Development of 3D printed pathophysiological in vitro device to study microenvironment effect on glioblastoma progression

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BACKGROUND

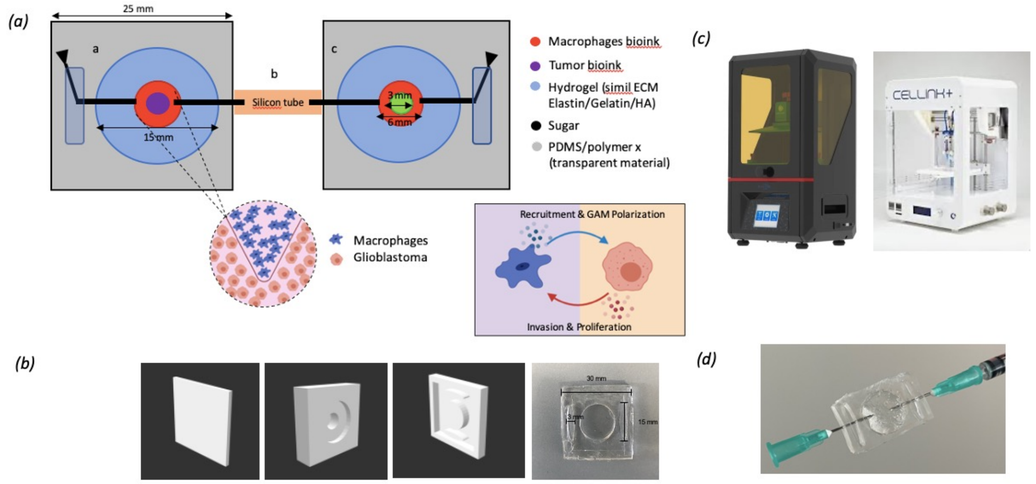
Glioblastoma multiforme is the most frequent malignant neoplasm which presents a survival of around 12-15 months with a recurrence rate of 80%.
One of the biggest limitation in Regenerative Medicine is the lack of vascularization. Due to oxygen and nutrient diffusion limits thicker tissues are often not properly vascularized, leading to the formation of hypoxic and necrotic areas which increase the metastatic predisposition of certain cell types.

OUR GOAL

Development of a technology that able to mimic the pathophysiological process that can be used to study the recurrence of this tumor after resection.

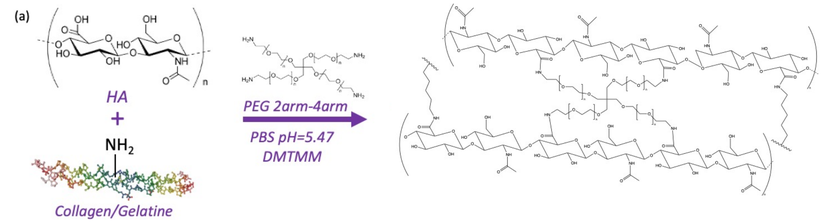
STRATEGY

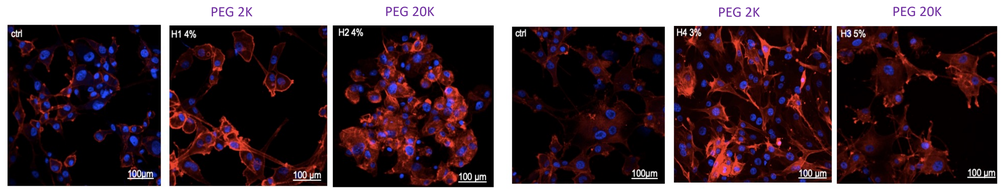
The device includes two main chambers connected with silicon tubes in which different cell lines will be grown in order to reproduce what happens *in vivo.* In the first one will be grown glioblastoma cells in combination with macrophages while in the other healthy cells.



EXPERIMENTAL PROCESS

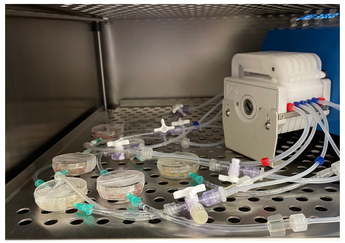
We have compared and highlight the main characteristics in terms of composition, morphological characterization, printability and biocompatibility of a hydrogels library based on hyaluronic acid (HA) and gelatin or collagen functionalized with with 2arms and 4arms PEG linkers of different lengths (2,10 and 20K). In this way we can obtain a very versatile bioink, that can be adapted to specific needs.
Once the hydrogel consistency has been fully optimized, we embedded U87 cell line in order to obtain a tumor organoid and we analyzed proliferation and invasiveness capacities under static conditions.





PRELIMINARY RESULTS AND FUTURE OUTLOOK

Since we have obtained a good proliferation rate with U87 cell line inside the hydrogel, we decided to move to dynamic conditions, using a peristaltic pump and applying a capillary flow rate around 300 µL/min with a 1mm ID tube, in a circular path.
In future we want to optimize the device, going from a closed system to an open one that allows us to change the medium removing the waste. In addition we want to test the ECM mimetic for its immunity response.



CONTACT DETAILS & ACKNOWLEDGEMENT

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