2023 Annual Research Day Poster Sessions – April 19th, 2023

Session/Poster#	Presenter
B12	Elana Cohen College of Medicine Student

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Controlling Vibrissae Movement with Electrical Stimulation in a Rat Model of Facial Nerve Reanimation

Unilateral facial paralysis due to CN VII damage interferes with social interactions, affecting patients' emotional and physical health. Purely surgical approaches suffer from variable and unpredictable success. Our current research uses vibrissae (whisker) movements in rats, controlled by CN VII, as an animal model for facial movements in humans. Specifically, we sought to test whether appropriate combinations of electrical stimulus parameters in the rat's exposed facial nerve could produce predictably different whisking responses.

After rats were anesthetized with urethane, the buccal branch of their right facial nerve was exposed and pierced with the steel needles of a bipolar electrode. Amplitudes and durations of constant-current pulses were varied with an isolated pulse stimulator, while videos of whisker movements were recorded at 240 fps. Whisker movements were scored visually post-acquisition to denote patterns graded on amplitude and number of whisks per single pulse.

We observed that pulses <1 ms and <1 mA did not elicit whisking. Pulses immediately above these thresholds elicited a single vibrissae movement. Pulse durations >10 ms, resulting in short trains of nerve action potentials, elicited multiple vibrissae movements regardless of pulse amplitude. Longer durations increased the number of whisks per pulse, while greater amplitudes produced greater movements. The responses were reproducible and did not fatigue.

Our results demonstrate that even with whole-nerve stimulation, different whisking patterns can be elicited by systematically varying pulse amplitude and duration. Our animal model suggests that controlled facial reanimation to overcome unilateral facial paralysis in humans might be achievable by appropriately parameterized electrical stimulation of a regenerated CN VII.