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Bioprinting Platform for the Fabrication of Assembloids

Stanford researchers developed a novel bioprinting platform for fabricating human assembloids with spatial control of organoid fusion.

Researchers use model systems to study important spatiotemporally controlled cellular interactions which occur throughout human development and are otherwise inaccessible. While current in vivo systems have provided insights into numerous diseases, translating these findings into the clinic has underdelivered due to key developmental differences between conventional in vivo model systems and humans. On the other hand, in vitro model systems remain limited and do not recapitulate human development and disease satisfactorily. In an effort to better recreate aspects of development and disease in a dish, organoids, three-dimensional clusters of organ-specific cells with organ-appropriate physiologies, have recently been fused together to form assembloids. Assembloids have been shown to better emulate various tissues, including the brain, gastrointestinal tract, liver, pancreas, and retina. Unfortunately, although assembloids allow temporal control of organoid interactions, spatial control of their fusion is currently challenging, which limits their utility as a high throughput in vitro model.

Stanford inventors, therefore, developed a novel bioprinting platform for fabricating human assembloids with spatial control of organoid fusion. The platform consists of an iron-oxide particle-laden hydrogel and electromagnetic 3D printer to mediate the fusion of human stem cell-derived organoids or spheroids derived from any cell type or source.

Stage of Development
Proof of concept

Applications

- Creating assembloid-based in vitro models to study normal tissue function and development
- Creating assembloids-based in vitro models for various diseases including cirrhosis of the liver and neurodevelopmental disorders

Advantages

- The method allows the user to control the positioning of multiple spheroids or organoids in three dimensions with high spatial fidelity
- The constitutive spheroid or organoid building blocks are not damaged or deformed throughout the printing process
- The process itself can be automated and is highly reproducibility
- The method, and associated device / materials, can be seamlessly replicated across any number of experiments, printers, or laboratories.

Patents

- Published Application: 20230357685

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