FALL 2023

SEMINAR FOR NEUROTRAUMA AND DISEASES

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PRESENTS

DECODING THE VAGUS NERVE

FEATURED SPEAKER

MATTHEW P. WARD, PHD

Assistant Professor of Biomedical Engineering, Purdue University; Adj. Assistant Professor of Clinical Medicine, Indiana University School of Medicine

Matthew P. Ward (he/him/his) received his B.Sc. in Biomedical Engineering and Ph.D. in Neural Engineering from Purdue University (West Lafayette, IN). He is a bilingual, first-generation immigrant from South Africa, the first engineer in his immediate/extended family, and the first to receive his PhD. Dr. Ward is currently Assistant Professor of Biomedical Engineering at Purdue University (West Lafayette, IN) and Adjunct Assistant Professor of Clinical Medicine in the Division of Gastroenterology and Hepatology at the Indiana University School of Medicine.

Dr. Ward has spent the last decade developing technologies that use real-time physiological feedback and learning algorithms to derive the mechanism(s)-of-action of vagus nerve stimulation (VNS) for numerous medical applications, including gastroparesis, depression, epilepsy, visceral pain, musculoskeletal pain, and autoimmune inflammatory disorders. In 2014/2017, he was inducted into the Purdue Innovators Hall of Fame for his work in self-optimizing neural interfaces for implantable and wearable neurostimulation devices, addressing gastroparesis and chronic pain. In 2020, he was recognized as a Top Faculty Innovator at Purdue. Since 2016, Dr. Ward's research has been supported by NIH, DoD, Indiana CTSI, and industry. Dr. Ward has numerous pending and issued patents in the US and abroad, and has grown a strong, highly productive translational research program through collaborations with clinician-researchers at the Indiana University School of Medicine and Icahn School of Medicine at Mt. Sinai.

Date: October 4, 2023 **Time:** 4:00 p.m. - 5:00 p.m. EST

Location: DLR 131 **Zoom Link:** https://bit.ly/441DIlq

Meeting ID: 998 3163 3744 **Passcode:** CPR

ABSTRACT

The compound nerve action potential (CNAP) contains a wealth of information about the composition, underlying organization, and functions of a nerve. The CNAP is easy to measure, but difficult to interpret and use, especially from the vagus nerve (VN), which is composed of ~80% unmyelinated C fibers. These unmyelinated fibers have roles in mediating reflexive and choreographed activity in most organs of the thorax and abdomen, making them attractive targets for modern neurostimulation-based treatments. Unfortunately, an almost complete lack of knowledge describing the structure-function relationships of vagal nerve fibers (especially C fibers) has hindered the development of such bioelectronics to date. With knowledge of any specific structure-function relationship, it will be possible to directly regulate the target fiber subpopulations and the functions they mediate using a specific volley of the CNAP as feedback to titrate stimulus parameters. In this talk, I will describe the ongoing challenges in interpreting the results from recently completed and ongoing rodent and human VNS studies intended to improve our understanding of the VN fibers that mediate stomach functions. I will then review the design and operation of HAPI, an interactive CNAP simulation and data mining tool that can bridge the gap between what is measurable in an experimental or therapeutic setting (i.e., the CNAP) and what is unseen (i.e., nerve composition and organization).

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