Photo-switchable hydrogel in regulating the growth of organoids

Thi Thuy Duong Dinh,[1,2] Changzhuang Bai,[1,2] Isis A. Middleton,[2] Kristopher Kilian,[1] Pall Thordarson[1,2]**

[1]School of Chemistry and the Australian Centre for Nanomedicine, University of New South Wales, Sydney, NSW 2052, Australia
[2]UNSW RNA Institute and the School of Chemistry, University of New South Wales, Sydney, NSW 2025, Australia
thi_thuy_duong.dinh@unsw.edu.au; k.kilian@unsw.edu.au, p.thordarson@unsw.edu.au

In the field of tissue engineering and regenerative medicine, the development of advanced biomaterials plays a crucial role in creating functional and realistic models of human organs. Photo-switchable hydrogel is one promising biomaterial for organoid culture, which allows precise control of the gel's mechanical properties through light exposure. This ability to switch between different stiffness levels in the hydrogel is particularly important for recreating the complex microenvironment of human organs, as it can mimic the dynamic nature of tissue stiffness during development and disease progression. Additionally, stiffness-tuneable hydrogels are promising materials for controlling the formation and morphogenesis of organoids, allowing the prediction and influence of the course of their development.[1]

This research aims to facilitate control over morphogenesis in organoids by using reversible photo-switchable hydrogels. Using transmitted 405 nm light with varying laser powers, we can create precisely positioned patterns in 3D volumes with different softness. The cancer organoids embedded in hydrogel were used to prove the concept, revealing differential growth rates of cells in response to varying levels of softness (**Figure 1**). These results strongly suggest the correlation between controlling matrix stiffness and the prediction and control of the growth of the organoids. This is a very important stepping stone to exploring the mechanical signalling in cells responding to dynamic changes in stiffness.

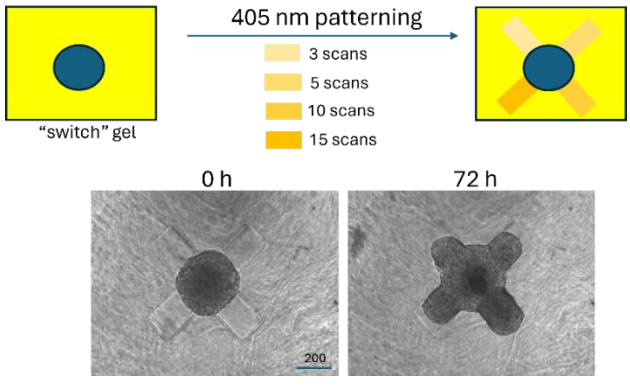

Figure 1. MCF-7 organoids embedded in "switch" hydrogel with photo-patterning.

References

1. Hofer, M., & Lutolf, M. P. (2021). Engineering organoids. *Nature Reviews Materials*, 6(5), 402-420.