



Mathematical modeling of cell-cell communication and collective behavior

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Communication allows groups of cells to perform behaviors that individual cells could not perform alone. I will discuss two examples of collective behaviors in cellular communities and the quantitative approaches that we are using to understand them. First, I will describe collective gradient sensing in epithelial organoids. Scaling laws from diffusion theory explain how groups of cells surpass single-cell bounds on sensory precision. Then, I will describe long-range electrical signaling in bacterial communities. Predictions from percolation theory explain why not all bacteria signal and why the ones that do are organized in a particular way. These works suggest that simple theories can quantitatively and predictively describe complex phenomena from the molecular to the multicellular scale.