mechanisms can be distinguished on the basis of single realisations and averages over many realisations. We emphasise the difficulty in distinguishing cell mechanisms from cellular automata simulations based on snap-shots of cell distributions, site-occupancy averages and the evolution of the number of cells of each species averaged over many realisations. This difficulty suggests the need for higher resolution cell tracking.

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