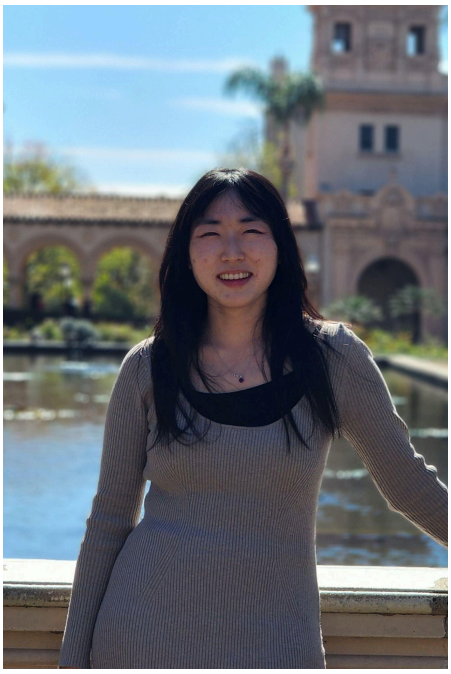
Neuroscience & Physiology Seminar Series

Tuesday, September 24th
12:00 - 1:30 PM | LILY 1-117

Low-dimensional encoding of somatosensation in mouse sensorimotor cortex



Seungbin Park
PhD Candidate, Biomedical Engineering
Dadarlat Lab

Somatosensation, particularly proprioception, is essential for planning and executing movements that require coordination across multiple joints or limbs. Neurons within mouse somatosensory cortex are thought to encode proprioceptive information as the distance and direction of limb movements irrespective of starting position of the limbs. Therefore, we hypothesized that neural activity in sensorimotor cortex associated with somatosensory feedback from the limbs would occupy a low-dimensional subspace. This hypothesis was validated in both anesthetized and awake animals by analyzing neural activity recorded using 2-photon calcium imaging in layers 2/3 of sensorimotor cortex. In both data, a small fraction of components obtained from the principal component analysis are defined as significant which explains a high proportion of variance (0.4-0.8) of data. In anesthetized animals, passive deflections of contralateral and ipsilateral hind- and forelimbs occupied distinct trajectories through low-dimensional space. In awake animals (analyzing an existing dataset by Alonso et al. 2023), passive deflections of the limbs are separated by the angle of movement relative to the body. Furthermore, just as in the motor cortex during active movement, neural representations of passive movements of ipsilateral and contralateral limbs occupy orthogonal subspaces within sensorimotor cortex. These low-dimensional representations of single and multi-limb movements are well conserved across both anesthetized and awake animals, suggesting a general form for neural encoding of proprioceptive feedback that could easily integrate with neural coding of motor plans during sensorimotor function.