Investigation of the effect of phenotypic plasticity on tumor growth: the Go or Grow mechanism

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Tumor cells possess a remarkable phenotypic plasticity that allows adaptation to changing environmental conditions. Prominent examples are the epithelial-mesenchymal transition and the shift towards glycolitic, anaerobic cell metabolism, known as Warburg effect. A further example is phenotypic plasticity with respect to cell proliferation and migration, a phenomenon known as go-or-grow mechanism.

Our work suggested that local cell density is a key factor for the regulation of the switch based on experimental results. However, potential effects of a density-dependent switch between migratory and proliferative phenotypes on tumor growth have not been investigated so far. To address this problem, we formulate and study a mathematical model of spatio-temporal tumor dynamics where different responses to local cell density mediate the go-or-grow dichotomy.

Our analysis reveals that different dynamic regimes can be distinguished. We discuss potential implications of our findings for the interpretation of recent experiments on tumor progression and for the design of new tumor therapies.