Functional 3D Microtissues Within a Microfluidic Perfusion Device

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OTHER INFORMATION

KEYWORDS

microfluidic, 3D, microtissue, hydrogel, platform, personalized medicine, drug testing, disease

CATEGORIZED AS

- **Biotechnology**
  - Health
- **Medical**
  - Disease: Substance Abuse
  - Research Tools
  - Screening
- **Nanotechnology**
  - Materials
  - NanoBio
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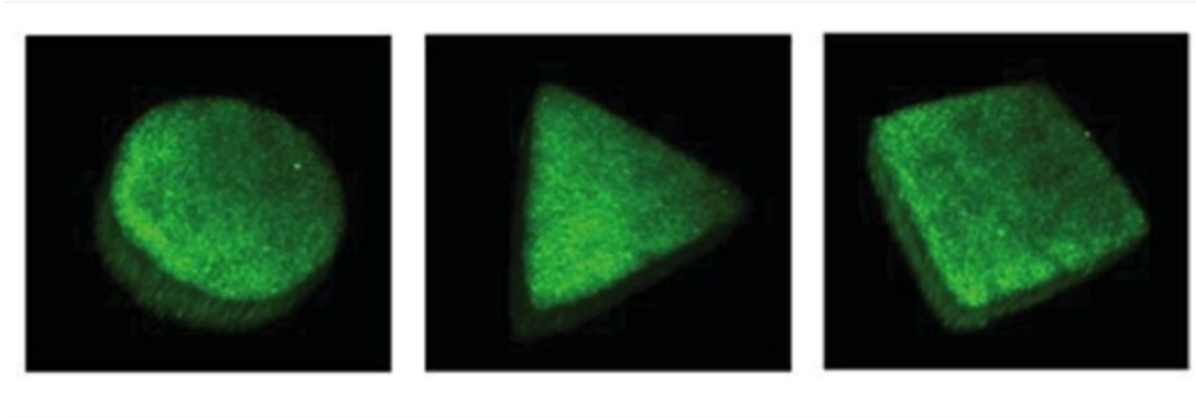
TECHNOLOGY DESCRIPTION

UCSD researchers have formulated a method to fabricate three dimensional microtissues within a microfluidic device. This platform can be customized and used to study the response of cells and/or tissues to physical, electrical, chemical and mechanical changes in the micro-environment. It is anticipated that patient specific drug testing systems could be modeled by using biopsied cells.

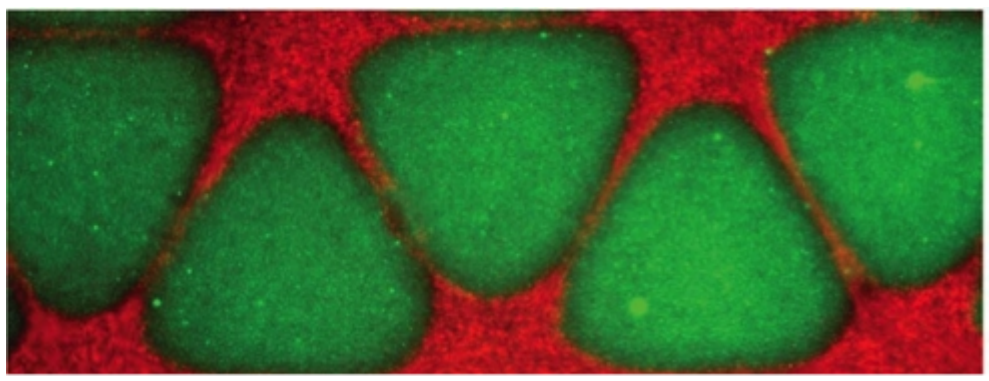
Photolithographic methods are used to to pattern hydrogels with varying geometries so the special distribution can be controlled. The microfluidic device component allows perfusion and interaction with the cells supported by the microtissues. With this approach several cell types can be included within one chip. The chip can be used as a bioreactor to study various cell and tissue activities over time. The investigators are using this method to simulate a variety of diverse and complex organs and systems and to model disease progression, organ-organ interactions and as a platform to investigate cell-matrix interactions, cell signaling and cell-cell interactions.

The microfluidic device comprises the floor and ceiling, sandwiching the spatially confined microtissues with specific geometries and cell types to simulate in vivo organ systems. The hydrogels used are tunable, providing the ability to create on-chip sensors responsive to multiple parameters (temperature, pH, etc.). The incorporation of dynamic flow provides the capability to assess aspects important in real physiological conditions such as shear stress and pulsatile flow as well as serve as a delivery system to determine the effect of natural or synthetic molecules on a particular tissue or cell type.

Images of 3D Microtissues



Close-up of Vascularized Tissue Array



STATE OF DEVELOPMENT

Working prototypes have been constructed for heart, skeletal muscle and liver and a tumor model. A provisional patent application has been filed.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Published Application	20180085750	03/29/2018	2015-211
Patent Cooperation Treaty	Published Application	2016164861	10/13/2016	2015-211

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