3D Bioprinting of Personalized Brain Cancer Organoids with Hydrogel-Based Scaffolds

*Graber P [1,2], Jung M [1,2], Dolman E [1], Shkinas JN ,[1,2], Tsoli M, Candotti J [1], Venkat P [1], Mayoh C [1], Ziegler D [1], Kavallaris M [1,2] **

[1] Children's Cancer Institute, Lowy Cancer Research Centre; School of Clinical Medicine, Faculty of Medicine and Health, UNSW Sydney, Sydney, NSW, Australia
[2] Australian Centre for NanoMedicine, UNSW Sydney, Sydney, NSW, Australia

34 High Street, Kensington New South Wales 2052
Children's Cancer Institute
Sydney, NSW, Australia
pgraber@ccia.org.au, m.kavallaris@unsw.edu.au

Paediatric high-grade gliomas (pHGGs) are a heterogeneous group of tumours with a dismal outcome and are the leading cause of death in children with brain tumours.[1] The lack of suitable models to study glioma biology and test new drugs in a high-throughput manner is a significant obstacle to improving the treatment of these deadly tumours. Traditional brain tumour *in vitro* models, such as 2D or neurosphere models, fail to mimic the complex environment of a patient's tumour, while engraftment into mice is time-consuming and variable in success.[2] This challenge is particularly significant for highly aggressive tumours like pHGGs, which progress rapidly.

To address these challenges, we are developing innovative 3D-bioprinted multicellular high-throughput models with tumour-like properties. To identify the extracellular genes associated with pHGGs, we interrogated bioinformatics data obtained from patients with the disease. Using this information, we identified hydrogel conditions that resemble the patient's tumour extracellular environment. We evaluated the viability and growth characteristics of patient-derived glioma cells using our 3D bioprinting technique, and identified various hydrogel conditions at which high viability and proliferation was achieved. Our findings suggest that incorporating extracellular components, such as collagen, fibronectin, and hyaluronic acid, into the hydrogel supports the growth and cellular behaviour of these tumours. Therefore, our 3D-bioprinted models offer a promising platform for *in vitro* cultivation of challenging-to-grow brain tumour samples, allowing for studying these tumours within a complex environment and in a clinically relevant timeframe.

By integrating patient-derived tumour cells, our pHGG models have the potential to capture the heterogeneity and genomic diversity of tumours and more accurately reflect human tumour-like features. As a result, these preclinical models will be invaluable for the identification of personalised and effective treatments for HGG patients.

References:
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