Title: Elucidating principles of biological signal processing using microfluidic and optogenetic tools

Biological networks, like electrical circuits, take specific inputs (nutrient availability, stress, hormones) and convert them into appropriate outputs (transcriptional responses, metabolic remodeling). Electrical engineers uncover the inner workings of such circuits by measuring the transfer function between input voltage and output voltage. However, unlike electrical engineers, biologists are more limited in the input signals they can generate to interrogate such networks. We are developing microfluidic and optogenetic tools to generate dynamic inputs to interrogate and control natural and synthetic biological networks. In this talk I will discuss our use of microfluidics to dissect the mechanisms and kinetics of signaling in stress response networks in the budding yeast *Saccharomyces cerevisiae*. In addition, I will discuss our recent efforts to develop real-time optogenetic control of protein concentration as a tool for manipulating biological networks.