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Tuneable Synthetic Peptide Hydrogels to provide Physiologically and Clinically relevant *in vitro* 3D cultures

3D cell culture is an increasingly reliable method to mimic the *in vivo* environment *in vitro* and offers a robust platform for several investigations ranging from disease processes, regenerative medicine to drug discovery and development. Several unmet clinical needs are partly due to the lack of suitable efficacious therapies and the development of resistance to currently used therapies. The development of new therapies involves a full mechanistic understanding of the disease's pathogenesis, thereby allowing better targeting of cell biological pathways involved in the disease's initiation and progression.

However, a major challenge in the mechanistic understanding of disease's pathogenesis is the lack of physiologically relevant *in vitro* models. Having more physiologically relevant 3D models of both healthy and diseased tissues will allow the better understanding of the key cellular processes and a more reliably screening of new drug entities.

Advancement in preclinical *in vitro* 3D models such as spheroids and organoids has made use of biomaterials to mimic the complex *in vivo* environment; however, some widely used biomaterials have limitations as they are animal derived and lack of tuneability to faithfully mimic the *in vivo* counterpart. Recent advances in the use of tuneable synthetic peptide hydrogels, such as PeptiGels®, have shown potential to overcome these limitations by better simulating tissue microenvironments for enhanced research, allowing the generation of more physiologically and clinically relevant data.

Here, we demonstrate the use of such systems for the growth of 3D organoids, tumour models, and their applications more broadly within regenerative medicine and drug discovery. PeptiGels® can be fine-tuned to recapitulate the tissue microenvironment and study disease-specific biology involved in disease activation and survival.