2017/2018 Summer Studentship Project Application Form

Send to: Research Office, University of Otago Christchurch, PO Box 4345, Christchurch, by 5pm on 3 July 2017

Supervisor Information (First named supervisor will be the contact):		
First Supervisor's Name and Title: Dr Khoon Lim		
Department - UOC &/or CDHB (if applicable): Orthopedics Surgery and Musculoskeletal Medicine		
First Supervisors Phone: 02108492312	First Supervisors Email: khoon.lim@otago.ac.nz	
First Supervisors Mailing Address: 2 Riccarton Avenue, Christchurch 8011		
Co-Supervisors Name and Title(s): Dr Elisabeth Phillips, Assoc Prof Tim Woodfield, Dr Margaret Currie		
Research Category (Choose one category only **– to be used for judging the students' presentations**):		
Clinical	Laboratory	Community
Project Title (20 words MAXIMUM):		
Engineering Physiologically Relevant Breast Cancer Tumor Models		
Project Description:		

Introduction:

In breast cancer, breast tumours grow in close proximity to fat cells (adipocytes). Although obesity has been linked to breast cancer showing that excess adiposity may favor tumour invasiveness and poor patient outcome, little is known about the paracrine effect of these adipocytes (fat cells) within the tumour stroma. *In vitro*, mature adipocytes can be co-cultured with breast cancer cells using a simple two-dimensional (2D) transwell method, but does not accurately recapitulate the native three dimensional (3D) tumour microenvironment. Therefore, we propose to encapsulate adipocytes and breast cancer cells in 3D hydrogel matrices that better mimic the native tumour microenvironment.

Aim:

This project aims to develop more physiologically relevant, 3D breast cancer and adipocyte models using advanced engineering technologies.

Possible impact (in lay terms):

The construction of these 3D breast cancer models, which encompass adipocytes and breast cancer cell lines, will not only provide a novel model in which to study the rarely investigated interaction between these cell types, but also provide a more physiologically relevant 3D structure which can be used to test novel cancer therapeutics in the future.

Method:

A light activated hydrogel based microfluidics technology developed in Dr Lim's group will be utilised to fabricate cancer/adipocyte-laden hydrogel spheres (Figure 1). Figure 1 shows the method currently established by Dr Lim in the Christchurch Regenerative Medicine and Tissue Engineering (CReaTE) laboratory for the assembly of encapsulated core-shell hydrogel spheres, and how it could be adapted in order to assemble adipocyte and breast cancer cell co-cultured 3D hydrogel models. The student will be involved in evaluating process parameters such as varying flow rates for both the macromer and oil phases, the viscosity of the continuous oil phase, and the interfacial surface tension. These studies will subsequently allow for formation of spheres of controlled sizes in the range of 200μm – 800μm; which will enable us to control the oxygen gradient and diffusion of nutrients to and from the cells.

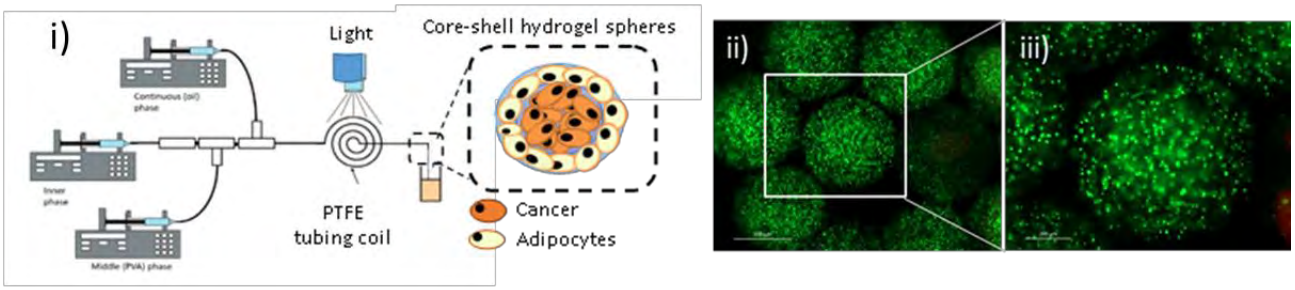

Figure 1: i) Fabrication of 3D hydrogel spheres using concentric co-axial flow microfluidic device. Hydrogel precursor solution and cells will be fed through silica-micro-capillaries (inner and middle phase), oil is used as a continuous phase to shear off the hydrogel spheres, which are then photo-polymerised. Live/dead images of breast cancer cell (MCF-7) encapsulated within gelatin based hydrogel spheres (ii & iii).

Student Prerequisites (eg. Medical Student) if applicable:
N/A