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Tumor growth instability and the onset of invasion

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Abstract-

Motivated by experimental observations, we develop a mathematical model of chemotactically directed tumor growth. We present an analytical study of the model as well as a numerical one. The mathematical analysis shows that: (i) tumor cell proliferation by itself cannot generate the invasive branching behavior observed experimentally, (ii) heterotype chemotaxis provides an instability mechanism that leads to the onset of tumor invasion, and (iii) homotype chemotaxis does not provide such an instability mechanism but enhances the mean speed of the tumor surface. The numerical results not only support the assumptions needed to perform the mathematical analysis but they also provide evidence of (i), (ii), and (iii). Finally, both the analytical study and the numerical work agree with the experimental phenomena.

Index Terms- immune system competition, multicellular spheroids, theoretical-analysis, capillary formation, factor expression, cell motility, human gliomas, field

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