Stanford

Xun Tu

Postdoctoral Scholar, Psychiatry

Bio

BIO

My research focuses on how molecular signaling processes scale to regulate brain-wide states and support cognitive health across the lifespan. I am particularly interested in the neurobiology of aging, a motivation shaped by witnessing the impact of Alzheimer's disease in my family, which drives my goal to understand the mechanisms of healthy aging as a foundation for treating age-related neurological disorders. Over the course of my training, my perspective has evolved from a neuron-centric view to an integrated understanding of glial–neuronal circuits. I have developed a multidisciplinary toolkit spanning human iPSC models, advanced imaging, and systems-level neuroscience to investigate how sleep-dependent glial plasticity supports cognitive resilience. During my doctoral training at the Max Planck Florida Institute, I used two-photon fluorescence lifetime imaging (2pFLIM) and biosensor engineering to dissect signaling dynamics at synapses. I then pursued postdoctoral training at UC Berkeley, where I pioneered in vivo 2pFLIM approaches to study microglial dynamics and intracellular signaling during sleep, and investigated how aging and sleep deprivation impair mitochondrial transport while contributing to large-scale mapping of dopamine dynamics across the brain. These experiences led me to focus on oligodendrocyte precursor cells (OPCs), which uniquely form synapses with neurons and act as active participants in neural circuits. Currently, as a postdoctoral fellow in Dr. Erin Gibson's lab at Stanford University, I study how OPC–neuron communication shapes sleep-dependent network activity using in vivo calcium imaging and circuit-level approaches, with the goal of identifying mechanisms to preserve memory and promote cognitive resilience in aging. In parallel, I am committed to mentorship and have supervised undergraduate researchers in experimental design, imaging, and data analysis.

STANFORD ADVISORS

- Erin Gibson, Postdoctoral Faculty Sponsor

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

As a postdoctoral fellow in Dr. Erin Gibson's lab, I am integrating my expertise in molecular signaling and systems neuroscience to study the role of OPCs in sleep. My interest in sleep has been further reinforced by observing the dramatic shifts in sleep architecture across developmental stages as a new parent, highlighting the necessity of sleep for neural refinement. My current research uses in vivo calcium imaging and closed-loop optogenetics to determine how OPC-neuron communication coordinates hippocampal sharp-wave ripples. By characterizing how aging blunts OPC responsiveness to sleep, I aim to identify novel strategies to preserve memory and promote healthy cognitive aging.

Publications

PUBLICATIONS

- **Brainwide dopamine dynamics across sleep-wake transitions** *Brainwide dopamine dynamics across sleep-wake transitions*
  Chen, C., Tu, X.
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- **Neuroendocrine circuit for sleep-dependent growth hormone release.** *Cell*
  Ding, X., Hwang, F. J., Silverman, D., Zhong, P., Li, B., Ma, C., Lu, L., Jiang, G., Zhang, Z., Huang, X., Tu, X., Tian, Z. M., Ding, et al

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- **Local autocrine plasticity signaling in single dendritic spines by insulin-like growth factors.** *Science advances*
  Tu, X., Jain, A., Parra Bueno, P., Decker, H., Liu, X., Yasuda, R.
  2023; 9 (31): eadg0666

- **Dual Regulation of Spine-Specific and Synapse-to-Nucleus Signaling by PKCδ during Plasticity.** *The Journal of neuroscience : the official journal of the Society for Neuroscience*
  Colgan, L. A., Parra-Bueno, P., Holman, H. L., Tu, X., Jain, A., Calubag, M. F., Misler, J. A., Gary, C., Oz, G., Suponitsky-Kroyter, I., Okaz, E., Yasuda, R.
  2023; 43 (30): 5432-5447

- **Rac1 is a downstream effector of PKCα in structural synaptic plasticity.** *Scientific reports*
  Tu, X., Yasuda, R., Colgan, L. A.
  2020; 10 (1): 1777