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Abstract for an Invited Paper
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Whole-brain neural dynamics and behavior in a freely moving worm

ANDREW LEIFER, Princeton University

How does the collective activity of many individual neurons drive an animals behavior? I will present a suite of optical tools to control and record neural activity in the nematode *C. elegans* as it moves, including an instrument to perform whole-brain calcium imaging with cellular resolution in an awake and unrestrained behaving animal. We are using this technology platform to investigate how a nervous system generates an animals behavior. We have already used these techniques to gain insight into the underlying neural mechanisms behind mechanosensation, forward locomotion, and the *C. elegans* escape response. Now we are beginning to expand our investigation to reveal how collective neural dynamics generates any behavior in the *C. elegans* behavioral repertoire. These measurements are a critical first step towards investigating higher-level functions like the time evolution of internal brain states and decision-making.