Dirk Jan Cornelissen et al., J Genet Mol Biol 2019, Volume 3

NOVELTIES IN ADDITIVE MANUFACTURING AND BIO-PRINTING

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It can take 10 to 20 years to fully develop new drugs, with an estimated average of 9 to 12 years. On top of that, only 16% of the drugs that begin pre-clinical testing end up to be approved for use in humans, but even than it can be taken of the market again due to unforeseen toxicity. Some of this low success rate can be attributed to the different responses that animals and humans have to the drugs being tested; some drugs have to be withdrawn from market due to toxic effects on human organs such as liver and heart, despite being tested safely on animals. HepaRG cells are a unique human hepatoma cell line, capable of expressing both phase 1 and 2 drug metabolizing enzymes. They are regarded as a promising alternative for primary human hepatocytes when it comes to drug and toxicity testing, but they have the advantage of being a cell line that can be cultured indefinitely. It has been shown that cells in 3D behave differently to cells cultured in a 2D environment. This seems to be especially true for drug testing, where 3D structures of hepatic cells can show hepatoxic effects that cannot be shown with any other pre-clinical test.

In this work, we developed a one-step method for the fabrication of encapsulated HepaRG organoids for drug and toxicity testing. Encapsulated organoids are easier to handle and upscale compared to non-encapsulated aggregates, and the combination of the cell type and the 3D culturing method will create clinically relevant test subjects with more ease of access than traditional primary cultures. We have shown that in our method, HepaRG cells will readily aggregate and rearrange into organoids within our capsules. These organoids show an increase in enzymatic break-down activity when introduced to certain drugs.

BIOGRAPHY

Dirk Jan Cornelissen is currently finishing his PhD at the University of Strathclyde at the department of Biomedical Engineering under supervision of Prof Will Shu. His research involves developing an encapsulation method for cells and organoids, to be used for transplantation and drug testing purposes. He focused on encapsulating pancreatic islets for transplantation in patients with diabetes type I. Previously, Dirk-Jan studied Biomedical Engineering at the University of Twente.

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