3D Microtissue Models to Study Human Infarction

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3D Microtissues mimic infarction injuries in order to produce a small scale model of cardiovascular disease

Market Overview

These cardiac microtissues mimic the presentation of infarct injuries in individuals with cardiovascular disease, such as heart attack or stroke, allowing for a model to study pathogenesis and drug development for injuries caused by cardiovascular disease. Cardiovascular disease is the leading global cause of death, accounting for more than 17.6 million deaths in 2016. While incidences of cardiovascular disease are on the rise globally, human organoid systems have largely focused on modeling genetic disease, rather than tissue-level pathology, such as heart attack or stroke. This speaks to a need for a human infarction model for drug development and disease progression research. Where previous models relied on 2D multicellular systems, or drug-induced oxygen depletion, this method utilizes upstream stimuli to create and control the formation of the tissue injury. Clemson University researchers have developed a method for producing organoids that accurately mimic cardiovascular disease injury at the 3D tissue level.

Technical Summary

This technology is an infarct model generated by oxygen deprivation of tissue microspheres. The 3D microtissues/ organoids are grown in a controlled low oxygen environment, with non-viable levels of oxygen creating the region of damaged cells representing the "infarct" and creating a gradient of oyxgen in the outer zones of the microsphere. This utilizes transport limitations of tissue engineering, as these spheres are not vascularized, and oxygen diffusion to the center of the sphere is limited by its size. This serves to recreate the 3D structure of infarcted tissue, which damages the cells in a similar physiological manner to an actual infarct. This method can be used to model pathogenesis of infarction injury by tracking changes in microtissue genetics, structure, and function over time, screen patient-specific tissue-level response to infarction injury, such as Type I diabetes, drug screening for infarction injury response, as well as re-oxygenation/reperfusion injury.

Application

Medical; tissues engineering

Development Stage

In vitro data

Advantages

- Mimics biological conditions to induce infarct injury, creating a near identical injury, creating a near identical injury to that seen in infarct tissue.
- This approach focuses on mimicking the oxygen gradient in infarcted tissues, ensuring more accurate models of injured human organs
- Patients' generated tissues can be screened for drug reaction, reducing the time needed to achieve a proper drug prescription

App Type	Country	Serial No.	Patent No.	CURF Ref. No	Inventors
Provisional	United States	62/696660	US20170369847A1	2018-033	Ying Mei Dylan Richards

About the Inventors

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Dr. Ying Mei earned Ph.D. in Material Chemistry from the Polytechnic Institute of New York University. From 2003 to 2005 he served as a guest researcher in the National Institute of Standards and Technology. After that he joined the Langer Lab at MIT as a post-doctoral researcher, studying technologies for stem cell research. He joined the Department of Bioengineering at Clemson University as a faculty member in 2012. His interests include smart biomaterials, cell reprogramming, and stem cells for tissue engineering.

For more information about this technology, please contact:

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