Abstract:
To investigate neurophysiology, control advanced neuro-prosthetics, and develop neuromodulatory therapeutics, devices that stably record and precisely stimulate the nervous system are required. However, stable, long-term interfacing with the central and peripheral nervous system remains a grand challenge – in part because it requires safely interacting with morphologically complex neural tissues within a biomechanically challenging in vivo environment. Materials and devices constructed at the micro- and nano-scales can circumvent many of the limitations of currently available technologies, allowing us to both interface with tissue more densely and take advantage of the increased biocompatibility and decreased material stiffness as minimum implanted feature sizes shrink to the micron scale. In this seminar, I will present my recent work creating a new class of highly-customizable and ultra-miniaturized interfaces for the nervous system. Central to this is my developing of a novel form of rapid, high-resolution 3D-printing: two-photon resonant direct laser writing (rDLW). My approach makes feasible rapidly fabricating mesoscale devices with nanoscale minimum feature sizes using photopolymers with mechanical, electrical, and optical properties that can be modified programmatically. Using rDLW, I developed a printable device – the nanoclip – for interfacing with fine peripheral nerves in small animal models. In addition to demonstrating chronically stable, high-quality recordings and multi-channel, current-steering-based microstimulation within a very small device geometry, these results constitute a proof of concept for using nanoscale 3D-printing to create implantable devices for mapping and controlling neuronal activity in vivo. I will close with a brief overview of my future research plans for printable bioelectronic and optical interfaces tailored to implant targets in the peripheral and central nervous system.

Bio:
Dr. Otchy studied Mechanical Engineering at GeorgiaTech and subsequently worked in industry developing machine vision and robotic control systems. He later earned his Master’s in Philosophy of Science at Tufts University followed by a PhD in Neuroscience at Harvard University with Bence Ölveczky, where he focused on the neural mechanisms that support the acquisition and adaptation of motor skills in songbirds. In work at Boston University – first as a postdoctoral scientist with Timothy Gardner and now as a Principal Investigator and Research Assistant Professor – he uses novel micro- and nano-fabrication techniques to create chronically stable, high-density bioelectronic and optical interfaces for the peripheral and central nervous system.