Bionanoscience for Innovative Global Healthcare Research & Technology (BIGHEART)

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Abstract

It is critical time to solve the problems of both developed and developing world healthcare challenges. In the first part of talk, I will present an external optical manipulation of genetic circuits for future individualized medicine in the context of global healthcare. High-precision NIR optical control of nanoplasmonic optical antenna allows a remote gene regulation in living cells. Since the abnormal NFκB signaling pathway has been associated in cancer, infectious diseases, inflammation, and neurological diseases, we found a solution for the spatiotemporal regulation of NF-κB activation by the selective optical liberations of IκB siRNA and p65 siRNA from biophotonic antennas. The efficacy of multistep bidirectional control of specific gene expression was demonstrated through the expression measurements of IP-10 and RANTES activated by nuclear p65.

In the second part of talk, I will discuss cellular BASICs (Biologic Application Specific Integrated Circuits) for aging biology, single cell chemotaxis, label-free electro-physiologically activated cell sorting (ePACS) of induced pluripotent stem cells, and integrated molecular diagnostic system (iMDx). The iMDx comprises a self-contained sample preparation from whole blood, multiplexed protein assays, and nucleic acid amplification assays on chip with a sample-to-answer readout platform. As we gain more insight into the genomic basis of pathogen infectivity and drug resistance, point-of-care nucleic acid testing will likely become an important tool for global health. Additionally, the iMDx features cell phone data connectivity and GPS sample geotagging, which can enable epidemiological surveying and remote healthcare delivery. In summary, I will share my vision for the convergence of art, culture, technology and science (ACTS) to transform life sciences. Creative ACTS will allow us to find the solutions for preventive medicine and low-cost healthcare systems