Title: Optimizing Current Steering in Deep Brain Stimulation for Treating Parkinsonian Axial Motor Symptoms

Background: The proposed study will investigate deep brain stimulation (DBS), of the subthalamic nucleus (STN) to improve gait dysfunctions in advanced Parkinson's Disease (PD). DBS requires implantation of electrodes into the brain that contain contacts where current traverses to stimulate neurons. Imprecise electrode implantations are inherent in surgical implantation; thus, contributing to the elusiveness of DBS on gait.

Methods: The proposed investigation will divide current between two contacts to receive 0, 30, 50, 70, or 100% of current, to find the best combination to improve gait. Gait changes associated with fractional combinations will be visually assessed with clinical scales, and with data from a pressure sensitive gait mat, as participants walk at a slow, normal, and fast pace; and backwards. The latter two reduce confidence, and backwards walking additionally disrupts balance.

Results: We predict that a specific fractional combination will improve gait by increasing stride length and velocity, and decreasing stride width and double support time. The former two represent improved mobility and latter two represent improved balance.

Discussion & Conclusion: Current steering is a feasible technique to overcome imprecise electrode implantation by independently dividing current delivered to each contact. Allowing for maximal stimulation of more optimally localized contacts in areas believed to control gait while, minimizing stimulation of sub-optimal contacts. Gait improvements following current steering will conclude if body-specific sub-regions of the STN exist.

Interdisciplinary Reflection: Current steering is a therapeutic technique to improve PD, a nervous system disease. Current steering can provide insight of the STN body-specific sub-regions through motor control; thereby, integrating neuroscience and kinesiology.