ELECTRICAL & COMPUTER ENGINEERING BIO-SEMINAR Spring 2019 ENGINEERING TEXAS A&M UNIVERSITY

When: **Friday 12:40 – 13:40**

Where: **ETB 1020**

Speaker: **Woo Seok Kim**

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Texas A&M University

Title: **A fully implantable, closed-loop wireless recording and stimulation system for the treatment of obesity**

Date: **4-26-2019**

Abstract: Over the past several decades, obesity has grown into a major global epidemic. In the United States, more than two-thirds of adults are now overweight and one-third is obese [1]. Unfortunately, the current available treatments for obesity are often ineffective, and do not treat the underlying pathology. Moreover, therapies for these conditions are limited by our inability to understand and control the network of neuronal circuitry, in particular vagus afferent fibers, that regulate energy homeostasis [1]. Meal cessation is to a large extent mediated by feedback from the gut to the brain. Distension of the stomach, the absorption of nutrients and the release of satiety hormones (GLP-1, peptide YY, and cholecystokinin) cells can activate the vagus nerve that then signals the nucleus tractus solitarius (NTS) in the hindbrain [2]. Neurons in NTS then relay signals to the parabrachial nucleus (PBN) and other nuclei to suppress feeding [3]. Because the vagus is a major origin of satiation signals, it is a logical place to intervene to treat obesity. Furthermore, several studies indicate that the vagus becomes insensitive to satiation signals in obese animals. Consequently, the ability to bypass this obesity-induced insensitivity and experimentally activate the vagus has significant potential [4]. However, a human nodose ganglion contains 100,000 neurons that can innervate many different internal organs [5]. Therefore, cellular level control of nerves is crucial to this pursuit. In addition, there is no way to directly record the activity of vagal neurons in awake mice, which can provide real insights into how satiety information is processed. Thus, all the experiments that suggest that the vagus becomes insensitive to nutrients and hormones in response to obesity are indirect [4]. Here, we propose soft, miniaturized implantable battery-free wireless device that can offer exceptional spatial/temporal resolution, optogenetic stimulation, and capabilities in wireless recording. These innovative and disruptive technologies allow experiments that examine subtypes suppressing feeding, thereby identifying a signaling pathway that could regulate food intake to treat obesity. Here, we use adult male mice (C57/Bl6 background) for experiments and inject AAV9-Syn-DIO-ChrimsonR-TdTomato virus into nodose ganglion to infect vagus nerve.

Bio: Woo Seok Kim received Bachelor of Science in Computer Science and Master of Science in Electrical and Electronic Engineering from Korea University, South Korea, in 2011 and 2013, respectively. He is currently pursuing Ph.D. at Texas A&M University. From 2013 to 2015, he was an software engineer of Research and Development Center at KT(Korea Telecom) Inc., Seoul, S. Korea. His current research interests include bioelectronics system development and advanced algorithm to reconstruct and classify the neural signals.

1. Wu et al. Cell 137:1225-1234, 2009.
2. De Lartigue, et al. Mol Metab 3: 595-607, 2014.
3. Morton et al. Nature Rev Neurosci 15(6):367-78, 2014.
4. Carter et al. Nature 503:111-114, 2013.
5. Famm et al. Nature 496:159-161. 2013.