Maia Building, Babraham Research Campus,
Cambridge, CB22 3AT

t: +44 (0) 01223 967316
e: info@cellgs.com
w: www.cellgs.com

Self-assembling Peptide Hydrogel Recapitulates *in-vitro* Mechanisms of Breast Cancer Progression

The Challenge

Breast cancer caused 600k deaths worldwide in 2020, therefore the development of new treatments is essential. During anti-cancer drug development, the use of high-throughput two-dimensional (2D) culture systems lack diffusion gradients, leading to an overestimation of the efficacy of novel compounds. Animal derived Type 1 collagen can be used to encapsulate cells to create realistic three-dimensional (3D) culture environments to model breast cancer. However, Type 1 collagen hydrogels are prone to batch-to-batch variation, are chemically, undefined and lack the mechanical properties to sufficiently recapitulate cancerous breast tissue, thus are unsuitable for scale required for drug development.

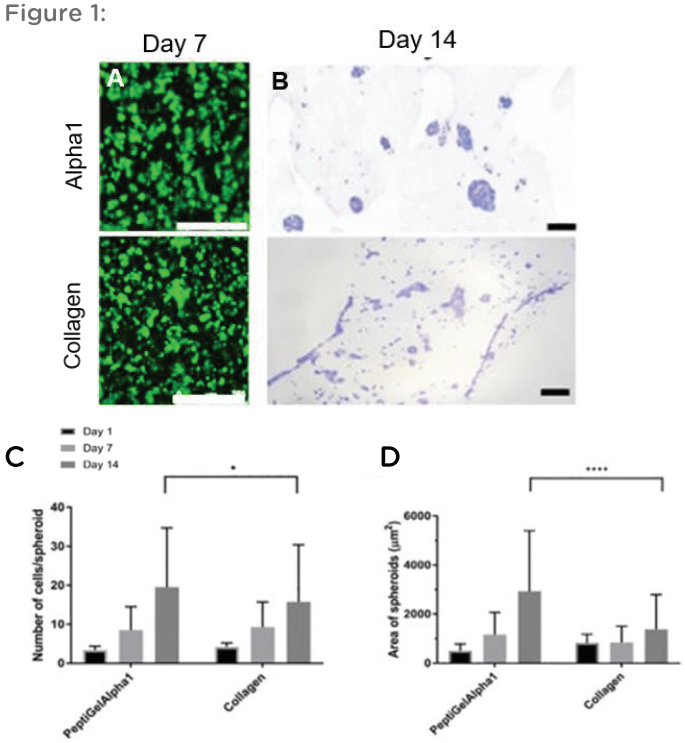
The Solution

Cell Guidance Systems fully synthetic peptide hydrogels, PeptiGels®, can be modulated to mimic a range of tissue types, healthy or diseased, to enable scaffold optimization to meet cells' needs. Composed of deined components, PeptiGel® Alpha 1 was used as a platform to more accurately mimic the 3D tumour microenvironment of breast cancer *in-vitro*, compared to Type 1 collagen and Matrigel™.

The Results

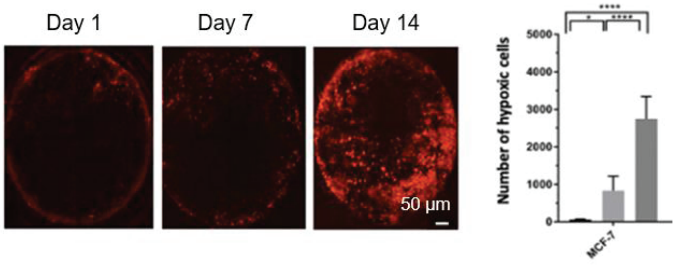
The breast cancer cell line MCF-7 was encapsulated in PeptiGel® Alpha 1 and compared to MCF-7 cells encapsulated in Type 1 collagen. Live/dead staining at day 7 confirmed both hydrogels supported a viable population of cells which had formed spheroid structures in both hydrogels (Figure 1A). Hematoxylin and eosin staining at day 14 highlights the formation of compact spheroids (Figure 1B). By day 14, the spheroids in PeptiGel® Alpha 1 were significantly larger and contained more cells per spheroid than the MCF-7 spheroids in Type 1 collagen (Figure 1 C&D). This confirms the suitability of PeptiGel® Alpha 1 compared to Type 1 collagen.

Figure 1:



An indication of cancer is rapid cell growth beyond the oxygen diffusion limit leading to formation of hypoxic regions within the tumour. In PeptiGel® Alpha 1, the rapidly proliferating MCF-7 cells led to a significant increase in hypoxic MCF-7 cells, successfully mimicking a main indication of the tumour microenvironment (Figure 2).

Figure 2:



The Future

This study has successfully demonstrated the potential of PeptiGel® Alpha 1 as a scaffold for creating physiologically relevant 3D models of the breast cancer tumour microenvironment *in-vitro*. The platform could be applied to *in-vitro* drug assays for the development of novel therapeutics.

H.C. Clough et al.
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