Force Clamp in a Single Myocyte: Measuring Work Loops

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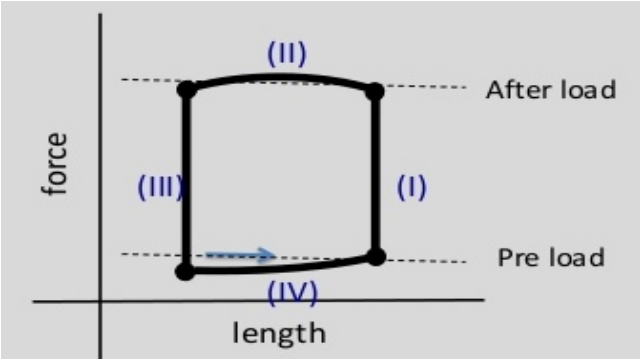


Mimic cardiac cycle in single myocytes

Fast feedback clamp of pre- and after-load forces

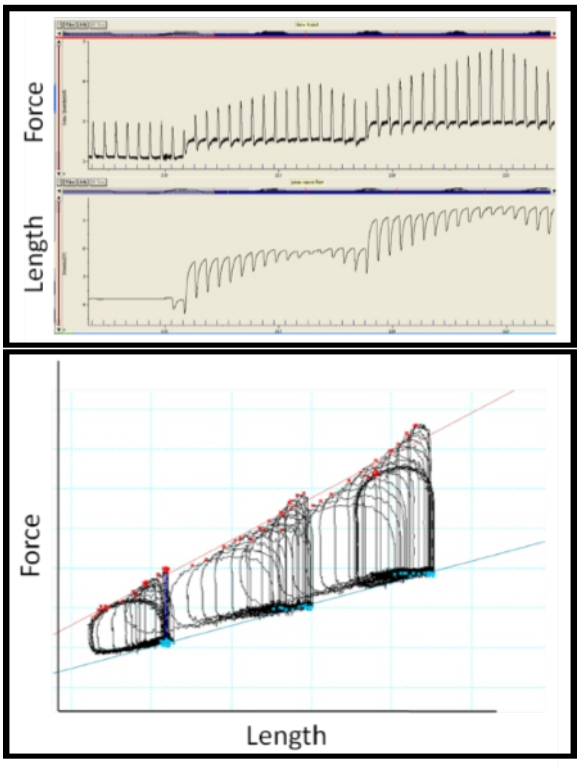
Programmable control of pre- and after-load levels

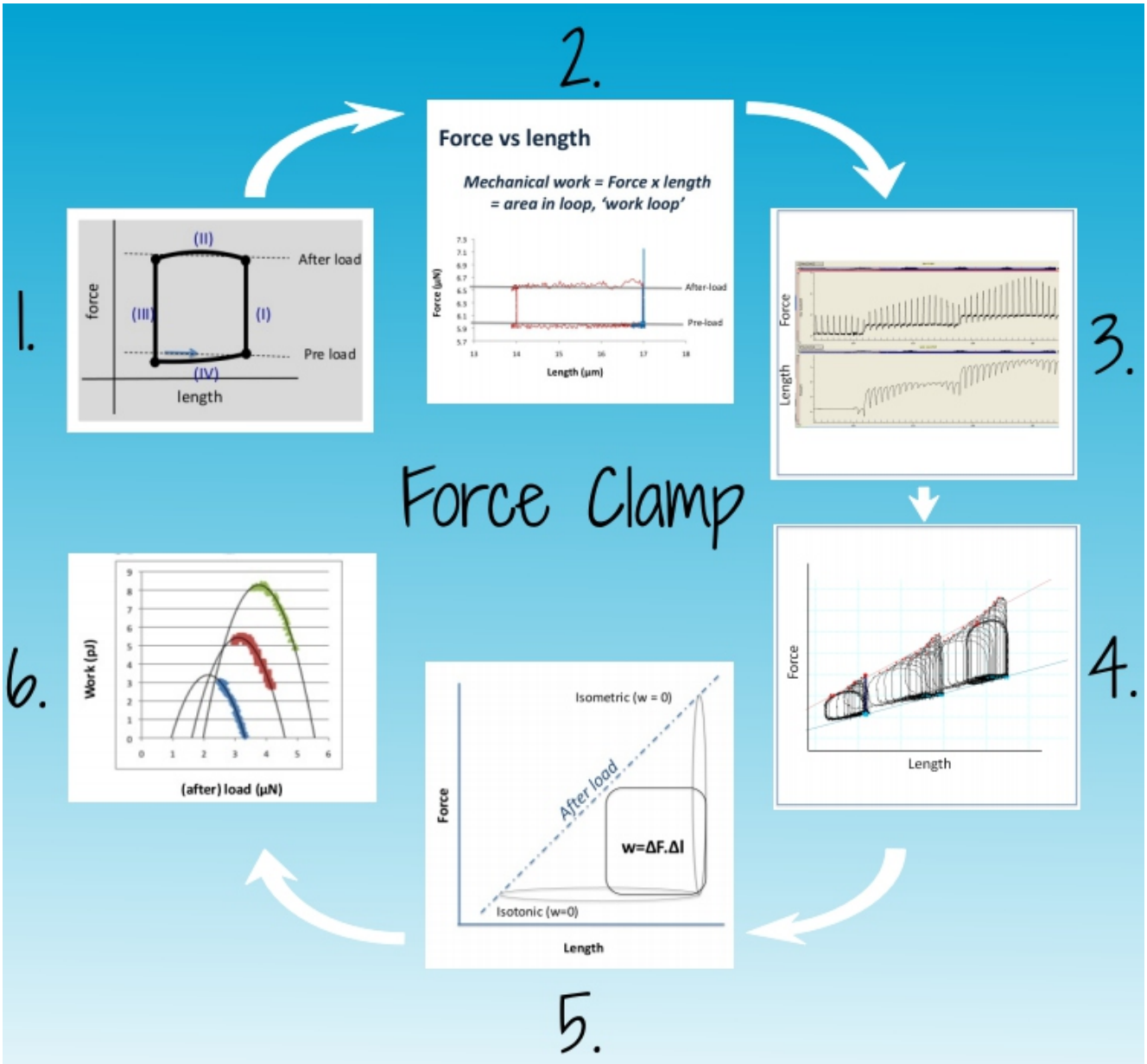
IonOptix MultiClamp

Measure work loops and power output in isolated intact myocytes

The cardiac work cycle consists of four well-defined isometric and isotonic phases. The IonOptix MultiClamp software enables fast feedback control of pre- and after-load force levels. Together with the IonOptix MyoStretcher OptiForce force transducer and fast piezo motor, we can modulate the force development by rapidly changing the length of the myocyte in response to changing force load. By clamping the diastolic and systolic force levels (pre- and after-load), we can mimic the cardiac cycle, enabling work measurements in single, isolated cardiomyocytes.

The data shown on the right were obtained from a rat ventricular myocyte at 37C.





1. **The Idea:** A single cell PV loop based on isometric force measurements with fast feedback control of myocyte length. A piezo motor drives cell shortening and relengthening in response to forces.
2. **The Proof of Principle:** After-load (systolic) and pre-load (diastolic) forces are clamped.
3. **The Results:** Three pre-load clamps are tested against increasing after-loads.
4. **The Data:** Force is plotted against corresponding lengths.
5. **The Calculation:** Work is a function of integrating force X length.
6. **The Result:** Work output plotted at varying after-loads.

Select Publications

Mimicking the cardiac cycle in intact cardiomyocytes using diastolic and systolic force clamps; measuring power output

Helmes M, Najafi A, Palmer BM, Breel E, Rijnveld N, Iannuzzi D, Van Der Velden J. Cardiovascular research. 2016 Apr 1:cvw072. DOI: 10.1093/cvr/cvw072