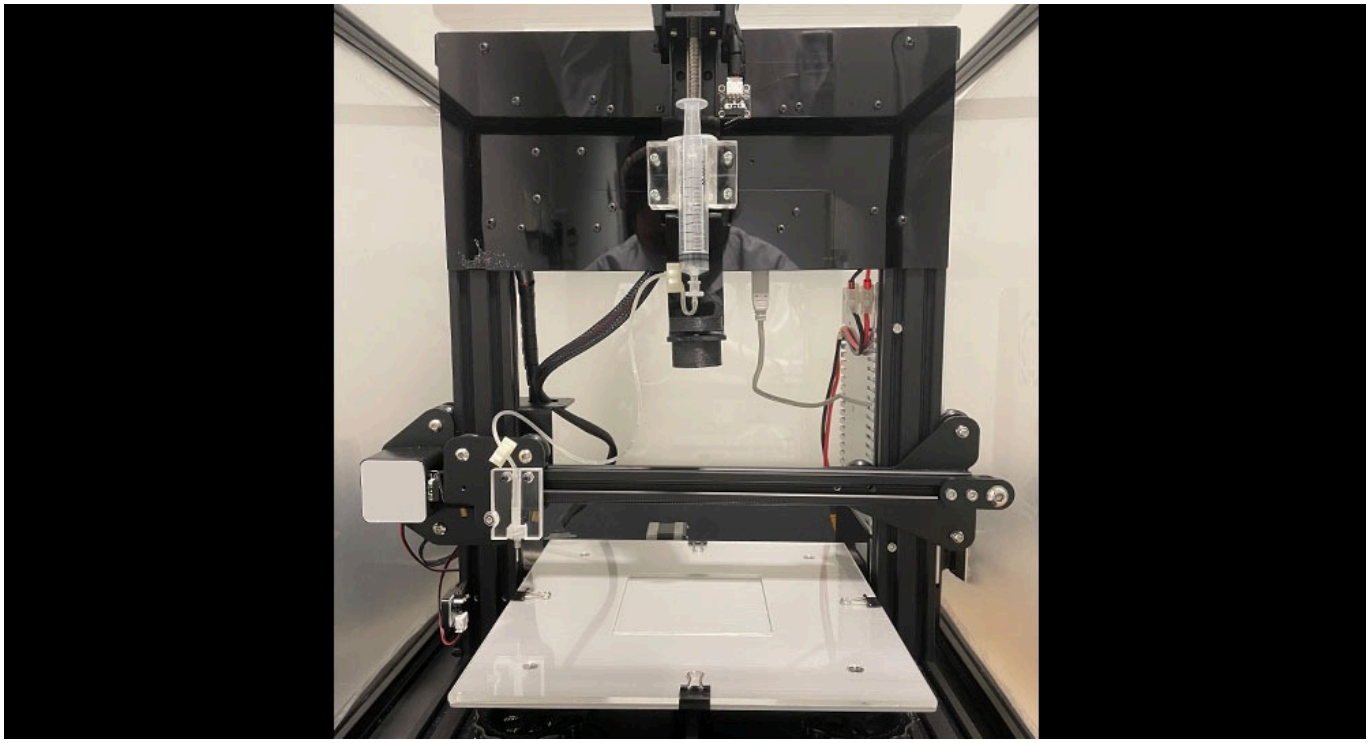
TECH OFFER

Automated, Scalable Generation Of 3D Cell Cultures By Novel Bioprinter



KEY INFORMATION

TECHNOLOGY CATEGORY:
Healthcare - Pharmaceuticals & Therapeutics
Life Sciences - Biotech Research Reagents & Tools

TECHNOLOGY READINESS LEVEL (TRL): TRL4
COUNTRY: SINGAPORE
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OVERVIEW

Conventional methods of 2D cell culture have limitations. They do not completely mimic the 3D tissues and organs of the human body. 3D bioprinting offers a way to generate 3D cultures in forms of spheroids (from cancer cells) and embryoid bodies (from stem cells). 3D cell culture is able to better mimic the *in vivo* conditions of human tissues and organs. Spheroids behave similar to tumors and make good cancer models for studying oncology and testing drugs. Embryoid bodies from stem cells mimic the development of embryos and can be used to study the effects of drugs on the three germ layers of the body – ectoderm, endoderm and mesoderm. The hanging-drop method, a manual generation of such 3D cell structures, is labor-intensive and not amenable to up-scaling in biotech industry.

This technology overcomes the forementioned limitations by offering an automated, cost-effective, novel bioprinter that can rapidly generate 3D cultures of various cell types with multiple applications in drug discovery, cosmetic testing, tumor studies etc. Unlike existing technologies that generate structural parts, this bioprinter can produce functional components like organoids and embryoids, which can be further developed into functional tissues. This feature offers means to create artificial yet

biologically-relevant functional tissues.

This bioprinter is developed in-house and extensively tested out over three years. Target users are cell culture researchers and companies engaging in clinical trials of novel drugs and vaccines. Partners are sought for technology development and commercialization collaborations, including 3D bioprinting solution providers, robotics industry, clinical trial companies etc.

TECHNOLOGY FEATURES & SPECIFICATIONS

Key Features:

- Rectangular printing arm and stage provides high stability and accuracy in X, Y and Z motion (95% each) during the printing process
- Nozzle print head controlled in two ways; software and nozzle size controls that regulate droplet size and reduce variability between droplets. Both features in conjunction give user greater control over the size, volume and eventually the numbers of cells per droplet.
- Compact and lightweight to be ported between biosafety cabinets, which does not require the dismantling of the whole system.
- Temperature control stage at 37°C which is optimal for cell printing.
- A stand-alone, removable UV unit and glass cabinet provides aseptic working conditions.
- Bioprinting software with graphical user interface makes system easy to operate, which can even be executed by amateurs in the field.

Key Biological Innovations:

- In-built agitator system helps to maintain the cells in a uniform suspension. This helps to resolve the issues of cell clogging in the nozzle that is usually seen in other commercial bioprinters
- Compatible with various cell types (e.g. human and mouse stem cells, transformed cells etc.).
- Ability to produce uniform-sized 3D embryoid bodies and spheroids containing accurate cell numbers - ideal for embryotoxicity testing of drugs, cosmetics and nutraceuticals.
- Easily customizable for various applications and cell types. The end-user is not required to do troubleshooting or additional validations on the system, unlike the existing bioprinters in the market.

POTENTIAL APPLICATIONS

- This bioprinter produces highly uniform 3D structures containing accurate number of cells. The process is repeatable and suited for up-scaling in biotech industry.
- It has been extensively tested for the creation of functional tissues like cardiomyocytes, using stem cells. This can be used in cardiac disease modeling.
- There is potential for large scale continuous or semi-continuous production with a production rate of 50 3D structures called spheroids of embryoid bodies per minute (3,000 per hour).
- All surfaces and materials that are in contact with cells are sterilizable (aseptic conditions). Bioprinter is portable and can be housed within a biosafety cabinet, class II inside a cell culture lab facility.

BENEFITS

- Cost-effective and simple method to do bioprinting.

- System is easy to operate and requires little training.
- Target end-users are cell culture laboratories, pharmaceutical companies, health industry and cosmetic industry where cell cultures are used extensively for research and testing purposes.
- It is an automated method for high-throughput screening of drugs, chemicals and cosmetics on cell cultures in lieu of expensive animal testing.