USC Stevens Center for Innovation

USC University of Southern California

"Heart-on-a-Chip": Gelatin Hydrogel Membrane for Culturing Heart Cells

USC Case #2018-003

Market Opportunity:

Cardiovascular disease (CVD) is the leading cause of mortality around the world. In the United States alone, heart failure currently affects over 5 million people costing the nation an estimated $32 billion annually. A major limitation in cardiovascular drug development is that current CVD models lack relevance to native human tissue. The "Heart-on-a-chip" device overcomes these limitations, but the synthetic elastomer polydimethylsiloxane (PDMS) it uses for culturing cardiac cells is not suitable for long-term studies. The $120 billion market for CVD drugs will benefit from a device that provides conducive culture conditions to heart cells in a physiological microenvironment.

USC Solution:

USC scientists have developed a gelatin hydrogel membrane to serve as the basement layer for culturing cardiac myocytes in a "Heart-on-a-chip" device using PDMS frames and a biodegradable mesh for added mechanical support. They also created a semi-permeable barrier that supports endothelial cells and mimics native vasculature. This device provides a physiological microenvironment conducive to long-term culturing of heart cells.

Value Proposition

- "Heart-on-a-chip" mimics natural tissue microenvironment
- Allows for cell-to-cell signaling across cell types
- Offers new insight into deficits caused by genetic mutations
- Platform to validate effectiveness of potential new therapies

Keywords:

Cardiomyocytes, heart-on-a-chip, iPS, cardiovascular, epithelial cells, heart failure

Applications

- Platform for drug development and modeling of cardiovascular diseases

Stage of Development

- Validated using cardiac myocytes derived from pluripotent stem cells
- Available for exclusive and non-exclusive licenses

Intellectual Property

Status:

Patent Filing in Process

Key Publication:

"Microfluidic heart on a chip for higher throughput pharmacological studies." Agarwal et al., 2013. Lab Chip. 13(18):3599-608. doi: 10.1039/c3lc50350j.

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