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CASE STUDY: The use of PeptiGels® in the Development of Gastro-intestinal (GI) Organoids

The Challenge

One major challenge in advancing preclinical studies is the lack of robust and scalable in vitro culture systems that fully recapitulate what happens in vivo. Organoids are 3-dimensional (3D) self-replicating miniatures of in vivo tissues and organs and are powerful models for ex vivo experimentation in the fields of tissue engineering, drug testing and disease modelling. Organoid formation requires the use of an extracellular matrix (ECM), usually Matrigel™, which comes from a tumorigenic source, and consequently this limits the translational and scalability of the adoption of organoids.

The Solution

The use of synthetic ECM, such as PeptiGel®, for 3D organoid growth will allow reproducible and scalable results. It also opens up the potential of fine-tuning ECM mechanical and chemical functionality in a modular fashion to optimize ECM environment for the formation of a wide range of different organoids.

The Science

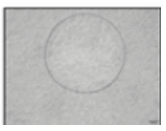
Liver crypts or single cells were isolated from healthy porcine liver tissue and propagated and maintained in liver organoid growth media on five different PeptiGels® Alpha 1-5 (Starter Pack). This allowed the optimal environment to grow gastro-intestinal (GI) organoids to be identified as an ex vivo model for in vivo systems. The morphology of the resulting organoids were monitored using optical microscopy and compared to Matrigel™ as a control.

In association with 3DBioNet, Northwick Park Institute for Medical Research and the University of Liverpool. Supervised by Prof. Christopher Goldring.

3D organoid growth in a fully synthetic and reproducible ECM like PeptiGels® offers enormous growth potential for pre-clinical studies.

Dr Dammy Olayanju
Senior Research Scientist, Northwick Park Institute for Medical Research

The Results

	Day 6	Day 13	Day 27
Alpha 2			
Matrigel			

Hepatic cells were maintained as single cells over the first 2 days in all PeptiGels®. They then began to cluster and display 3D organoid features by day 6. By day 12, all PeptiGels® supported the growth of fully formed organoids within the culture, exactly like those grown on Matrigel™. Interestingly, PeptiGel® Alpha2 supported the quickest growth of fully formed organoids, which was notably quicker than Matrigel™ (see time-course images taken at x 10 magnification using an inverted optical microscope). Alpha 2 also provided the most stable environment for prolonged study, lasting at least the one-month in culture explored here.

The Future

The PeptiGel® technology platform provides a reproducible and disease free ECM for the growth of 3D organoids, which in turn provide more reliable and physiologically relevant preclinical models for pharmacological and toxicology studies and personalized medicine.