>> A novel non-invasive workflow for differentiation and characterization of iPSC-derived hepatic organoids

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Nathalie Opdam – van de Laar[1,✉], Inge Thijssen – van Loosdregt[1], Denise Sullivan[2]
[1]Axion BioSystems, Eindhoven, the Netherlands; [2]Axion BioSystems, GA, USA ✉ Email: nathalie.opdam@axionbio.com

Omni: Kinetic cell tracking

Automated whole-vessel imaging

In vitro models are essential for studying diseases and development. While traditional 2D cell culture models have provided valuable insights, they often fail to replicate *in vivo* complexity. This has led to increased interest in 3D models such as spheroids and organoids, which better mimic in vivo conditions.

Live-cell provides a powerful technique for studying these 3D models, enabling real-time visualization and analysis at defined time intervals.

The Omni product family

>> Assay your cells in brightfield and fluorescence

>> Track every moment, straight from your incubator

>> See every cell by movement of the camera

>> Monitor and analyze your cells remotely

>> Get started quickly

AI-Driven imaging software for powerful, yet simple analysis

The Omni platform software modules simplify assay setup, offer real-time cellular visualization, and enable fast analysis.

- Cell Confluence
- Clonogenic Assay
- Scratch Assay
- Organoid Analysis
- Fluorescence Analysis
- iPSC Monitoring

Real-time Monitoring of iPSCs

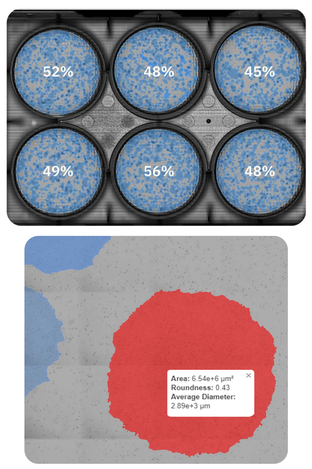
Background

The liver plays vital roles in detoxification, protein synthesis, metabolism, and hormone regulation. While it regenerates efficiently in vivo, expanding hepatocytes in vitro is difficult. Induced pluripotent stem cells (iPSCs) provide a versatile source for generating hepatic cells and organoids that mimic liver structure and function. This study presents a novel non-invasive workflow for monitoring iPSC-derived hepatic organoid development using the Omni.

iPSC Module tracks iPSC growth

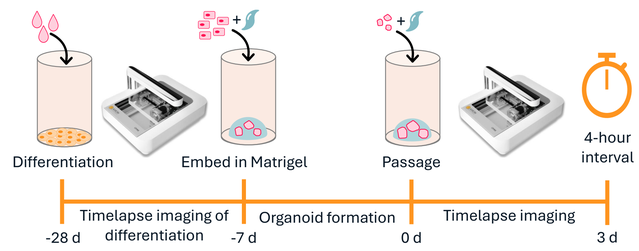
The Omni is a live-cell analysis platform is capable of continuous multi-well imaging directly from the incubator.

Example whole-well brightfield images of iPSC colonies acquired by the Omni in a 6-well plate with the confluency map overlay and a close up of a single colony with the metrics provided by the iPSC Module including area, diameter, and roundness.



Methods

iPSCs were differentiated into hepatic progenitor cells (HPCs) and hepatocyte-like cells (HLCs) and subsequently formed into organoids. Organoid area, diameter, and roundness were determined every 4 h for 3 days.



iPSC-derived organoid workflow

iPSC differentiation

Distinct morphological changes occurred during differentiation: iPSCs were compact, definitive endoderm cells smaller, HPCs larger with a cobblestone appearance, and HLCs the largest with a similar arrangement.

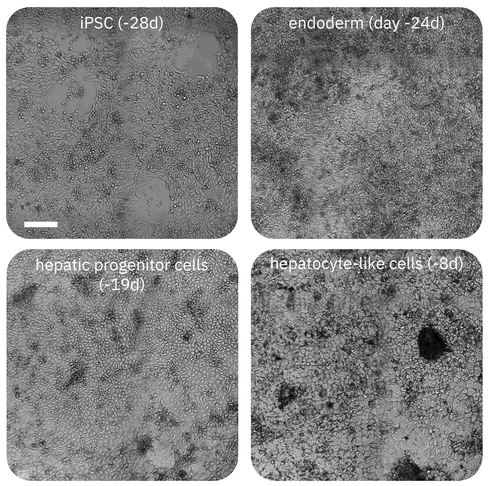


Figure 1: Morphological changes during differentiation of iPSC towards hepatocyte-like cells. Scalebar is 200 µm and accounts for all images.

Hepatic organoid formation

HPC- and HLC-derived organoids were spherical with lumens and had similar roundness (0.85). Initially smaller, HPC-derived organoids grew 3.6-fold over 72 hours, compared to 3.0-fold for HLC-derived organoids, reflecting differences that may be related to cell maturity.

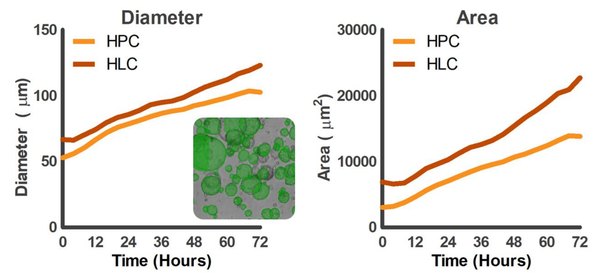


Figure 2: Change in organoid diameter and area over time for the hepatic progenitor cell derived organoids (HPC) and the hepatocyte-like cell derived organoids (HLC), including an example of organoid detection (green overlay) at 72h by the Omni.

Conclusion

This workflow demonstrates the power of live-cell imaging for real-time monitoring of iPSC differentiation and hepatic organoid formation, enhancing liver research and applications in disease modelling and therapy.