

2016/2017 Summer Studentship Project Application Form

Send to: Research Office, University of Otago Christchurch, PO Box 4345, Christchurch, by 5pm on **4 July 2016**

Supervisor Information (First named supervisor will be the contact):

First Supervisor's Name and Title: Dr Tracy Kirkbride

Department - UOC &/or CDHB (if applicable): UOC

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First Supervisors Mailing Address: Academic Radiology and Centre for Bioengineering, UOC, Riccarton Ave, Christchurch

Co-Supervisors Name and Title(s): Prof Lisa Stamp; A/Prof Nigel Anderson

Research Category (Choose one category only – to be used for judging the students' presentations):

Clinical

Laboratory X

Community

Project Title (20 words MAXIMUM):

MARS Analysis of Calcium and Gout Crystals

Project Description:

Introduction:

Calcium crystals are involved in the pathogenesis of pseudo-gout and osteoarthritis. Uric acid crystals are the cause of joint disease in gout. Non-invasive assessment of these crystals would facilitate the treatment and monitoring of patients with crystal arthropathy. The MARS spectral scanner for specimens and small animals is the first example of a new imaging modality developed in Christchurch. This technique allows the characterization of materials based on X-ray attenuation differences at different energy levels. Dual-energy CT studies have shown promising results in the detection and characterization of MSU crystals and gout. Recent tests since the studentships last year have shown that, through a change in scanning protocol, MARS multi-energy CT is able to distinguish between different calcium crystals, namely calcium hydroxyapatite and calcium oxalate encountered in breast disease. Our goal is to expand on this research to differentiate between calcium types encountered in crystal arthropathies, and distinguish them from gout. This investigation will determine the ability of the revised MARS protocol to differentiate between these crystal types, and determine the lowest detectable limit of calcium.

Aim:

1. To discriminate between different calcium compounds encountered in crystal arthropathies.
2. To determine the sensitivity of MARS scanning for calcium and uric acid crystal detection.

Possible impact (in lay terms):

The prevalence of crystal-induced arthropathies (CIA) - gout (monosodium urate (MSU)), pseudogout (calcium pyrophosphate dihydrate (CPPD)) and basic calcium phosphate (BCP) –is increasing. The treatment of gout is very different from the treatment for CPPD and BCP. This summer studentship will help initiate an international collaborative project using spectral CT involving UOC (Radiology and Rheumatology), University of Auckland (Rheumatology) and CHUV, Switzerland (Rheumatology, and Radiology) to enable improved diagnosis and management of arthritis. The health and economic burden from arthritis in all its forms is unsustainable. Better methods to identify if and what crystals are causing arthritis will allow rapid diagnosis to ensure the appropriate therapy is provided. Better and timely management of arthritis can reduce disability and reduce the need for joint replacements. The student will gain knowledge and experience in the scientific method, working with a large research group and experience how national and international collaborations in research operate. The student will be encouraged to continue on to post-graduate research with the research team. The long-term aim is to diagnose crystal-arthropathies in affected joints of patients using a human MARS scanner, due to be built in 2020. The research project fits into a broader objective to provide new insights on the role the new modality of spectral molecular imaging for early detection and characterization of articular crystals so as to improve care for sufferers of crystal arthritis by enabling better diagnosis and management. National and international collaborations related to the broader research aim are in process with Auckland University, Lausanne University hospital (Switzerland), and Oregon Health and Sciences University (USA).

Method:

The Rheumatology group and the MARS research team will provide the student with the relevant crystals and surgical specimens, the MARS scanner, and expertise on optimal scanning parameters. The student will help design an appropriate phantom incorporating the crystals, perform the scans under supervision, and analyze the results. Existing stored samples of synovial fluid

containing CPPD will be analysed for calcium concentration by MARS along with renal calcium and urate based stones and a surgically removed tophus.

