Abstract:

Individual living cells generate forces and direct their motion in well-known ways. For example, planktonic bacteria swim through fluids by rapidly turning their flagella, and individual tissue cells migrate across surfaces in a cyclic process of expansion, adhesion, and retraction. These canonical types of motion, however, are not characteristic of cells within large, dense aggregates, such as bacterial colonies or the tissues of complex organisms. In this talk I will discuss tools and concepts of condensed matter physics that we have adapted to study the forces that control multi-cellular motion within enormous cell aggregates. I will present research on bacterial biofilms, showing how they can spread by generating molecular gradients throughout a colony. I will also present new work on collective motion within tissue cell aggregates. Preliminary exploration of cell motion on 2D and 3D micro-periodic culture surfaces has revealed unanticipated connections between collective cell migration and solid-state atomic systems.