Dendritic Spines: Old News, New Applications

February 27

Tuesday, 12:30 pm

Billings Building—Rosedale Room

SPEAKER:

Andrew M. Tan, Ph.D.

Deputy Director | Assistant Professor
Center for Neuroscience and Regeneration Research
Yale University School of Medicine & VA Connecticut

Hosts: Xiaofei Guan, M.D., Ph.D.
Edmund Hollis II, Ph.D.

Publications

1. Benson CA, Olson KL, Patwa S, Kauer SD, King JF, Waxman SG, Tan AM. *Conditional Astrocyte Rac1KO Attenuates Hyperreflexia after Spinal Cord Injury.* J Neurosci. 2024 Jan 3;44(1). doi: 10.1523/JNEUROSCI.1670-22.2023. PubMed PMID: 37963762.

2. Benson CA, King JF, Kauer SD, Waxman SG, Tan AM. *Increased astrocytic GLT-1 expression in tripartite synapses is associated with SCI-induced hyperreflexia.* J Neurophysiol. 2023 Nov 1;130(5):1358-1366. doi: 10.1152/jn.00234.2023. Epub 2023 Oct 25. PubMed PMID: 37877184.

3. Benson CA, King JF, Reimer ML, Kauer SD, Waxman SG, Tan AM. *Dendritic Spines and Pain Memory.* Neuroscientist. 2022 Dec 3;:10738584221138251. doi: 10.1177/10738584221138251. [Epub ahead of print] Review. PubMed PMID: 36461773.

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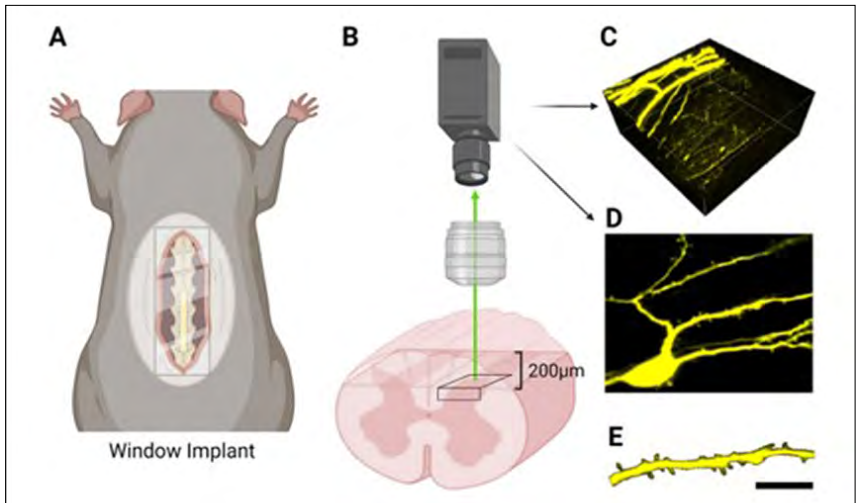
Abstract

My research interests focus on spinal cord injury (SCI) pathology, particularly mechanisms underlying neuropathic pain and spastic movement disorders. My long-term goal is to identify and assess novel targets and strategies that can help restore normal function after SCI. My hope is that our efforts will eventually lead to more effective and safe clinical therapies.



In Vivo Imaging Technique for Neuronal Structures in Rodent Spinal Cord. This image series illustrates a process for in vivo imaging of neuronal structures in a rodent model. Panel A shows a rodent with a spinal window implant allowing optical access to dorsal spinal cord tissue. Panel B represents a side view of a microscope objective lens with camera with imaging location into the spinal cord, through the window implant. Panel C displays a three-dimensional reconstruction of the imaged tissue. Panel D provides a high-resolution two-dimensional image of the neuronal structures. Finally, Panel E offers a detailed view of a single dendritic branch, showcasing the level of detail that can be obtained through this imaging technique.

As the Principal Investigator (PI) of US Federal awards and privately funded grants, I have applied my expertise toward managing the execution of a broad range of projects, and have developed strong collaborations with domestic and international teams. As an Associate Director of the Center for Neuroscience and Regeneration Research at the West Haven VA Medical Center, I currently supervise a wonderful team of students, postdocs, and junior faculty in our SCI/D research program. Our published research has utilized in vitro and in vivo approaches, including a combination of anatomical analyses, behavioral assessment, viral-based gene therapy, and whole-animal electrophysiological techniques.

Over the past decade, my team has laid the groundwork demonstrating that maladaptive dendritic spine remodeling within nociceptive or motor reflex circuits underlies SCI-induced hyperexcitability disorders, i.e., neuropathic pain and spasticity. This body of work has also demonstrated for the first time that the Rac1-PAK1 pathway is a key mechanism involved in maintaining chronic pain and spinal motor reflex dysfunction. A core implication of these insights is that dendritic spine profiles may serve as a morphological correlate for sensory-motor hyperexcitability disorders, and could be used to predict therapeutic-drug response. Recently, we pioneered the use of long-term, in vivo two-photon imaging assays that we now use to investigate the relationship between dendritic spine dynamics in the spinal dorsal horn and neuropathic pain.