

## Medical Student Research Program

Title: Optogenetic rehabilitation for neuromuscular disease

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### Research project description:

Spinal cord and peripheral nerve injuries result in severe motor deficits and have a profound impact on physical activity and psychosocial well-being of affected individuals. A similar presentation is observed clinically in patients with neuromuscular disease. Restoring function to specific muscle groups which play a critical role in meaningful function provide increased independence and quality of life. Functional electrical stimulation (FES) has been shown to augment function in the hand, lower limb and diaphragm. However, when innervation is limited or absent following injury or disease-related pathogenesis, FES-based neural stimulation excludes patients from this technology. We propose an alternative option utilizing a light-sensitive ion channel-channelrhodopsin-2 (ChR2). This technology has been widely used in neuroscience to control and monitor individual neurons in living tissue. Whether this application extends peripherally to neuromuscular control and maintenance remains to be elucidated. Hence, we will test chronic LED light-based stimulation of skeletal muscle within injury and disease animal models to determine impact on arborization, re-innervation and restoration of the neuromuscular junction (NMJ) and skeletal muscle function.