UCF DEPARTMENT OF ELECTRICAL ENGINEERING AND COMPUTER SCEINCE

Spring 2015 Seminar Series

Presented by the ECE Division

MONOLITHIC CMOS BIOELECTRONICS IN BIOPHYSICAL AND BIOMEDICAL RESEARCH

WEDNESDAY APRIL 1, 2015

2:00 PM – CREOL 103

Monolithic CMOS bioelectronics has been an invaluable instrument in biotechnology due to the need for high-throughput and high performance signal acquisition at extremely low cost. Emerging applications can be found in high-throughput gene sequencing as exemplified by the activities of leading biotechnology companies such as Oxford Nanopore Technologies and Ion Torrent at Life Technologies. In this talk, I will present the development and application of monolithic CMOS bioelectronics in biophysical and biomedical research. The CMOS manufacturing process is used to design and fabricate low-noise amplifier arrays and mixed-signal multiplexers. And this is followed by post-CMOS processing to monolithically integrate sensor electrodes on the surfaces of the CMOS chips. The monolithic CMOS bioelectronics eliminates a large percentage of the noise source (60 Hz and capacitive noise) by amplifying the signal at close proximity (< 5 μm) to the electrodes, and allows increased scalability and throughput by reducing the size of individual amplifiers. The application of monolithic CMOS bioelectronics in electrophysiology shows low noise performance - on the order of 100 fA at 2 kHz bandwidth - and accelerates the data collection from living cells by using a 320-electrode parallel recording array in a few mm2 silicon chip (25 × 40 μm2/amplifier).

DR. BRIAN N. KIM
Stratos Genomics

Brian Kim received his Bachelor of Science in Electrical and Computer Engineering, with summa cum laude, from Hanyang University, Seoul in 2008, and his Ph.D. in Biophysics from the School of Applied and Engineering Physics at Cornell University in 2013. His thesis work included system design of Monolithic CMOS Bioelectronics for biomedical instrumentation; he demonstrated massively parallelized signal acquisition with low noise and high sensitivity. He was a postdoctoral fellow at the University of California, Berkeley for a brief period in 2013 before he was referred to a Seattle-based biotechnology company, Stratos Genomics, where he continues to apply his expertise in CMOS circuit design for biomedical instrumentation as a Senior Electrical Engineer. He is currently involved in the development of a next-generation gene sequencing (NGS) technique.