Abstract:

Throughout adult life, adult neuronal stem cells (NSCs) continuously generate neurons in discrete brain regions. I am interested in harnessing this natural regenerative process for repairing the diseased and aging brain. To effectively use this regenerative capacity in a clinical setting requires first an advanced understanding of NSCs, adult neurogenesis and neuronal regeneration during neurodegenerative diseases and aging. Study of these areas, however, is challenging, as it requires profiling rare continuous processes in the adult brain. To this end, I developed sNuc-Seq, a method for profiling RNA in complex tissues with single nuclei resolution by RNA-sequencing, and Div-Seq, for profiling RNA in individual dividing cells. I applied sNuc-Seq to study the adult hippocampus brain region, revealing new cell-type specific and spatial expression patterns. I then applied Div-Seq to track transcriptional dynamics of newborn neurons within the
adult hippocampal neurogenic region and to identify and profile rare newborn GABAergic neurons in the adult spinal cord. I am currently developing follow-up technologies to sNuc-Seq and applying them to study the cross-talk between neurons, NSCs, glia and immune cells during neurodegenerative diseases and its role in inhibiting or promoting regeneration. I will continue to work towards advancing our ability to mitigate and even reverse neurodegenerative disease and age-related pathologies. Incorporating in my work techniques from molecular neuroscience, single cell genomics, genome engineering and computational biology.

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