Medical Innovations by BioPOETS*

**** Biologically-inspired Photonics-Optofluidics-Electronics Technology & Science***

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Abstract

In this talk, I will share my vision for medical innovations (i.e. *Innovative Biology, Quantitative Biomedicine, and Personalized Medicine*) by BioPOETS. As biologically-inspired photonic device and systems, we have created quantum nanoplasmonic probes, Oligonucleotides on a Nanoplasmonic Carrier-based Optical Switch (ONCOS), quantized Plasmon Resonance Energy Transfer (PRET)-based nanospectroscopy [1], and artificial compound eyes [2] for high-resolution spectroscopic detections and imaging of cellular dynamics. Quantum nanoplasmonic PRET, molecular ruler [3] *in-vivo* Surface Enhanced Raman Spectroscopy (SERS) probes [4], and optofluidic IC [5] are developed for label-free biomolecular detections. PRET-based ultrasensitive biomolecular absorption spectroscopy using single nanoplasmonic probes can be used for cellular and molecular spectroscopic imaging. ONCOS allows remote optical control of gene regulation and protein expression in living cells by NIR laser diode activations [6]. This method allows gene release with nanometer-scale spatial resolution (less than 100 nm) and localized temperature disturbance (less than few nm) on the surface of ONCOS.

For biologically-inspired optofluidics and physiologically relevant cellular microprocessors, we have developed Biofluidic Application Specific Integrated Circuits (BioASICs) [7] for quantitative biology and cell-based diagnostics by connecting novel microfluidics and nanofluidic circuits, which can impact on high-speed and high-content experimental biology in new ways. We are creating a library of these “building blocks" to develop innovative biological microprocessors with integrated optical controls and detections capability. For biologically-inspired electronics, we are elucidating the electron transfer mechanism of natural photosynthesis to develop artificial photosynthesis on chip. Finally, I will describe a new 3D optical lithography for the self-assembly of waveguides by self-aligned microlenses and a self-writing process in photopolymers for BioPOETIC system integrations, which can create future innovative biology, quantitative biomedicine, and personalized medicine platforms.

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