Cardiomyocyte Maturation Platform

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OTHER INFORMATION

KEYWORDS

Cardiomyocytes, Maturation, Caridiac ECM, Endothelial cells, Vasculature, Maturation platform

CATEGORIZED AS

- **Medical**
  - Disease: Cardiovascular and Circulatory System
  - Other
  - Stem Cell
  - Therapeutics
- **Research Tools**
  - Other

RELATED CASES

BRIEF DESCRIPTION

Human induced pluripotent stem cells (iPSCs) can be differentiated into cardiomyocytes (CMs) and can used for the study of heart disease related therapies. The current issue is that iPSCs have an immature phenotype and need to be matured from a fetal to an adult state. This technology provides a platform that would mimic the natural 3D environment necessary to mature these cells, providing a relevant extracellular matrix (ECM) and appropriate physiological cues.

FULL DESCRIPTION

Human CMs differentiated from human IPSCs hold great promise as they can be used for varying downstream applications, ranging from the study of cardiovascular diseases to potential therapies and treatments. However, CMs derived from IPSCs are immature and exhibit improper biological and physiological characteristics such as spontaneous beating, absence of specific ion channels, and incorrect electrophysiology and calcium signaling. Current methods to mature these CMs are risky to implement (hormone-based or genetic manipulation), necessitate the use of specialized equipment (mechanical stretching and pacing of cells), or may take a long time. This UCI technology uses a biologically relevant ECM scaffold in combination with other non-CM cell types in order to recapitulate a more native environment to induce CM maturation.

The in vitro platform utilizes decellularized cardiac ECM derived from adult bovine tissue in conjunction with non-CM cell types such as endothelial and stromal cells to mimic the CM maturing environment. The technology utilizes a bovine scaffold having an increased density of collagen, which helps to create a stiffer matrix. The appropriate matrix having a suitable stiffness has been shown to directly influence CM growth and maturation. This platform also supports the development of in vitro blood vessels, which also aid the maturation of CM. The introduction of endothelial and stromal cells creates the walls of the vessels and supports vessel formation and maintenance respectively. Moreover, these cells also provide key signals to CMs via physical contact and soluble factors. Together, the ECM and non-CM cells work to provide a biologically relevant and complex platform for maturation of iPSC derived CMs.

SUGGESTED USES

· Differentiate cardiomyocytes on the 3D scaffold

· Utilize scaffold as coating substrate for other biological applications

· Inject as a therapeutic material into the heart to treat myocardial infarctions

· Use as a cardiac platform for drug screening applications

· Induce cardiac regeneration via tissue engineering applications

ADVANTAGES

· Safe: biocompatible scaffold and does not require genetic manipulation of iPSCs

· User-friendly: does not require specialized equipment

· Time efficient: does not require long-term culturing

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,837,001	11/17/2020	2015-514

STATE OF DEVELOPMENT

In progress

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