

## **Free Boundary PDE Models of Active Gels.**

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We consider free boundary PDE models of active gels that arise in the studies of motility of eukaryotic cells. Our goal is to capture mathematically the key biological phenomena such as steady motion with no external stimuli, spontaneous breaking of symmetry, and rotation.

We first review our past work on phase field models and then present recent work on the two types of the free boundary models : curvature driven motion and a generalized Hele-Shaw flow for nonlinear PDEs.

In the analysis of the above models our focus is on proving existence of the traveling wave solutions that are the signature of the cell motility. We also study breaking of symmetry by proving existence of non-radial steady states. Bifurcation of traveling waves from steady states is established via the Schauder's fixed point theorem for the phase field model and the Leray-Schauder degree theory and Crandal-Rabinowitz theorem for the free boundary problem models.

These are joint works with V. Rybalko (ILTPE, Kharkiv, Ukraine), J. Fuhrman (PSU & Mainz, Germany).