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Non-Local Cell Adhesion Models: Symmetries and Bifurcations in 1-D

In both normal tissue and disease states, cells interact with one another, and other tissue components using adhesion proteins. These interactions are fundamental in determining tissue fates, and the outcomes of normal development, and cancer metastasis. Traditionally continuum models (PDEs) of tissues are based on purely local interactions. However, these models ignore important nonlocal effects in tissues, such as long-ranged adhesion forces between cells.

In this talk, I focus on the nonlocal "Armstrong adhesion model" (2006) for adhering tissue (an example of an aggregation equation). Since its introduction, this approach has proven popular in applications to embyonic development and cancer modeling. Combining global bifurcation results pioneered by Rabinowitz, equivariant bifurcation theory, and the mathematical properties of the non-local term, we prove a global bifurcation result for the non-trivial solution branches of the scalar Armstrong adhesion model. I will demonstrate how we used the equation's symmetries to classify the solution branches by the nodal properties of the solution's derivative.

Joint work with Thomas Hillen (University of Alberta).