Dynamic culture system to asses the efficacy of a cell trap targeting cancer cells infiltrated in the brain

Record number : OPR-300

Overview

RESEARCH DIRECTION

Marc-Antoine Lauzon, Professeur - Department of Chemical and Biotechnological Engineering

INFORMATION

marc-antoine.lauzon@usherbrooke.ca

RESEARCH CO-DIRECTION

Nathalie Faucheux, Vice-doyenne - FGEN Administration

INFORMATION

nathalie.faucheux@usherbrooke.ca

ADMINISTRATIVE UNIT(S)

Faculté de génie
Département de génie chimique et de génie biotechnologique

LEVEL(S)

2e cycle
3e cycle

LOCATION(S)

Campus principal

Project Description

THE PROJECT:
Glioblastoma multiforme (GBM) is the most aggressive form of brain cancer with a survival rate of less than 5% beyond 5 years [1]. GBM cells can leave the tumor and infiltrate into the surrounding brain tissue, which is the main cause of treatment failure [2]. Alas, unlike bulk tumor, those infiltrated cells cannot be removed surgically and are protected from chemotherapeutic drugs by the blood brain barrier. Radiation treatments are also limited because of the low tolerance of healthy brain cells to radiation [3, 4]. To overcome the limitations of current treatments, we propose to reverse the direction of GBM cell migration towards an
implanted device in a confined area in which they can be eliminated with localized radiotherapy using a chemoattractant gradient [2, 5, 6]. This device combines a porous hydrogel with embedded nanoparticles (NPs) loaded with chemoattracting molecules, designed to promote a controlled release and create a cancer cell attracting gradient. However, in order to optimize the trap, there is a need to better understand the behavior of glioblastoma cells in contact with the components of the proposed technology. It is also essential to develop a model that takes into account the brain fluid flow, which can influence significantly the release and concentration profile of the chemoattractant [7, 8], and so the capacity of the trap to retain tumor cells.

OBJECTIVE:
The main objective of this interdisciplinary project (biomedical engineering, material sciences and applied mathematics) consists in: i) better understanding the behavior of glioblastoma cells in contact with the chemoattractant molecule and ii) modeling the convective contribution of in vitro simulated brain fluid flow on the release of this molecule from the trap using a perfusion bioreactor system.

PROFILE OF THE CANDIDATE:
1. Holding a bachelor degree (Master position) or Master's degree (PhD position) in pharmacology, biology, chemical engineering, biotechnological engineering or biomedical engineering

2. Relevant technical skills:
- Cell culture: human or animal cells
- Material/biomaterial science: synthesis and characterization
- Molecular biology and immunotechnologies: ELISA, Werstern blot, immunostaining, RT-PCR, qPCR

- Being familiar with mathematical modeling softwares such as COMSOL Mutliphysics, MatLab and notions of scientific programming would be an asset
- Being familiar with perfusion bioreactor systems would also be an asset

Starting date : september 2019

Third research supervisor : M. Bernard Marcos

REFERENCES: [1] Ostrom Q. T. et al. (2015), Neuro. Oncol., Suppl 4: iv1-iv62, [2] Donaldson S. S. et al. (2006), J. Clin. Oncol., 24(8), pp. 1266-1272, [3] Rubben J. D. et al. (2006), Int. J. Radiat. Onco. Biol. Phys., 65(2), pp. 499-508, [4] Kohutek Z. A. et al. (2015), J. Neurooncol., 125(1), pp. 149-156, [5] Ko C.-Y. et al. (2012), Biomaterials, 33(3), pp. 876-885, [6] Autier L. et al. (2019), Acta Biomat., 84, pp. 268-279, [7] Han H. et al. (2012), Sci. China. Life. Sci., 55(9), pp. 782-787, [8] Nicholson C. et al. (2017), Biophys. J., 113(10), pp. 2133-2142.

Discipline(s) by sector

Sciences naturelles et génie

Génie chimique

Funding offered

Yes