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Modelling cell invasion with proliferation mechanisms motivated by time-lapse data

Cell invasion involves a population of cells which are motile and proliferative. Traditional lattice-based discrete models of cell proliferation involve agents depositing daughter agents on nearest neighbour lattice sites. Our new work is motivated by time-lapse images of cell invasion associated with the development of the enteric nervous system where a population of precursor neural crest cells invades the developing gut tissues. Using time-lapse data, we show that the traditional proliferation model is inappropriate and we propose a new proliferation model consistent with time-lapse observations. Using simulation and analysis, we show that the discrete model is related to a family of reaction-diffusion equations and can be used to make predictions over a range of scales appropriate for interpreting experimental data