# Electromechanically Stimulate Cells in Culture





Induce and maintain cardiomyocyte phenotype

New user-friendly software

New C-Stretch for simultaneous stretch and stimulation

Customizable protocols to mimic physiological conditions

# IonOptix C-Pace EM

The C-Pace EM is a multi-channel culture stimulator capable of delivering electrical stimulation or a combination of electrical stimulation and mechanical stretch to up to eight tissue culture plates or C-Stretch electromechanical devices simultaneously. Chronic electrical stimulation has been shown to prevent dedifferentiation of cardiomyocytes and maintain their rod shaped, striated morphology, while electrostimulation coupled with mechanical stretch offers a powerful tool to promote maturation of naive cell lines.

# **C-Pace Navigator**

The new C-Pace Navigator software allows the user to operate both the C-Dish and C-Stretch with a user-friendly interface.

- Simple adjustments of both stretch and electrical parameters for each channel
- Pre-defined basic protocols for simple pacing procedures
- Adjustable trapezoidal waveform with expansion, hold, and contraction phases
- Customize specific protocols to mimic exercise routines or pathogenic conditions:

Arrhythmia Protocols – Insert an offbeat pulse at a fixed interval

**Exercise Protocols** – Run multiple pulse trains with programmable frequency and duration

**Irregular Pacing** – Percent defined random variation of specified frequency

janks Options Help			
Bank 4 (CStretch) Enabled Basic 💌	4 ms 12 V	Bank 7 (CPace) 6 wells Enabled Sequence 💌 4 ms 0 V	ſ
1 3 Hz Var 0 %		1 Pulse Train V 1 Hz Var 0 % 1 Sec V Aux Out Os	_
2 2 Hz Var 0 %		2 Pulse Train V 1 Hz Var 0 % 999 Min V Aux Out	
3 3 Hz Var 0 %		3 Pulse Train Y 1 Hz Y Var 0 % Trig Y Aux Out	
4 1.2 Hz Var 0 %		(4) End V	
Stretch: 10 13%   Start: 0 % P Trig:   Hold: 0 % P Delay: -5   Hold: 0 % Ratio: 1 Pulse   Contract: 50 % 1 Stretch	20 43 34 0 0 20 40 60 80 100 % Period		

#### www.ionoptix.com

### C-Dish: For Electrostimulation

- Physically stable 2-piece assembly that is adapted for a variety of standard culture plates
- Carbon electrodes + bipolar pulses minimize electrolysis byproducts
- Digital adjustment of frequency (0.010 to 99Hz), pulse duration (0.4 to 10 msec) and voltage (max ±40 V)

#### **Supported Culture Plates**

- Rectangular 4 and 8-well plates
- Circular 6, 12, and 24-well plates
- Discrete 35mm dishes

### C-Stretch: For Electromechanical Stimulation

- Fully customizable trapezoidal waveform with adjustable expansion, holding and contraction phases
- Digital adjustment of frequency (up to 10 Hz), pulse duration (0.4 to 10 msec) and voltage (max ±40 V); maximum stretch 20%
- Program stimulus pulse to occur at any time during stretch protocol



### Select Publications

Laminin-111 enriched fibrin hydrogels for skeletal muscle regeneration Marcinczyk, Madison, et al. Biomaterials 141, 233-242 (2017). DOI: 10.1016/j.biomaterials.2017.07.003

Mechanical Stress Conditioning and Electrical Stimulation Promote Contractility and Force Maturation of Induced Pluripotent Stem Cell-Derived Human Cardiac Tissue. Ruan, Jia-Ling, et al. Circulation (2016): CIRCULATIONAHA-114. DOI: 10.1161/CIRCULATIONAHA.114.014998

## Mechanical Stress Promotes Maturation of Human Myocardium From Pluripotent Stem Cell-Derived Progenitors.

Ruan, Jia-Ling, et al. Stem Cells 33.7, 2148-2157 (2015). DOI: 10.1002/stem.2036

Direct Cardiac Reprogramming: From Developmental Biology to Cardiac Regeneration. Li Qian and Deepak Srivastava. Circulation Research 113, 915-921 (2013). DOI: 10.1161/CIRCRESAHA.112.300625

Growth of Engineered Human Myocardium With Mechanical Loading and Vascular Coculture Nathaniel L. Tulloch, et al. Circulation Research 109, 47-59 (2011). DOI: 10.1161/CIRCRESAHA.110.237206

**Electro-mechanical conditioning of human iPSC-derived cardiomyocytes for translational research** Katharina Kroll, et al. Progress in Biophysics and Molecular Biology (2017). DOI: 10.1016/j.pbiomolbio.2017.07.003