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**Multiscale brain tissue models for studying brain diseases and nerve regeneration**

**Abstract**

To better understand the complicated pathological states of human brain diseases and disorders, there is a critical need for experimental and/or analytical models that have high fidelity to brain micro-environments. Towards this end, my research has focused on the development of diverse brain tissue models by employing *in vitro*, *in vivo*, and *in silico* approaches. This talk will present my current and future research interests that are aligned to the application of experimental and computational models into (1) recapitulating neuropathological signatures (e.g., Lyme disease, hydrocephalus, and brain cancer), (2) recovery of neural tissues using an electric field and stem cells, and (3) quantitative/physical analysis of neuronal growth and activity. The outcomes of these studies will provide an opportunity to deepen our insights into mechanisms underlying the progression of diseases and expand our scopes on therapeutic targets by capturing the dynamic changes in transcriptome, network structure, and physiological activity. Along with 3D *in vitro* human models (i.e., brain-on-a-chip, organoids), the parallel approach using *in vivo* medical imaging (e.g., MRI) and the mathematical/graphical models will further increase the translation into clinical practice.