Project Title: Printed cell scaffolds for rapid, robust tox testing of new chemicals – beyond animal testing.

Supervisors at Bath: Professor Janet L. Scott (lead) and Dr Paul de Bank
Supervisor at Monash: Professor Bayden Wood

Home Institution: University of Bath

Indicative period at Host Institution: From February 2021 to January 2022

Project Summary

The introduction of new chemicals to the market must be preceded by a range of tests to ascertain whether or not these can cause deleterious effects on humans or other organisms. Regulations, such as REACH list a large number of endpoints that must be tested for and many of the requisite tests are (currently) animal based studies. These apply even for new compounds that may be greener or more sustainable replacements for current chemicals in wide use. This can be a barrier to entry to the market for replacement chemicals and this is even recognized by agencies such as the European Chemicals Agency, ECHA, which “encourages industry to use reliable non-animal approaches to adequately comply with the information obligations of the regulations”.

In this PhD project, we propose to combine the expertise at Bath in production of materials for tissue scaffolds and cell growth (Scott and De Bank, Bath) with the exquisite imaging and spectroscopic tools being developed at the Monash Centre for Biospectroscopy, MCB (Wood, Monash), to generate easy-to-use rapid testing devices for the effect of new and known chemicals on cells. While cytotoxicity tests relying on live/dead assays are relatively simple to implement, detection of more subtle changes in cells, such as those that might indicate teratogenicity, is far more challenging.

Thus, these printed cell scaffolds for rapid, robust tox testing would be achieved by: a) immobilizing cells onto discrete sensing points on 2D printed scaffolds (capability already demonstrated at Bath, Fig. 1); b) to combine these “cell islands” into printed microchannel devices that will allow variable dosing of chemicals to be tested; and c) to use the

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advanced spectroscopic techniques demonstrated at the MCB for disease detection to probe subtle changes to cell chemistry, indicating endpoints that usually rely on animal models.

The expertise of the two centres is entirely complementary, yet not overlapping making this a very balanced partnership and providing a PhD student with access to knowledge and skills that could not be gained at a single institution. The technology developed could also be applied to drug testing, but we focus on tox testing as this will be a limiting factor in the introduction of new, safer chemicals in well regulated markets.