3D Bioprinting Epithelial Organoids

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ABSTRACT

Researchers at the University of California, Davis have developed a novel 3D printing approach to culture and construct epithelial tubular mini-tissues.

FULL DESCRIPTION

The gastrointestinal (GI) tract plays a key role in mediating the absorption or other bioactive compounds (e.g. drugs, gut flora metabolites) and shaping host immune responses. Dysfunction of GI is related to chronic inflammatory conditions, e.g. inflammatory bowel disease, Crohn's disease and ulcerative colitis, and cardiovascular disease and neurological disorders. While in vivo studies using animals such as gnotobiotic mice have been indispensable in observing associations between the gut and wider aspects of host health, in vitro models of the GI tract are highly coveted due to their relative simplicity and relative ease of use. Indeed, in vitro models of the gut epithelium have immense utility in facilitating molecular mechanistic studies that provide clinically useful insights into the manifold ways in which the GI tract regulates human health. For example, primary-derived intestinal epithelial tissues have been used to construct intestinal organoids that recapitulate physiological functions of the GI tract and model GI disease pathophysiology and studying drug responses. However, unlike the tubular structures of the GI tract, current models engineered from intestinal organoids exhibit a spherical structure with epithelial cells enclosed inside the organoids. Such enclosed spherical structure limits drug or nutrients access to the epithelial lumen and induces epithelial cell death in the inner part of the organoids, preventing continuous growth of organoids and creating a hurdle for drug screening.

In order to overcome these limitations, researchers at UC Davis have developed a novel 3D printing approach that can produce tubular epithelial organoids and mini-tissues of greater size (upto 7 cm) and geometric complexity than what was previously possible. The system can produce, for example, perusable, tubular mini-gut with epithelial organoids such as intestinal organoids The culture system can be produced via a 3D printing process.

APPLICATIONS

- Production of perusable, tubular mini-gut and mammary duct
- Modeling human diseases
- A screening tool to evaluate libraries of pharmacologic compounds, biomolecules, and/or cells

FEATURES/BENEFITS

- Tissues and organoids can be produced at larger sizes and/or with more complex geometries than previously possible
- Culture systems can be produced using 3D bioprinting

PATENT STATUS

Patent Pending

CONTACT

Byron N. Roberts
bnroberts@ucdavis.edu
tel: 530-754-8689.

INVENTORS

- Mea, Hing Jii
- Wan, Jiandi

OTHER INFORMATION

KEYWORDS

3D printing, 3D tissue culture, tissue regeneration, bioprinting, bioengineering

CATEGORIZED AS

- **Medical**
  - Devices
  - Disease: Digestive System
  - Other
  - Research Tools

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University of California, Davis
Technology Transfer Office
1850 Research Park Drive, Suite 100, ,
Davis,CA 95618

Tel: 530.754.8649
techtransfer@ucdavis.edu
https://research.ucdavis.edu/technology-transfer/
Fax: 530.754.7620