MODELING TISSUE GROWTH

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The goal of this project is to better understand how a tissue's environment affects its growth. Think of, for instance, a cancer tumor growing in an organism. Some of the existing tissue may be favorable to the tumor, and some may be unfavorable. Can we characterize "how much" unfavorable tissue would prevent the tumor's spread?

The model we will be focused on is formulated in terms of a partial differential equation (PDE). It's no problem if you have never worked with PDEs before! We will tackle a simplified version for which you already have many tools — namely, what you learned about ordinary differential equations (ODEs) in calculus class. And, we will explore the full model using numerical simulation; part of the project will be learning how to do this.

REFERENCES:

The following work from 2003 answers some of these questions for the case of organisms, rather than tissues, invading a fragmented environment. Since the publication of this work, there has been a LOT more research on this topic!

https://pubmed.ncbi.nlm.nih.gov/14522170/

My recent preprint (with my former PhD student), which studies a model of tissue invasion in a heterogeneous environment:

https://arxiv.org/abs/2503.19849