

2022 Winner: Ann Kennedy, Ph.D.

Ann Kennedy is a theoretical neuroscientist investigating neural computation and the structure of behavior. Following a degree in biomedical engineering at Johns Hopkins, she earned her Ph.D. with Dr. Larry Abbott at Columbia University, where she modeled the representation of sensory and motor signals in cerebellum-like structures, and their implications for learning. She then joined the lab of Dr. David Anderson at Caltech, where she worked with experimentalists to characterize neural activity of the hypothalamic circuits that govern social and fear behaviors, and developed machine learning tools for animal behavior analysis with the lab of Dr. Pietro Perona. Her lab at Northwestern uses theory and modeling to understand how motivational states and past experiences modify neural circuits to shape behavior.

Essay: Boiling Over

Brains are not simple input-output machines: we respond differently to the world we encounter depending on our internal motivational state, such as our levels of hunger, alertness, or anxiety. But how does the brain keep track of these signals, and how do they alter our decisions? Working in the laboratory of Dr. David Anderson, and now in her own lab, Dr. Ann Kennedy collaborated with experimentalist lab members to characterize the activity of hypothalamic neurons implicated in the control of essential survival behaviors such as aggression, fear, and reproduction. While neurons in some hypothalamic nuclei have clear responses to specific behaviors, other regions show only a weak correlation with animal's actions. With collaborators Dr. Prabhat Kunwar and Dr. Lingyun Li, Ann Kennedy showed that a hypothalamic nucleus implicated in defensive behaviors shows persistent activity that long outlasts the stimulus that evoked it. This activity was required to keep animals in a defensive motivational state. She and her student Adi Nair went on to show how the complex responses of individual neurons give rise at the population level to a low-dimensional signal that escalates in intensity with animals' level of aggressive motivation.

