Cortical Sculpting of a Rhythmic Motor Program

July 15

Tuesday, 12:30 pm

Billings Building—Rosedale Room

SPEAKER:

Britton A. Sauerbrei, Ph.D.

Assistant Professor of Neurosciences

Case Western Reserve University School of Medicine

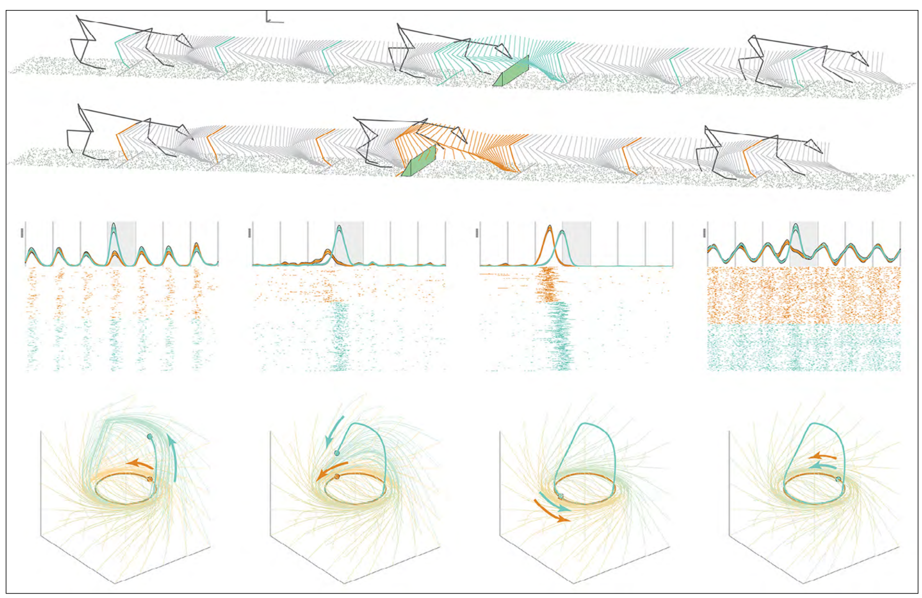
Cleveland, OH

Host: Nicole Mercer-Lindsay, Ph.D.

For more information contact
Darlene White
daw9085@med.cornell.edu

Abstract

The standard model of motor cortex maintains that firing rates evolve over time based on the local connectivity of neurons within the cortical network and on external inputs to the network. The resulting activity patterns influence spinal circuitry through descending projections, and ultimately determine neuromotor output. This model has been highly successful in explaining cortical control of discrete, voluntary movements such as reaching. Yet it fails to explain cases in which cortical commands for voluntary action must be integrated with commands generated by independent subcortical centers. Our recent work has focused on coordination between neural population dynamics in motor cortex and the spinal central pattern generator (CPG) in mice performing a voluntary gait modification task. To enable animals to traverse an obstacle, motor cortex must integrate inputs conveying the barrier's proximity and the phase of the locomotor CPG, then compute the appropriate commands to modify the forelimb trajectory. By combining large-scale neural recording in freely-moving animals, behavioral and optogenetic manipulations, and computational approaches, we identify the population-level representations motor cortex uses to implement this computation, and propose a simple algorithm that generates the appropriate output through phase-dependent gating. Our results reveal a regime of cortical function in which higher brain areas do not directly specify motor output, but must sculpt an ongoing, spinally-generated motor program to flexibly control behavior in a complex and changing environment.



Publications

1. Kirk EA, Hope KT, Sober SJ, Sauerbrei BA. *An output-null signature of inertial load in motor cortex.* Nature Communications 2024.

2. Sauerbrei BA*, Guo J-Z*, Cohen JD*, Mischiati M, Guo W, Kabra M, Verma N, Mensh B, Branson K, Hantman AW. *Cortical pattern generation during dexterous movement is input-driven.* Nature 2020.

3. Guo J-Z*, Sauerbrei BA*, Cohen JD, Mischiati M, Graves A, Pisanello F, Branson K, Hantman, AW. *Disrupting cortico-cerebellar communication impairs dexterity.* eLife 2021.