Abstract:
Dopamine neurochemicals govern key behaviors including movement and motivation. Dopamine dysregulation is linked to most forms of mood disorders, Parkinson’s disease, and many other neurological and neuropsychiatric disorders. In Parkinson’s disease, there is a massive loss of dopamine and an abnormal elevation of beta-band electrical signaling throughout the brain, and these are highly correlated with the debilitating loss of normal motor and mood functions. Techniques that allow long-term tracking of these neurochemical and electrical neural signals are needed to identify and intervene at the sources of these diseases.

I will present on my work focused on addressing key unmet needs in neurochemical interfacing: long-term stability, multi-site monitoring, and synchronous measures of electrical and chemical forms of neural activity. I will describe recent advances in chronic monitoring of dopamine in rodents and primates, where we were able to record these chemical signals over the longest periods following implantation (> 1 year). We recently created multi-modal interfaces to record, for the first time, both chemical and electrical neural activity concurrently. These systems were employed to investigate directly the link between dopamine and beta-band oscillations, prevalent biomarkers of Parkinson’s disease, in behaving primates (rhesus monkeys). We further explored the link between these chemical and electrical neural signals and the control of mood and movement behavioral variables that are compromised in Parkinson’s. Finally, I will describe my goals of leveraging these new tools to build systems to improve diagnosis and treatment of human disorders.

Bio:
Helen received the B.S in biomedical engineering and M.S.E in electrical and computer engineering from Johns Hopkins University in 2008 and 2009, respectively, and the Ph.D in electrical engineering from Arizona State University in 2014. She was a recipient of the NASA Graduate Student Research Program fellowship to support her graduate work on wireless backscattering Microsystems for recording neural activity. Helen is currently a research scientist in the laboratories of Dr. Ann Graybiel and Dr. Michael Cima at the Massachusetts Institute of Technology. She has been working on integrating the fields of microdevice technology and neuroscience with the objective of building clinically viable tools to improve the way we diagnose and treat debilitating neurological disorders including Parkinson’s disease and mood disorders. Helen received the NIH Ruth L. Kirschstein National Research Service Award in 2015 to develop chronic interfaces to interrogate deep brain circuits in primates. She was recently awarded the NIH K99/R00 Pathway to Independence Award in 2018 to create new multi-modal neural interfaces and to implement these to investigate the electrical oscillations and dopamine chemicals that are significantly dysregulated in Parkinson’s disease. Helen’s long-term goals are to improve treatment of brain disorders by building micro-invasive implants that target the electrical and chemical basis of these diseases with lifelong stability.