

University of Houston - Biomedical Engineering Seminar
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Computations in the cerebellum during control of a movement



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Abstract

Damage to the cerebellum typically causes dysmetria, affecting endpoint accuracy. What is the cerebellum computing that is so important for stopping a movement? In the marmoset, we have been studying saccadic eye movements, using silicon probes to quantify both the information that the cerebellar cortex receives via mossy fibers and climbing fibers, and the output it produces via Purkinje cells (P-cells). Our results suggest that the input encodes two different kinds of information: the goal of the movement in sensory coordinates, and the ongoing commands in motor coordinates. The output, as computed by populations of P-cells, produces a burst that rises analogous to predicting the real-time displacement of the eyes, and then suddenly and synchronously is inhibited when the eyes need to decelerate and stop. Thus, we speculate that the cerebellar cortex is computing in real-time the sensory consequences of the motor commands until it reaches a bound, as set by the desired goal of the movement, at which point the P-cells synchronously disinhibit the nucleus, thus stopping the movement.

Biosketch

Reza Shadmehr was born in Tehran, Iran, and was fortunate to be allowed by his parents to immigrate to the United States when he was 14 years old. He was raised in Spokane, Washington by foster parents and attended Gonzaga University, earning a BS in Electrical Engineering. He was subsequently mentored in robotics at the University of Southern California by Michael Arbib, where he was an IBM Graduate Fellow, then was awarded a McDonnell-Pew Postdoctoral Fellowship to attend MIT, where he was mentored in computational neuroscience by Emilio Bizzi. After MIT, he joined the Johns Hopkins Biomedical Engineering Department, where he has remained his entire career. He has authored three books and is an elected Fellow of the AIMBE. His greatest accomplishment, however, has been mentoring [students](#) who have gone on to become good citizens and creative scientists.