

Overview of the Johnston lab



One of the underlying interests of Dan's lab is the contribution of different ionic conductances to the intrinsic excitability of neurons. Ion channels of different types are distributed across the different areas of neurons, and their location and levels of activity play a major role on how neurons interact within the nervous system. We use many methods to approach our research: cellular and optical neurophysiology, anatomy of neurons, computer modeling of cellular properties, molecular biology to modify neurons, behavioral studies and anything else we need to do.



Darrin Brager has been working on neurophysiological properties of neurons that might be involved in Fragile X syndrome, one of the autism-spectrum disorders. He studies neurons from the prefrontal cortex and the hippocampus. He is particularly focused on changes in voltage-gated ion channels in the dendrites. **Brandy** is working with him on these projects.

Brager, D. H., Akhavan, A. R., & Johnston, D. (2012). Impaired dendritic expression and plasticity of h-channels in the *fmr1(-/-)* mouse model of fragile X syndrome. *Cell Reports*, 1(3), 225–233. [[PDF](#)]



Routh, B. N., Johnston, D. & Brager, D. H. Loss of Functional A-Type Potassium Channels in the Dendrites of CA1 Pyramidal Neurons from a Mouse Model of Fragile X Syndrome. *J Neurosci* 33, 19442–19450 (2013). [[PDF](#)]

Brager, D. H. & Johnston, D. Channelopathies and dendritic dysfunction in fragile X syndrome. *Brain research bulletin* 103, 11–7 (2014). [[PDF](#)]



Randy Chitwood uses *in-vitro* and *in-vivo* recordings to understand how neurons support learning and memory. He and Jenni Siegel have been studying the role of the prefrontal cortex in eye-blink behavior in the mouse. This includes behavior training and testing of the mice as well as multi-unit recording of neural activity. **William** is also working on these projects with Randy and Jenni



Jenni Siegel uses single neuron recording methods in awake behaving animals and anatomical tracing to determine how the prefrontal cortex interacts with other brain regions to support learning and memory and executive function.

Moya, Maria V, Jennifer J Siegel, Eedann D McCord, Brian E Kalmbach, Nikolai Dembrow, Daniel Johnston, and Raymond A Chitwood. Species-Specific Differences in the Medial Prefrontal Projections to the Pons between Rat and Rabbit. *The Journal of comparative neurology* 522, 3052–74 (2014). [[PDF](#)]

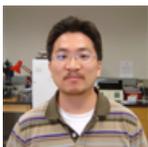


Siegel, JJ, Taylor, W, Gray, R, Kalmbach, B, Zemelman, BV, Desai, NS, Johnston, D and Chitwood, RA. Trace Eyeblink Conditioning in Mice Is Dependent upon the Dorsal Medial Prefrontal Cortex, Cerebellum, and Amygdala: Behavioral Characterization and Functional Circuitry. *eNeuro*, 2(4) e0051-14.2015 1–29. (2015). [[PDF](#)]



Brian Kalmbach studies the intrinsic properties of neurons in the prefrontal cortex to elucidate cellular changes that contribute to working memory-related neural activity in medial prefrontal cortex.

Kalmbach, B. E., Chitwood, R. A., Dembrow, N. C. & Johnston, D. Dendritic generation of mGluR-mediated slow afterdepolarization in layer 5 neurons of prefrontal cortex. *J Neurosci* 33, 13518–13532 (2013). [[PDF](#)]



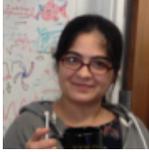
Chung Sub Kim is interested in ion channels that might underly depression and other mental disorders. He does neurophysiology, molecular biology, and behavioral experiments.

Kim CS, Johnston D. A1 adenosine receptor-mediated GIRK channels contribute to the resting conductance of CA1 neurons in the dorsal hippocampus. *J Neurophysiol* 113: 2511–23 (2015). [[PDF](#)]



Niraj Desai has developed a robotic system for patch-clamping neurons in intact, awake, behaving mice. This is a new method in our lab and he is using it to study the neuronal basis of working memory in prefrontal cortex.

Desai N, Siegel J, Taylor W, Chitwood R, Johnston D. Matlab-based automated patch clamp system for awake behaving mice. *J Neurophysiol* (2015). [PDF]



Ruchi Malik has been studying the differences in the properties of neurons from the dorsal, ventral, and middle of the hippocampus. Ruchi is also studying differences in synaptic plasticity and somatodendritic integration in neurons from dorsal and ventral parts of the hippocampus. Ruchi has a paper that is in the final stages of publication — if you ask she may share the manuscript with you.



Liz Arnold is a grad student in the lab, and is working on elucidating differences in the intrinsic properties of neurons in dorsal and ventral hippocampal neurons in an animal model of epilepsy.



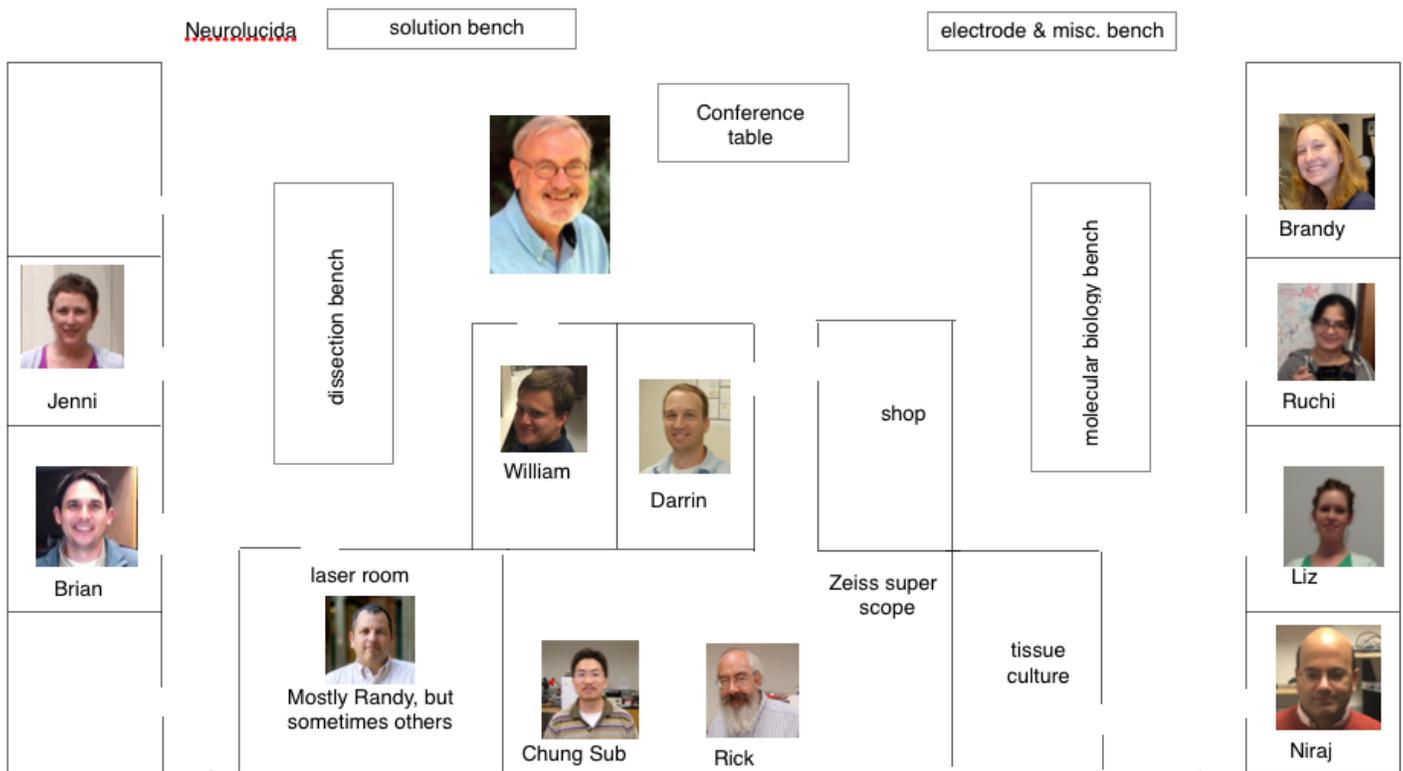
Rick Gray is interested in the properties of single ion channels in neurons. He is currently beginning a study of potassium channels in hippocampus and prefrontal cortex neurons. He also oversees the computational needs of the lab and helps with software development when needed.

Web pages that might be useful to you:

<http://clm.utexas.edu/djlab> — the lab webpage. Includes all publications from Dan's lab.

<http://ca1.clm.utexas.edu/djlabwiki> — a wiki containing many protocols and other information. Ask us how to login.

<https://ca1.clm.utexas.edu/neuron/> — an introduction to the lab's use of the NEURON cellular modeling system



Dan's office is in the CLM offices

Jenni, Liz, Randy, William and Rick also have office space in the room just past the walk-in cooler.

