HONOURS ABSTRACT FORM – MEDICAL SCIENCES SYMPOSIUM

STUDENT: _____

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☐ Platform presentation

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Template for abstract (250-300 words):

Acute Effects of Mechanical Stimulation on the Stiffness of Cardiac Cells

Background: The heart's mechanical properties are altered by mechanical stimuli, and thus susceptible to changes in the mechanical environment. Chronically, environmental changes are known to alter physical properties of cardiac tissue, which affects its mechanical performance. For instance, a chronic increase in intracardiac pressure generally results in myocardial stiffening, which can lead to heart failure. Acute changes in cardiac mechanics, on the other hand, are known to feedback on the heart's electrical activity, which can lead to deadly arrhythmias. Yet, whether these changes occur with acute mechanical stimulation is unknown. The aim of this study was to investigate the effects of acute mechanical stimulation on cardiac cell stiffness. It was hypothesized that repetitive mechanical stimulation would result in an acute increase.

Methods: A method was developed for measuring the stiffness of single myocytes isolated from the left ventricle of New Zealand white rabbits. This involved the use of specialized carbon-fibres that adhere to the cell surface, coupled to a custom piezo-electric micrometer position system, for controlled stretch of single cells. By stepwise stretch and calculation of applied force, this technique allowed for measurement of the force-length relationship in contracting cells, which is representative of cell stiffness.

Results: To validate the ability of our system to measure acute changes in cell stiffness, force-length relationships of control cells and those exposed to 10µm paclitaxel (causing microtubule hyperpolarization) were measured, which showed an increase in stiffness in paclitaxel treated cells. When cells were instead subjected to 1min of repetitive mechanical stimulation by cyclic stretch, however, no change in stiffness was observed.

Conclusions: Our carbon-fibre based system allows for the measurement of stiffness in single isolated cardiac cells, however it appears that repetitive mechanical stimulation has no acute effect on cell stiffness.