

# Neural Circuits of Pain and Itch

**May 5**

**Tuesday, 12:30 pm**

**Billings Building—Rosedale Room**

**SPEAKER:**



**Sarah E. Ross, Ph.D.**

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Neurobiology

Director, Pittsburgh Center for Pain  
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Pittsburgh, PA

**Host: Nicole Mercer Lindsay, Ph.D.**

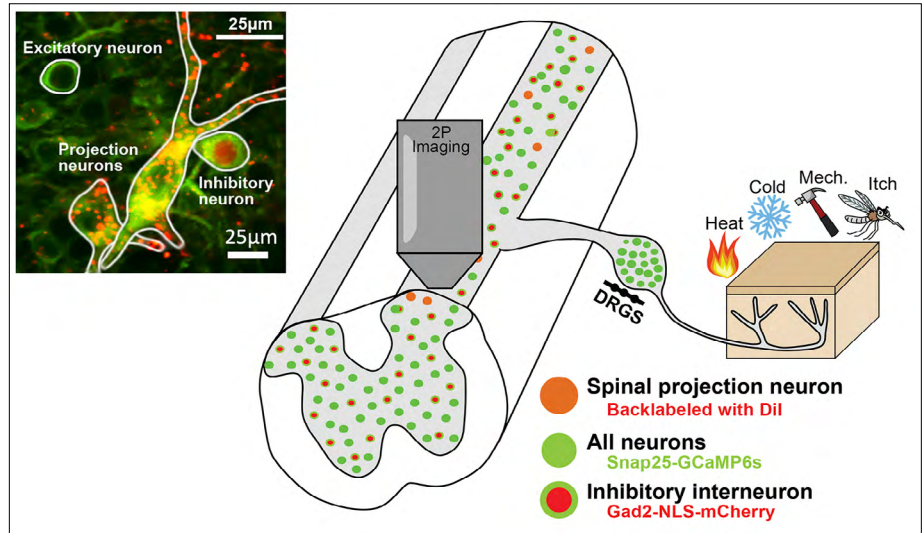
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## Abstract

In this talk, I will describe an ex vivo somatosensory preparation that preserves the skin, peripheral nerves, and spinal cord in a continuous circuit. Using this system, we perform two-photon calcium imaging to monitor activity in both primary afferents and spinal neurons. A key advantage of this preparation is the ability to resolve defined neuronal populations: we can distinguish excitatory and inhibitory spinal neurons, identify spinal output neurons, and classify neurons based on their responses to specific neuromodulators. This approach enables a rare combination of experimental control and circuit-level resolution—allowing us to precisely manipulate sensory input, measure circuit output, and characterize the transformations that occur within identified spinal populations. Using this framework, I will show how this preparation has yielded new insights into the circuit mechanisms underlying itch and pain. Finally, I will propose a conceptual model for the fundamental organization of the neural circuits that give rise to these sensations.



## Publications

- Holland, R. A., K. M. Smith, I. B. Bleimeister, J. J. Okoro, S. A. Sherman, A. V. Zoltanski, M. C. Chiang, B. N. Phan, B. M. Hooks, A. R. Pfennig, E. K. Nguyen and S. E. Ross (2026). *Tegmental kappa-opioid receptor neurons modulate opioid withdrawal via the periaqueductal gray*. *Brain*.
- Sheahan, T. D., C. A. Warwick, A. Y. Cui, D. A. A. Baranger, V. J. Perry, K. M. Smith, A. P. Manalo, E. K. Nguyen, H. R. Koerber and S. E. Ross (2024). *Kappa opioids inhibit spinal output neurons to suppress itch*. *Sci Adv* 10(39): eadp6038.
- Warwick, C., J. Salsovic, J. Hachisuka, K. M. Smith, T. D. Sheahan, H. Chen, J. Ibinson, H. R. Koerber and S. E. Ross (2022). *Cell type-specific calcium imaging of central sensitization in mouse dorsal horn*. *Nat Commun* 13(1): 5199.