Biomedical Engineering Department Journal Club

OptoDyCE: Automated system for high-throughput all-optical dynamic

Aleks Klimas is a BME Ph.D. student in the Cardiac Optogenetics and Optical Imaging Lab. Her primary focus is developing imaging systems that employ optogenetics to optically control and measure electrical activity of the heart.

DATE: **Monday, February 8th, 2016**
TIME: **10:00-10:30 AM**
PLACE: **SEH Room 2000**

ABSTRACT

In the last two decades, >30% of drugs withdrawals from the market were due to cardiac toxicity, where unintended interactions with ion channels disrupt the heart's normal electrical function. Consequently, all new drugs must undergo preclinical testing for cardiac liability, adding to an already expensive and lengthy process. Recognition that pro-arrhythmic effects often result from drug action on multiple ion channels demonstrates a need for integrative and comprehensive measurements. Additionally, patient-specific therapies relying on emerging technologies employing stem-cell derived cardiomyocytes (e.g. induced pluripotent stem-cell-derived cardiomyocytes, iPSC-CMs) require better screening methods to become practical. However, a high-throughput, cost-effective approach for cellular cardiac electrophysiology has not been feasible.

Optical techniques for manipulation and recording provide a contactless means of dynamic, high-throughput testing of cells and tissues. Here, we consider the requirements for all-optical electrophysiology for drug testing, and we implement and validate OptoDyCE, a fully automated system for all-optical cardiac electrophysiology. We demonstrate the high-throughput capabilities using multicellular samples in 96-well format by combining optogenetic actuation with simultaneous fast high-resolution optical sensing of voltage or intracellular calcium. The system can also be implemented using iPSC-CMs and other cell-types by delivery of optogenetic drivers, or through the modular use of dedicated light-sensitive somatic cells in conjunction with non-modified cells. OptoDyCE provides a truly modular and dynamic screening system, capable of fully-automated acquisition of high-content information integral for improved discovery and development of new drugs and biologics, as well as providing a means of better understanding of electrical disturbances in the heart.

For questions or more information:

Kara Garrott karagarrott@gmail.com
Aleks Klimas aleks.klimas@gmail.com
Kedar Aras kedar_aras@gwu.edu

THE GEORGE WASHINGTON UNIVERSITY
WASHINGTON, DC