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Evolutionary game theory elucidates the role of glycolysis in glioma progression and invasion.

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OBJECTIVES: Tumour progression has been described as a sequence of traits or phenotypes that cells have to acquire if the neoplasm is to become an invasive and malignant cancer. Although genetic mutations that lead to these phenotypes are random, the process by which some of these mutations become successful and cells spread is influenced by tumour microenvironment and the presence of other cell phenotypes. It is thus likely that some phenotypes that are essential in tumour progression will emerge in the tumour population only with prior presence of other different phenotypes. MATERIALS AND METHODS: In this study, we use evolutionary game theory to analyse the interactions between three different tumour cell phenotypes defined by autonomous growth, anaerobic glycolysis, and cancer cell invasion. The model allows us to understand certain specific aspects of glioma progression such as the emergence of diffuse tumour cell invasion in low-grade tumours. RESULTS: We have found that the invasive phenotype is more likely to evolve after appearance of the glycolytic phenotype which would explain the ubiquitous presence of invasive growth in malignant tumours. CONCLUSIONS: The result suggests that therapies, which increase the fitness cost of switching to anaerobic glycolysis, might decrease probability of the emergence of more invasive phenotypes.

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