Questions

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Why is 3D culture in hydrogel better for cell biology research than conventional 2D culture?

A hydrogel matrix presents a more realistic microenvironment to cells than a plastic surface. Cells behave differently in a 3D matrix. Studies have shown that 3D cell models better represent human tissues[1] and more accurately replicate biological processes and drug responses[2].

1. Picollet-D'hahan (2016) Trends Biotechnol. 34, 757; Yamada (2007) Cell 130, 601; Knight (2015) J. Anat. 746;
2. Breslin (2013) Drug Discov. Today 18, 240; Mogilner (2011) Trends Biotechnol. 21, 692

How is RASTRUM™ different to other bioprinters?

RASTRUM is not a typical bioprinter. It is a platform designed from the ground-up for the simple creation of 3D cell culture models. To enable this, there are two major aspects unique to RASTRUM.

Firstly, RASTRUM is based on proprietary Digital Bioprinting technology. This includes hardware, software and printable biomaterials that together enable a robust drop-on-demand bioprinting approach, as opposed to the common extrusion-based bioprinter (see What are the key differences between drop-on-demand and extrusion bioprinting? What are the advantages of drop-on-demand printing for a cell biologist?).

Secondly, RASTRUM is designed for a cell biologist, not a tissue engineer. Many bioprinters require a user to design 3D structures, tweak printing parameters, and optimise printing protocols depending on the hydrogel and desired outcome. This is great if the core focus of your research is bioprinting, but not so great if all you are after is better 3D cell models. RASTRUM delivers a platform where hydrogels, printable structures and printing parameters are pre-validated, enabling a simple and efficient workflow for the creation of 3D cell models, with no prior bioprinting knowledge required.

What is the printing resolution?

The smallest droplet volume is 15 nL and the typical droplet volume ranges from 20-25 nL. The size of the printed gel structure depends on the specific properties of the bioink. The most common structure yields a basic structural building block of approximately 250 µm in diameter and 50 µm in height.

What are the key differences between drop-on-demand and extrusion bioprinting? What are the advantages of drop-on-demand printing for a cell biologist?

RASTRUM's Digital Bioprinting technology is a drop-on-demand bioprinting approach. This is akin to inkjet printing, but instead of depositing pixels of colour onto a page, RASTRUM deposits hydrogel components and cell suspensions onto the surface of a well plate and builds these components layer-by-layer to form a 3D structure.

Extrusion bioprinting is akin to squeezing toothpaste out of a tube, where pre-formed hydrogel with or without cells is forced out of a needle that is in contact with the surface under the application of pressure.

One of the advantages of drop-on-demand printing is higher cell viability, as the pressure required to eject a droplet from the RASTRUM print head is lower than that required to extrude pre-formed hydrogel from a needle, thus lowering shear stresses on cells.

Extrusion bioprinting requires contact of a needle with the surface of the well plate, whereas the RASTRUM print head moves seamlessly across a well plate and builds 3D cell models using fly-by droplet deposition, enabling a step-change in printing speed and throughput.

Additionally, with RASTRUM it is possible to print multiple cell and matrix components in a single pass of the printhead. This multiplexing capability makes it easier and more efficient to build complex 3D cell models.

What is the maximum printing frequency?

The printer is capable of depositing 1,000 droplets per second onto the surface.

Does the printer feature inbuilt temperature regulation?

No. Our hydrogels form at room temperature, and cells are within the system for a short amount of time (<30 mins), so temperature control is not required.

Can RASTRUM™ print large cells?

RASTRUM has successfully printed large cells such as hepatocytes and cardiomyocytes. For cells that do not easily dissociate into single cells (e.g. cells from patient-derived tissues), we recommend filtering suspensions through a 40 µm cell strainer prior to use. For further information about specific cell types, please contact Sales & Support.