# Congratulations to Meena!

## *Bullock Postdoctoral Fellowship 2016*

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The Bullock Postdoctoral Fellowship for research is aimed at understanding and solving important biomedical problems. This multidisciplinary fellowship was created to foster interactions between researchers from diverse fields of science and medicine. The Fellowship provides one year of support, up to $60,000 direct costs.

## An intraoperative PS-OCT camera for quantitative assessment of peripheral nerve injury

### ***Abstract***

The overarching motivation of this work is to create an intraoperative camera that can non-invasively assess the degree of injury in peripheral nerves. Peripheral nerve injuries are an extremely common condition in all age groups. Managing patients who have had these injuries is a challenge because varying degrees of injury require different clinical courses. Mild injuries regenerate by themselves over time, while more severe injuries require interventional grafts. Without a quantitative method to assess the degree of injury intraoperatively, surgeons rely on visual inspection of the nerve to determine when to intervene, and this often leads to missed opportunities to repair the nerve. Polarization-sensitive optical coherence tomography (PS-OCT) is an imaging technique that uses light polarization contrast to resolve functional features within tissue. It has been shown that PS-OCT provides contrast for peripheral nerve injury in rat nerves. In our group we have recently developed a vectorial birefringence (VB) method to distinguish nerve from surrounding tissue and display injury by the loss of birefringence in the nerve. However, a method to scale this technology to intraoperative settings has been limited by small imaging fields and slow speeds. I recently developed a high-speed OCT system that is capable of imaging large fields at video rates. Whereas previously OCT was limited to a few $cm^2$ fields of view requiring minutes to acquire, we have created a system that can image >30 $cm^2$ fields in a fraction of a second. This system has a novel laser that is 200 times faster, and relies on innovative technological developments in interferometer and acquisition system to be able to acquire signals at this speed. The goal of this work is to evaluate the utility of this high-speed platform for intraoperative assessment of peripheral nerve injury. In Aim 1 we will implement the hardware and algorithm modifications that are needed to enable VB contrast in the high-speed OCT platform. We will confirm that we can measure birefringence values similarly to low-speed PS-OCT. In Aim 2 we will image swine ulnar tissue ex vivo and perform histological correlations of myelin thickness, g-ratio, and axon density with our measurements of VB. And finally in Aim 3, we will develop a hand-held scanner and perform an *in vivo* study in swine that have undergone nerve transection and repair. If our system is successful in the pig intraoperative study, this will serve as a platform for doing in-human trials in patients who are undergoing surgical exploration for peripheral nerve injury.