DEPARTMENT OF NEUROLOGY & REHABILITATION MEDICINE
COLLEGE OF MEDICINE

SUMMER RESEARCH OPPORTUNITIES FOR UNDERGRADUATE students

FOR APPLICATION YEAR: 2026

PROJECT TITLE: The Impact of Carbon Dioxide on Brain Metabolism after Traumatic Brain Injury

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Project Description

Traumatic brain injuries are common and lead to the development of secondary brain injuries which impact outcome, including metabolic dysfunction within the brain tissue itself. The metabolic function of the brain can be measured directly using a technique called cerebral microdialysis, which measures the redox potential of brain tissue. Invasive cerebral microdialysis devices are used to monitor the brain after severe traumatic injuries along with other physiologic monitoring data to help guide clinical management of these patients. Carbon dioxide is the most potent modulator of cerebral blood flow in the body and is also measured regularly along with cerebral microdialysis. While studies are inconsistent in the role of oxygen therapy to improve brain metabolism, the role of CO2 holds promise to improve brain energetics but its effect in patients with severe traumatic injuries is unknown. For this project, the student will gather existing data on brain metabolism from cerebral microdialysis and carbon dioxide measurements and learn how to handle large, complex datasets, learn R or Python to analyze these data to understand the effects of carbon dioxide on various microdialysis measures such as lactate and pyruvate. Our hypothesis will be that increased levels of carbon dioxide will be metabolically protective, associated with improvements in the ratio of lactate to pyruvate, a marker of metabolic stress.