Stony Brook University
The Graduate School

Doctoral Defense Announcement

Abstract

Cardiac Arrhythmogenesis In Urban Air Pollution: Optical Mapping In A Tissue-Engineered Model

By

Harold Bien

Recent epidemiological evidence has implicated particulate matter air pollution in cardiovascular disease. We hypothesized that inflammatory mediators released from lung macrophages after exposure to particulate matter predisposes the heart to disturbances in rhythm. Using a rational design approach, a fluorescent optical mapping system was devised to image spatiotemporal patterns of excitation in a tissue engineered model of cardiac tissue. Algorithms for automated data analysis and characterization of rhythm stability were developed, implemented, and verified. Baseline evaluation of spatiotemporal instability patterns in normal cardiac tissue was performed for comparison to an in-vitro model of particulate matter air pollution exposure. Exposure to particulate-matter activated alveolar macrophage conditioned media resulted in paradoxical functional changes more consistent with improved growth and increased resistance to arrhythmias. These findings might be indicative of a "stress" response to particulate-matter induced pulmonary inflammation, or may be specific to the animal model (neonatal rat) employed. In the pursuit of elucidating the proposed pathway, we have also furthered our understanding of fundamental behaviors of arrhythmias in general and established a model where further testing might ultimately reveal the mechanism for urban air pollution associated cardiovascular morbidity.

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