2014/2015 Summer Studentship Project Application Form

Send to: Research Office, University of Otago Christchurch, PO Box 4345, Christchurch, by 5pm on **4 July** 2014

Supervisor Information (First named supervisor will be the contact):	
Supervisor's Name(s): Dr Aamir Raja, A/Prof Anthony Butler, Joe Healey	
Department: Centre for Bioengineering, Radiology	Institution: UOC
Phone: (03) 364-1987; 022-654-0417	E-mail: aamir.raja@otago.ac.nz
Mailing Address: Centre for Bioengineering, Christchurch School of Medicine, 2 Riccarton Ave, P.O. Box 4345, Christchurch	

Research Category (Choose one category only – to be used for judging the students' presentations):		
~~**Clinical**~~	**Laboratory**	~~**Community**~~

Project Title (20 words MAXIMUM):

Spectral imaging for non-invasive quantification of gold nanoparticles in tumour mouse model

Project Description:

Introduction: Personalised cancer treatment becomes possible when the amount of drug entering a tumour can be measured, and the response to treatment assessed noninvasively. MARS Spectral CT is a new molecular imaging modality developed in New Zealand [1] which can identify non-invasively tumour markers or drug markers labelled with non-toxic high atomic number particles of gold. However, the challenge is to achieve sufficient payload of the gold atom to allow quantification within the tumour. This pilot project will provide a method for the assessment of accumulated gold nanoparticles inside the tumour to start an extensive study for the effectiveness of drug delivery into tumours.

Aim: To quantify gold nano-particles (AuNP) in small animal tumour model by using MARS spectral CT

Methodology: The student will image 10 wild type mice (C57BL6) with Lewis Lung Carcinoma subcutaneously implanted tumours in conjunction with Gabi Dachs. Each mouse will be injected with 50nm gold-nanoparticles in 200µl of 0.31 g/kg. The nanosize of Au nanoparticles will enhance its deposition in the tumours through enhanced permeability and retention. Mice will then be euthanized; scanned with MARS small animal spectral CT scanner to obtain quantitative images. The student will gather the required data and perform all the analyses. The student will use five or more energy bins to reconstruct 3D CT images using the MARS-ART 3D reconstruction routine. For quantitative analysis and material decomposition, capillary tubes having different concentrations of Au (31, 15.5 and 7.75 mg/ml) and CaCl2 (500, 250, 125 mg/ml) along with air and water will be attached to the sample tube. The capillary tube data from one specimen will be used to calibrate the others as scanning conditions will be the same. The student will then apply material attenuation information obtained from the capillary tubes to quantify gold nano-particles by using material decomposition (MARS-MD).

This summer studentship can be completed within 10 weeks and will complement current research in the MARS research group. All equipment, supplies a d support from postgraduate students and staff of the Centre for Bioengineering are already available. The student will be expected to undertake necessary experimentation on the mice injected with gold-nanoparticles and prepare a detailed report of the work performed. The student will be encouraged to be a co-author on publications arising from the research.

Significance: The student will demonstrate the feasibility that MARS spectral molecular CT can non-invasively quantify biological processes by using gold nanoparticles and provide data for a longer grant from other funding bodies. The ability to quantify biomarkers of tumours within the tumour itself paves the way for measuring multiple biomarkers simultaneously in a live animal model of cancer in a way that can be translated to human imaging once a human size MARS scanner is built in Christchurch. The specific identification and quantification of multiple markers of cancer is not possible with PET scanning. This project is part of a long-term programme to measure over time drug delivery, tumour biomarkers, and markers of response to cancer treatment in a live mouse, then translate this to human imaging. The student will gain experience with state of the art spectral imaging technology and undertake experimentation and preparation of research for publication..

Locations: MARS research Laboratories at Rutherford building, University of Canterbury, and UOC.

Reference:

1 Anderson NG, Butler AP. 2014. Clinical applications of spectral molecular imaging: potential and challenges. *Contrast media & molecular imaging* 9:3-124.