"Vocal control and sensorimotor learning - neurons, muscles, and behavior"

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Abstract:

"Our lab uses the songbird vocal control system to investigate how the brain generates behavior and learns from experience. The neural circuits governing the learning and production of song are easily accessible to measurement and manipulation, providing a rich system in which to study the interplay between sensory feedback, motor control, and neural plasticity. However, although much is known about both song behavior and the functional anatomy of the songbird brain, we know very little about how the brain uses sensory feedback signals to rewire the neural circuits driving vocal behavior.

In my talk I will present studies that employ a range of behavioral and physiological techniques to investigate song learning and vocal control. First, by developing a system for manipulating auditory experience in the singing bird, we have demonstrated that adult birds maintain vocal performance by a process of error correction. Shifting the pitch (fundamental frequency) of auditory feedback leads to compensatory changes in the pitch of song. This result suggests that song is constantly evaluated relative to an auditory target and that the resulting error signals are used to correct vocal output, a process similar to that believed to maintain the accuracy of human speech. Second, neural recordings from nucleus RA (robust nucleus of the arcopallium) in the songbird brain have begun to reveal how premotor neurons contribute to the moment-by-moment control of vocal output. Third, preliminary studies using electromyographic (EMG) recordings from the muscles controlling song describe the precise patterns of muscle activation that accompany the production of different song elements. Future work will extend and combine these techniques to understand the relationship between vocal learning, the neural encoding of motor commands, and the transformation of neural activity into vocal behavior by the motor periphery."