

I-Wire: A Biotension Measurement Device for Tissue Engineering and Pharmacology

Summary

Vanderbilt researchers have developed an integrated system ("I-Wire") for the growth of miniature, engineered 3D cardiac or other muscle or connective tissues and their active and passive mechanical characterization. The system utilizes an inverted microscope to measure the strain when the tissue constructs are laterally displaced using a calibrated flexible cantilevered probe.

Addressed Need

Current tissue biotension devices do not permit control over the applied force.

Technology Description

The figures shown on the right provide a pictorial description of the I-Wire system. A flexible, calibrated probe exerts a lateral force onto the tissue to be interrogated. A microscope is used to detect the relative deflection of both the probe and the specimen. A simple calculation yields the mechanical properties of the construct.

Technology Features

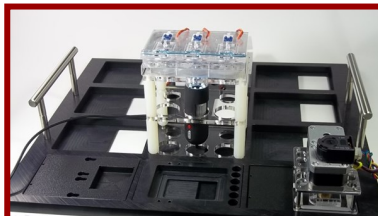
- ◇ Microscope-enabled quantitative measurements of tissue properties
 - ◇ Mechanical, electrical, calcium signaling, transmembrane potential
- ◇ Controlled application of mechanical force and electrical stimulation
- ◇ Supports Hill-model analysis of construct contractility
- ◇ Perfusion of tissue-growth chamber for drug dosing and metabolomics
- ◇ Scalable to medium-throughput with intra-incubator imaging and control

Technology Development Status

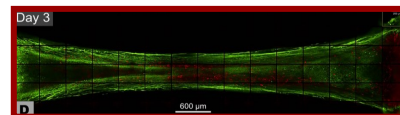
- ◇ Laboratory-scale prototypes constructed and validated
- ◇ Software developed for control and analysis
- ◇ Prototypes created for medium-throughput applications

Intellectual Property Status

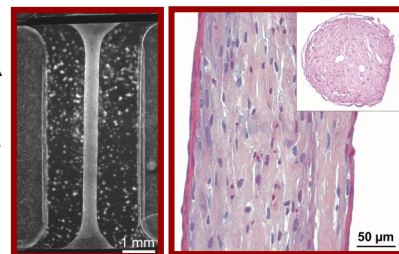
- ◇ A patent application has been filed
- ◇ Manuscripts submitted
- ◇ Visit <http://www.vanderbilt.edu/viibre> for detailed description of ongoing research programs, core research capabilities and list of publications



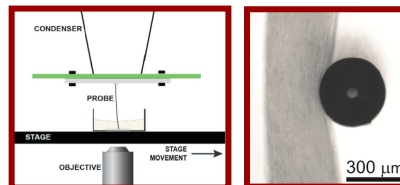
Self-contained medium-throughput I-wire modules, with camera readout on an incubator shelf



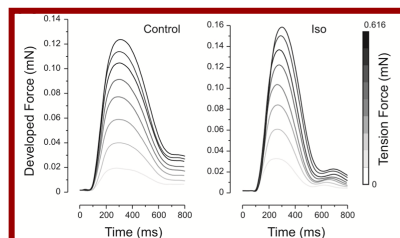
Collagen-fibroblast construct



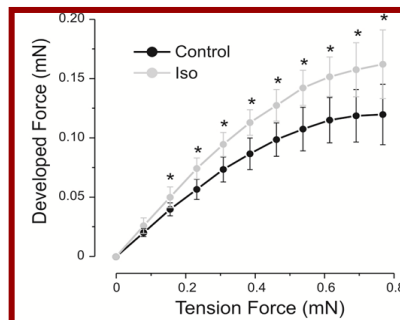
Neonatal rat cardiac construct



Force application/measurement



Force measurement at different tensions and with isoproterenol



Frank-Starling force-tension curve with and without isoproterenol

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