Integrative Model of Actin, Adhesion, and Signaling Dynamics at the Leading Edge of Migrating Cells

I grew up in India and Botswana and came to the United States to pursue higher education. I received a BS (Hons) degree from Lafayette College and a MS degree from Cornell University, both in Chemical Engineering. In 2016, I joined Prof. Jason Haugh's lab at North Carolina State University to pursue a PhD. We have constructed a spatiotemporal model that incorporates adhesion, cytoskeletal and signaling dynamics governing protrusion of lamellipodia in mesenchymal cells. The model includes actin polymerization at the leading edge and the resulting retrograde flow of the F-actin network. Nascent adhesions promote actin polymerization via Rac signaling and interact with the F-actin network to activate RhoA. Consequently, myosin II is activated and applies contractile stress on the F-actin network. Our model predicts an optimal adhesion density for maximal protrusion velocity. Moreover, myosin contractility is limited in its ability to control protrusion velocity, unless global tension of the membrane boundary is considered. I am interested in all aspects of system biology at the cellular and tissue level length scales. Going forward, I want to expand our current model and develop a multiscale model of wound healing incorporating single cell as well as tissue-level length and time scales.