NANObiose
Smart Tools for Cell Biology

Impact Of SecretCells® Microfluidic Lab-On-a-Chip Platform on Cell Viability.

Objectives

SecretCells® platform allows to better mimic the *in vivo* environment of cells by providing a 2D or 3D dynamic cell culture with a controlled perfusion of nutrients and compounds to be tested, all with a removable biosensor for the capture and multiplexed analysis of secreted biomarkers.

This application note presents the assessment of the impact of continuous perfusion cell culture in SecretCells® lab-on-a-chip system on the viability of human macrophages.

Experiment Setup

- **Cells:** Human macrophages differentiated from the human monocytic cell line THP-1 using 10 ng/mL Phorbol 12-myristate 13-acetate (PMA, Sigma P8139) for 48 hours.

- **Culture Scaffolds:**
  - *Nitrocellulose membranes* (Millipore, GSWP04700). Cells directly seeded onto the membrane at 2 × 10^4 cells/cm^2 (30 000 cells/well).
  - *CultiSpher®-G macroporous gelatin-coated microcarrier beads* (M9418 - Sigma-Aldrich): 2.5 mg microcarrier beads with 50 000 cells per well.
  - *3D Biotek 3D Insert™ Polystyrene (PS) scaffold* for 96 well plates: One insert with 125 000 cells per well.

- **SecretCells® System:** assembled and used following the operating instructions implemented by Nanobiose. Cells were seeded under static conditions - as with a standard culture in plates and then constantly perfused at 5 µL/min with culture medium for 18 hours in a 37°C and 5% CO_2 environment.

- **Cell viability analysis:** determined at the end of the experiment using Resazurin assay, as described by Nanobiose. For more details, please see "*Cell viability Analysis by Resazurin Endpoint Assay*" protocol from Nanobiose.

Results

THP-1 derived macrophage cells remained healthy in flow conditions in SecretCells® system (Figure 1). The Resazurin endpoint assay results show that macrophage cells under continuous perfusion in SecretCells® microfluidic system have similar or greater cell viability after 18 hours compared to parallel cultures under static conditions in standard plate culture.

After 18 h perfusion in SecretCells®, the viability of THP-1 macrophage cells on a 2D nitrocellulose membranes was found to be over 90% of the microplate counterparts as measured by fluorescence signal of resorufin generated (Figure 2). In 3D configurations, there was nearly 100% of viable cells within porous polystyrene 3D scaffold and about 150% in macroporous gelatin microcarrier beads (CultiSpher®-G) of equivalent cultures

under static conditions (Figure 2). The same experiment was repeated for up to 72 hours and achieved similar results (*data not shown*).

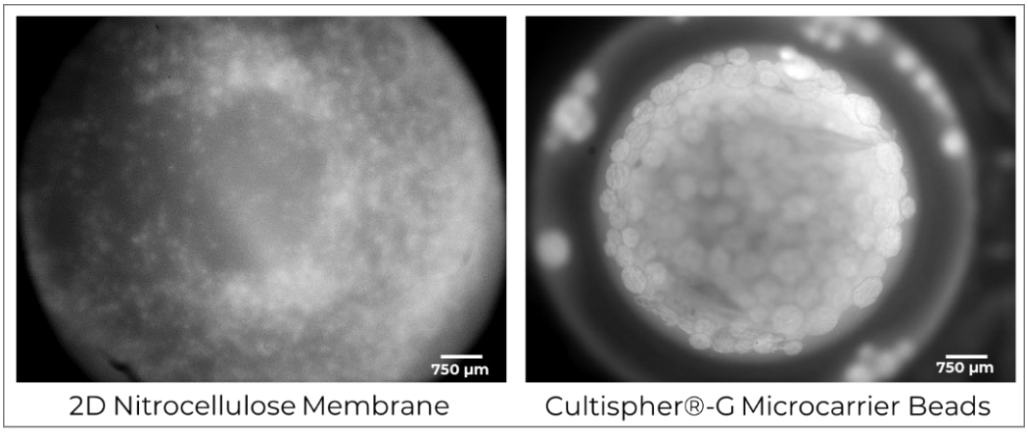

Figure 1: Fluorescence microscopy images of Resorufin-stained PMA-differentiated THP-1 macrophages in the SecretCells® microfluidic chip.

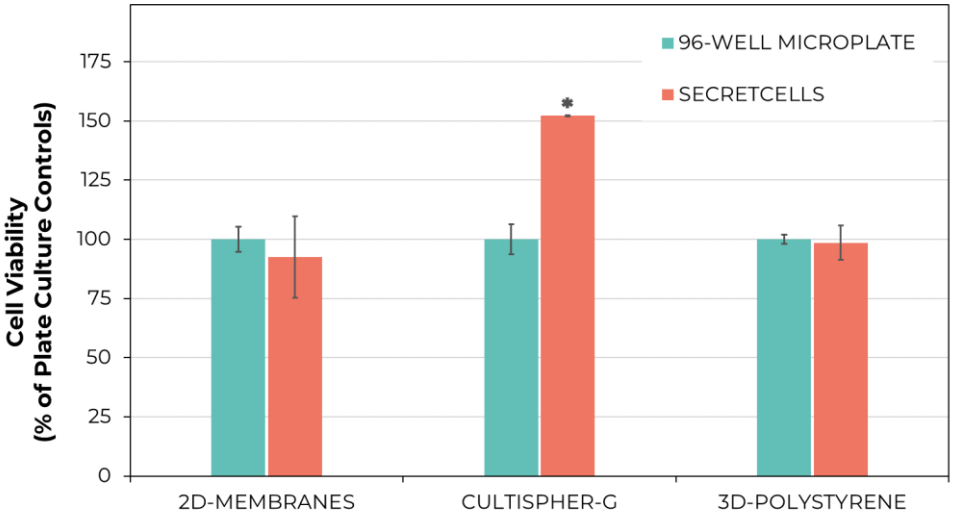

Figure 2: PMA-differentiated THP-1 macrophage cell viability after 18 hours under perfusion in SecretCells® microfluidic system compared to static culture in plate as determined by Resazurin Reduction Assay under Static Viability analysis. * $p<0.05$ (ANOVA & t-test)

Conclusion

Overall, our results show that continuous perfusion culture in SecretCells® did not affect the viability of the THP-1 derived macrophage cells since they exhibited substantially similar or higher viability to parallel cultures kept under static conditions in standard plate culture. SecretCells® hence provides a perfect device to achieve perfusion-based microenvironment control hands-free whilst offering in *vivo*-like conditions for optimized cell viability.

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