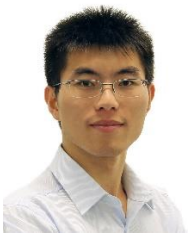
HBKU Thematic Research Grant 1st Cycle– Project Highlight

Project Title: A Miniaturized High-Dynamic-Range Bioluminescence and Fluorescence Biosensing System for Biomedical Applications



LPI Name: Dr. Bo Wang

Executive Summary

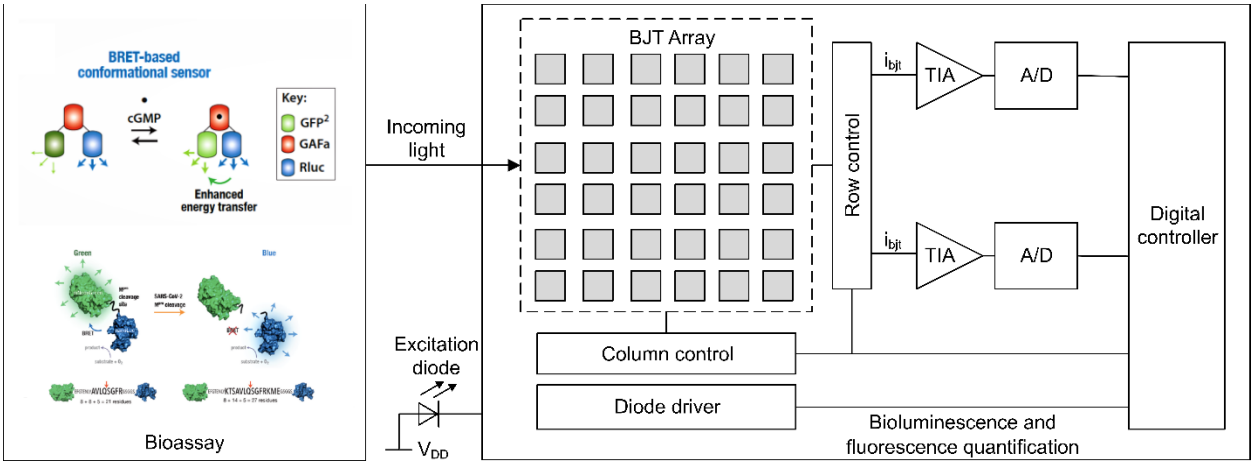
Precision medicine encompasses the development of patient-specific therapeutic regimes based on their genetic background, lifestyle choices, and environmental exposure. In this regard, massive efforts have been undertaken to sequence the genomes of as many individuals as possible, both in Qatar and in other countries in the world. However, effective precision medicine therapy development will require a concomitant development of technologies that allow the determination of various physiological parameters that complement genetic information, thus aid decisions related to therapy. There have been great advances in sensing technologies, including optical, bioimpedance and nanothermometer, etc., miniaturizing and making them available for wide-scale deployment in non-clinical settings, and thus enabling wide-scale biomedically relevant parameter monitoring continues to be a challenge. In this project, we will develop a high-dynamic-range bioluminescence and fluorescence instrumentation system using customized photoreceptor and readout circuits. The system will be used for discovering and characterizing allosteric inhibitors of the SARS-CoV-2 Mpro protease. It will also be used to decode the role of coevolving residues in cGMP-mediated allostery in PDE5, which is a major pharmacological target for treating diseases such as pulmonary hypertension and erectile dysfunction, with the aim of developing a new class of PDE5 modulators for precision medicine application.

Expected Outcome

The successful completion of the project will deliver a near-field lensless bioluminescence and fluorescence sensing system prototype and IP, and functional bioassays for SARS-CoV-2 Mpro and PDE5 (cardiovascular diseases) drug discovery. Importantly, we envisage that the sensing system can be applied for various other types of bioassays currently used in clinical settings including antibody-based biomolecule quantification.

Collaborating HBKU entities: College of Health and Life Sciences, HBKU

Photos:



Project highlight and high-level illustration