

# BioFrontiers - Biology Seminar

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Life Sciences Building - A117



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### From bench to bytes: Decoding the brain's role in pain using mouse models and computational biology

Sensory processing in the brain is a complex, dynamic process. Decades of surgical, electrical, pharmacological, optogenetic, and chemogenetic in vivo manipulations have revealed the nociceptive functions of anatomically- and genetically-restricted neuronal populations in the brain. In parallel, molecular and electrophysiological approaches have allowed for high-resolution, temporal examination of pain-induced alterations in brain plasticity. Computational integration of this data is critical for future therapeutic development; in practice, these models would allow for in silico prediction of brain activity following injury, and in a reciprocal fashion, changes in pain-like behaviors following manipulation of discrete brain populations. To this end, we utilize mouse physiology,

molecular biology, and physiology to build three-dimensional computer models of an area of the brain, the amygdala, involved in sensory-emotional processing. Our models capture properties of the amygdala that drive pain

modulation, including hemisphere-specific physiological differences, and generate predictions of nociception related to painful injury. Predictions from the model are compared retrospectively to pain outcomes during manipulation of neurons in whole mice. These comparisons show strong alignment between our model and in vivo outcomes showing the potential of an iterative circular approach between wet lab data collection and in silico evaluation of data to progress our understanding of how the brain modulates pain.

