Job talk abstract:

Cells constantly integrate localized signals and coordinate appropriate responses in time and space. To study these collective behaviors, I leveraged sequential Fluorescence In Situ Hybridization (seqFISH) , a methodology which allows detection of thousands of mRNA molecules in intact tissues, and investigated cellular interactions within their native microenvironments and their impact on disease. I used a mouse model of Acute Kidney Injury which progresses to chronic disease. I identified distinct microenvironments emerging post-injury, including fibroblast populations that drive immune activation and injury propagation. A subset of fibroblasts expressing *Crlf1* marked a persistently damaged microenvironment, while immune aggregates with pro-inflammatory cells and fibroblasts were linked to chronic inflammation. Additionally, I studied changes in microenvironments in In Low-Grade Glioma patients. seqFISH revealed a microenvironment enriched in pericytes and endothelial cells associated with Malignant Transformation (MT), suggesting early processes involving vasculature are a potential factor predicting MT. These findings underscore the importance of studying cellular behavior in situ and highlight the critical role of stromal cells (Fibroblasts and Pericytes) in disease progression and immune regulation.

Chalk talk abstract:

Tissue structure and function depends on coordinated intercellular interactions, with tissue resident stromal cells playing key roles by providing structural and metabolic support to their neighbors. Fibroblasts, the most common type of stromal cell, exhibit diverse phenotypes across different tissues and under various pathological conditions. These cells act as localized information hubs, and can propagate fibrosis, modulate tumor microenvironments, and regulate immune responses within the tissue. Yet mechanisms through which different fibroblast subsets contribute to disease initiation and progression remain unclear. A crucial component to understanding these processes is the spatial context of the cells. I will study how fibroblasts integrate localized signaling to regulate fibrosis, regeneration and cancer. Utilizing my expertise in spatial transcriptomics and the development of cell culture methodologies, my lab will identify the molecular mechanisms mediating interactions within heterogeneous fibroblast population, as well as between fibroblasts and other cell types. I will construct a detailed roadmap of stromal interactions and signaling during fibrosis and cancer progression, and systematically study their interactions with the immune system to uncover unifying principles regulating the behaviors of fibroblasts, pericytes and other stromal cells during homeostasis, disease and regeneration.