

Nanoscale Science Seminar Series Spring 2016

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“Quantum Biology and Its Medical Applications”

Abstract:

In this talk, I will present quantum bionanophotonics for fundamental life sciences and precision medicine. First, I will introduce a *quantum nanoscope* that allows non-invasive optical imaging of electron-transfer (ET) dynamics in live cells. The quantum nanoscope is designed to capture the real-time ET imaging of enzymes using *Plasmon Resonance Energy Transfer (PRET)* mechanism and quantized plasmon quenching dips in resonant Rayleigh scattering spectra. Second, I will discuss *photonic gene circuits* for noninvasive gene regulations in living organism and gene therapy. Since the activation of transcription factor NF- κ B plays a central role in the regulation of inflammation, immune responses, infections, differentiation, proliferation, oncogenesis, and apoptosis, precise spatiotemporal controls of NF- κ B signaling pathway by optically addressable siRNA-antennas will have significant implications in precision medicine. Third, I will discuss the important role of *bionanophotonics* in integrated molecular diagnostic systems (iMDx) for personalized precision medicine, and microphysiological analysis platforms (iMAPs) for drug discovery and regenerative medicine. The iMDx comprises three key elements of *precision medicine on chip*: ultrafast multiplexed photonic PCR for the early detection of DNA and RNA biomarkers in blood, signal amplifications of protein markers, and a self-contained sample preparation from whole blood on chip, which allows a sample-to-answer readout platform. The progress on patient-specific iPSCs-based iMAPs, pancreatic islets and mini-brains on chip will be discussed along with the vision of preventive medicine via precision engineering in medicine.

Biography:

Luke P. Lee is the Arnold and Barbara Silverman Distinguished Professor of Bioengineering at the University of California, Berkeley, a Co-Director of the Berkeley Sensor & Actuator Center, and the Director of the Biomedical Institute of Global Healthcare Research & Technology (BIGHEART).

Professor Lee's current research interests are bionanoscience, nanomedicine for global healthcare and personalized medicine, and Bioinspired Photonics-Optofluidics-Electronics Technology and Science (BioPOETS) for green building with living skin. He was Chair Professor in Systems Nanobiology at the Swiss Federal Institute of Technology (ETH, Zurich) and has more than ten years of industrial experience in integrated optoelectronics, Superconducting Quantum Interference Devices (SQUIDs), and biomagnetic assays.

Professor Lee is a 2010 Ho-Am Laureate and has authored and co-authored over 250 papers on bionanophotonics, microfluidics, single cell biology, quantitative biomedicine, molecular diagnostics, optofluidics, BioMEMS, biosensors, SQUIDs, SERS, and nanogap junction biosensor for label-free biomolecule detection.

Professor Lee received his B.A. in Biophysics and Ph.D. in Applied Science & Technology: Applied Physics (major) / Bioengineering (minor) from the University of California, Berkeley.

Thursday, March 24th @ 3:30 PM in Burson 115
Refreshments served at 3:15 PM