Microrobots can be used for medicine and microassembly, and acoustic fields offer the advantage of safe power delivery within the human body. This work describes a swimming mechanism for milli-scale robots utilizing an acoustic field. This mechanism was also tested in low Reynolds Number conditions to mimic the microscale environment.

This research project investigates the lipid content and composition of extremophilic and estuarine microalgae (harvested from the Severn River) for suitability as biofuel feedstocks. The impact of varying growth conditions (sugar and nitrogen content) on lipid content and composition for *Galdieria* and *Chlorella* was also assessed.

The aim of this project is to study changes in brain connectivity using graph theory and network modeling. We assessed several methods to create network models from magnetic resonance imaging data and multiple network connectivity measures to determine which combinations most reliably differentiated populations with and without signs of dementia.

Software-defined radio (SDR) leverages the processing power of computers to create communications systems that run as flexible software applications, where the radio operating parameters can be set or altered by software. This project created a SDR communication system that estimates and pre-compensates for Doppler Shift generated by an orbiting satellite communicating with a ground station.

The goal of this project was to perform system identification of the joint-actuated buoy and create control laws to keep the buoy vertical at all times. An experimentally derived model allows non-linear effects such as drag, added mass effects, and hydrodynamics to be inherently accounted for within the experimental data.

Proposed offshore structure designs for algal production using wastewater incorporate floating flexible tubes. This study includes physical modeling experiments to investigate the loads on and dynamic response of these tubes in waves and currents. Experiments were validated with numerical simulations and results provided an understanding for future potential designs.

Many applications for Autonomous Underwater Vehicles (AUV) require higher maneuverability than is available with traditional propulsion. This project investigates the hydroelastic coupling between a flexible propulsor and the surrounding fluid. Analysis of thrust data and wake flow structures seeks to facilitate future engineering of fish-like propulsion for highly maneuverable AUVs.

Detecting change in a stochastic process is a central problem in statistics. This project explores nonparametric graph-theoretic approaches to solving online change-detection problems using an extension of a powerful test recently developed for offline situations. The effectiveness of our modified procedure is tested against simulated and real-world data.