Dr. Zachary Dazinger

Project: Brain-Computer Interface Testbed
Brain-computer interfaces (BCIs) translate the brain's abstract electrical activity into purposeful command signals that are used by paralyzed patients to pilot power wheelchairs or move prosthetic limbs. However, because of the dangers associated with invasive brain recordings, advances in BCI technology are slow. To overcome this barrier to progress, students will develop a BCI simulator that substitutes raw brain signals with other body signals that are safer to obtain, such as hand or body posture. Students will then supervise healthy volunteers as they control interactive video displays using these body signals, mimicking the operation of BCIs. The knowledge gained from these experiments will advance our understanding of how people interact with abstract control signals when using BCIs, and help guide the development of computer algorithms designed to assist paralyzed patients during real BCI use.

Project: Electrical Stimulation of Peripheral Nerves
Compromised bladder function is an enormous problem worldwide and occurs very often in older adults and in patients with a wide variety of neural disorders, such as diabetes, spinal injury, and multiple sclerosis. The root cause of bladder dysfunction is frequently neural weakness (neuropathy), which interferes with the healthy reflexes that regulate voiding. To address this pervasive health issue, students will electrically stimulate the bladder, urethra, and their associated sensory nerves in acute animal models in order to hijack and enhance the function of bladder-emptying reflexes. Students will employ various engineering techniques, such as numerical optimization and stochastic resonance, to identify the most effective stimulation methods and parameterizations. The successful project will lead to the development of new stimulation-based treatments for a range of bladder dysfunctions.