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Interface Instabilities and Fingering in a Simulated Growing Tumor NIKODEM POPLAWSKI, MACIEJ SWAT, JAMES GLAZIER, Indiana University, Department of Physics and Biocomplexity Institute, ALEXANDER ANDERSON, University of Dundee, Division of Mathematics — We study the physical origin of interface instabilities, which may lead to metastasis in medical contexts, during the invasion of healthy tissue by a solid tumor. We use Glazier and Graner's Cellular Potts Model (CPM), a lattice-based stochastic framework designed to simulate cell interactions and movement. This model reduces the large molecular complexity of living cells to a few basic processes: cell-cell adhesion, cell growth, division, differentiation and death, secretion and absorption of materials, chemotaxis, and cellular deformation. We run our simulations in CompuCell3D, an open-source software environment based on the CPM (https://simtk.org/home/compucell3d). We show that cells adhesivity and growth, and rate per unit nutrient consumed, determine whether the growing tumor has a flat or fingered interface. Our results differ from those reported by Anderson (A. R. A. Anderson, Math. Med. Biol. (2005) 22:163) using a continuum model. This difference shows the importance of explicit modeling of spatially extended cells to understanding the morphologies of developing tissues.

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