Progress Report

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Title of Project: Using light stimulation to improve recovery following brain injury

Summary
Neurotrauma of the brain and spinal cord involves damage to neurons and their axons which can lead to neural degeneration and loss of function. This damage can be localised to a focal area affecting a small population of neurons, or it may be widespread and include multiple areas of the brain and spinal cord. Unfortunately, the extent of central nervous system (CNS) damage does not cease after the primary insult has concluded, a delayed cascade of damaging cellular events occurs at the site of injury termed secondary degeneration. This process can cause further damage to neural tissue at the site of injury, and susceptible neurons in surrounding and remote areas. The central nervous system (CNS) has limited capacity to recover after injury and interventions that promote neuronal survival and reduce neurodegeneration are therefore essential to preserving function and promoting recovery.

Our project is based on previous studies showing that increasing the availability of neuroprotective proteins in the CNS after injury can aid in neuron survival and reduce loss of function. Our novel approach harnesses the existing neural circuitry to promote the production of neuroprotective proteins in the brain after TBI using optogenetic stimulation, an exciting and cutting-edge technique that utilises light stimulation to control the activity of cells. Using this method, we aim to further our understanding of the mechanisms underlying novel interventions and improve functional outcomes following TBI.

Hypothesis vs Findings
We hypothesise that increasing the activity of neurons in injured brain tissue will increase the production of neuroprotective proteins that will promote the survival of at-risk neurons and preserve function. We experienced a delay in beginning the project due to manufacturing issues sourcing custom experimental reagents and issues with vendors that supply our samples. The custom items have been successfully sourced in Q1 2024, and we have verified their efficacy. We began preliminary experiments in a very small cohort of samples recently and the protocols and equipment are working as intended. Once these initial experiments are completed, we will continue with our main cohort of samples to complete the experiments. This is expected to begin in July with completion by the end of the year.

Unanswered Questions

As the experiments are still ongoing, the unanswered questions from our hypothesis remain; can manipulating the activity of damaged and at-risk neurons promote their survival and prevent loss of function? Does this protection last only for the period of time that the intervention is given for, or does this persist for weeks following the end of the intervention period?

What these research outcomes mean

Not applicable pending final results.