Project Title	Conducting polymer nanowire and graphene based transistors on paper and PDMS for ultradense ECoG (Electrocorticography) arrays
Supervisor	Dr Rylie Green Dr Bogachan Tahirbegi
Theme(s)	Biomechanics and Medical Devices Biomedical Sensing Diagnostics and Imaging Image Acquisition and Signal Processing Medical Devices Microscopy Neurotechnology and Robotics Regenerative Medicine and Biomaterials
Project Type	Lab based
Project Description	"Developing affordable and easy fabrication methods of bioelectronics circuits without the need of clean room facilities are an active field of research. Patterning of the nanocomponents into functional devices is the remaining challenge in the field. In our laboratory, we developed laser based fabrication methods of flexible networks of patterned conducting polymer nanowires for fully polymeric bioelectronics. Shortly, we are developing laser sintering and filter based processing methods for direct pattern transfer of components such as conducting polymer PEDOT nanowires and silver nanowires into paper and PDMS. The resulting films of patterned nanowires are found to possess high conductivity as well as improved wet electrochemical properties in comparison to platinum. Fabricated thin and flexible arrays of PEDOT nanowire films are tested successfully as an Electromyography (EMG) device for muscle contractions. Recently, we discovered that we could fabricate different materials layer by layer using this method. Therefore, we would like to improve our technique and fabricate 3d structures of bioelectronic circuits. MRES student will work as a part of multidisciplinary NISNEM (Non-invasive single neuron electrical monitoring) project to fabricate fully functional transistor based ultradense ECoG (Electrocorticography) arrays for brain research using the methods described above. Once, the device is fabricated and characterized, it will be tested first on neuron cultures and after that on brain. *Prof. Green's research has been focused on developing bioactive conducting polymers for application to medical electronics. Prof. Green has developed hybrids of conducting polymers and hydrogels to reduce strain mismatch with neural tissue and improve long-term cell interactions at the neural interface.* *Dr. Tahirbegi's research has been focused on the novel electrode materials and new fabrication approaches to enable the fabrication of the super high-density electrode arrays for Electromyography (EMG), electroencephalography (EEG) and microelectrocorticography (μECoG) to create a disruptive technology to non-invasively detect the activity of large populations of single neurons in the brain and the spinal cord."*