Plug-and-Play Neural Interfacing with Syringe-Injectable Nanoelectronic Networks

Abstract: Neural interfacing on month to year timescales has been challenging due to the chronic immune response typically elicited by conventional brain probes. Recently, mesh electronics have emerged as a promising technology to overcome this limitation. Due to their ultra-flexibility, >95% open macroporous structure, and minimally invasive delivery via syringe injection, mesh electronics have been demonstrated to integrate seamlessly with the surrounding brain tissue and thus allow electrical recording from individual neurons on at least a year timescale. Input/output (I/O) interfacing to measurement electronics, however, has remained a barrier, as the same unique features preclude the use of standard bonding methods and have instead required materials and methods uncommon to the life sciences community. Here we present a new mesh electronics design featuring plug-and-play I/O interfacing that is rapid, scalable, and can be implemented without special equipment. Enabled by this I/O strategy, we present recent efforts towards syringe-injectable mesh electronics with networks of silicon nanowire field-effect transistor (NW-FET) sensors that promise to push in vivo neural interfacing to nanoscale limits.

About the Speaker: Thomas Schuhmann is a Ph.D. candidate in Applied Physics at Harvard University. He received his B.S.E. degree from Duke University in Biomedical Engineering and Electrical and Computer Engineering. Before graduate study he worked as a SMART fellow at the U.S. Air Force’s Space, Aerial, and Nuclear Networks Division at Hanscom Air Force Base. He is currently a NDSEG fellow and graduate researcher advised by Professor Charles M. Lieber at Harvard, where he studies in vivo bio-nano interfacing.