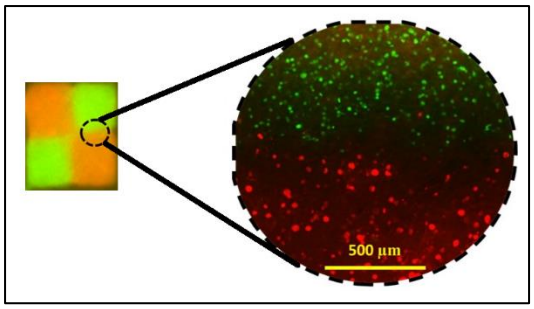
3D Bioprinting and Lamination Approach to Create Complex *In Vitro* Biological Models



A bioprinting on scaffold approach for creating 3D tissue models to recapitulate complex biological tissues with perfusable channels for performing in vitro assays.

Abstract

Bioprinting is becoming a powerful tool in tissue engineering for both whole tissue printing and development of *in vitro* models that can be used in drug discovery, toxicology, and *in vitro* bioreactors. Nevertheless, the ability to create complex 3D culture systems with different types of cells and extracellular matrix (ECM) integrated with perfusable channels has been a challenge.

A new layer-by-layer bioprinting and lamination approach has been developed that can recapitulate the complexities of natural tissues with proper 3D distribution of cells, ECM, and perfusion channels. This scaffold-based approach results in mechanically stable 3D structures with custom-patterned multicellular distributions and embedded perfusion channels that allow easy access to the cells throughout the structure without the need to fix or section the samples. This technique provides biologists with a unique tool to perform sophisticated *in vitro* assays.

Applications

- Fabricate complex 2D or 3D structures with patterned cells and channels for drug discovery and toxicology applications
- Evaluate cell migration, proliferation and signaling under a variety of conditions or in response to certain stimuli, e.g. different ECM types and/or presence of chemicals
- Create customized 3D bioreactor and artificial organ architectures

Advantages

- Method can accommodate a wide variety of cell, ECM and scaffold types with the ability to easily pattern multi-material combinations in a single construct
- Scaffold-based approach allows fabrication of “thin” or assembly of “thicker” complex 3D structures with high mechanical stability
- Closer complexity to that of biological tissues allows more accurate responses as *in vitro* models of cellular interactions

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Stage of Research

Proof of principle has been performed

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