Cell motility self-regulated by secreted footprints

Eukaryotic cell migration is essential to biological processes like embryonic development, immune response, wound healing, or cancer metastasis. During migration, there is a complex interplay between cells and their environment, as cells respond to environmental signals and actively alter their surroundings. Recent experiments observed that MDCK epithelial cells, when placed on 1D fibronectin micropatterned stripes, leave a footprint on the substrate that modifies their own motility, resulting in oscillatory motion. This talk will explore how footprint secretion affects cell motility patterns by combining mathematical modeling and experiments. We assume that cells secrete a footprint that activates signaling pathways that regulate cell polarity. The model reproduces the observed oscillatory motion and predicts new 2D motility patterns, which are experimentally verified. We show that minor changes in footprint interactions can cause cells to switch from confinement to complex exploratory dynamics. This study highlights the potential of cells to self-regulate their motility using footprints and provides insight into the mechanisms guiding cell migration.