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MINIATURIZED ENGINEERED HEART TISSUES FROM HUMAN INDUCED PLURIPOTENT STEM CELL-DERIVED CO-CULTURE

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1. Introduction | Engineered Heart Tissues (EHTs)

Three-dimensional *in vitro* model of a human heart on-a-chip

- Mimicking the human heart as good as possible
- Personalized medicine
- High throughput research
- Cost effective

Chip

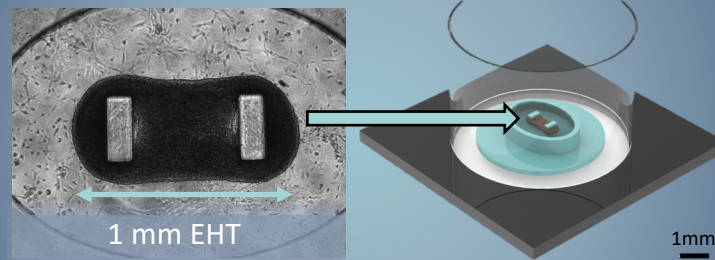
Wafer-scale silicon- and polymer-based fabrication

Cardiac tissue

Human induced pluripotent stem cell (hiPSC) derived:

- 80% Cardiomyocytes
- 20% Cardiac fibroblasts

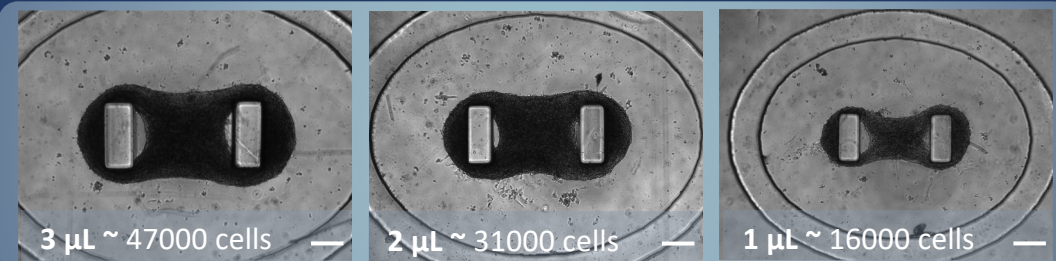
Mixing cells in collagen and matrigel (ECM)



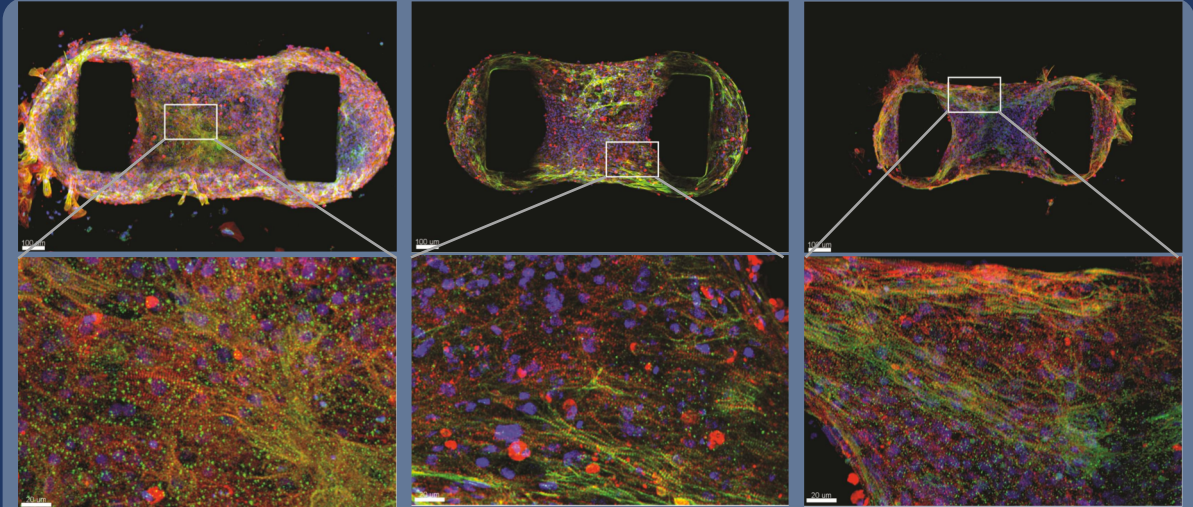
2. Methods | Miniaturized Engineered Heart Tissues

- Anisometrically downscaled
- Research (disease) mechanisms
- Volumes of cell-gel mix: 3, 2 and 1 μ L
- Test drug efficacy

Scale bars: 100 μ m



3. Results | Miniaturized EHTs show physiologically relevant sarcomere organization, contractile properties and drug efficacy

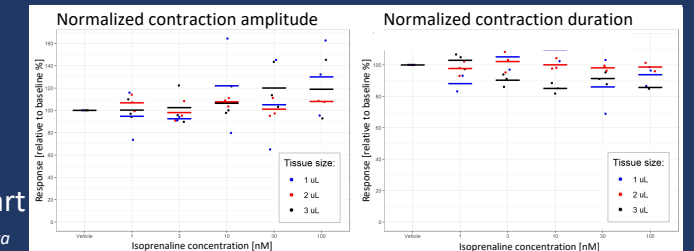


Immunofluorescence images of the three sizes of EHTs for cardiac specific markers: Alpha-actinin (red), Cardiac troponin-T (green), Nuclei: DAPI (blue) Scale bars: 100 and 20 μ m

Drug incubation (day 13):

- Isoprenaline 1-100 nM
- Increased contraction amplitude
- Decreased contraction duration
- Similar effects as in the human heart

Preliminary data



4. Conclusions | Miniaturized Engineered Heart Tissues ...

- ... containing solely hiPSC-derived cells were successfully formed
- ... express cardiac specific markers distributed over the whole tissue
- ... exhibited physiologically relevant contractile responses to Isoprenaline