

2015/2016 Summer Studentship Project Application Form

Send to: Research Office, University of Otago Christchurch, PO Box 4345, Christchurch, by 5pm on **3 July 2015**

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

Supervisor's Name and Title(s): A/Prof Nigel Anderson; Dr Aamir Raja; Prof Lisa Stamp;

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

Clinical

Laboratory X

Community

Project Title (20 words MAXIMUM):

A new way to diagnose and measure calcium crystal arthritis with MARS imaging

Project Description:

Introduction: 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. Calcium crystals are involved in the pathogenesis of osteoarthritis. Non-invasive assessment of these crystals would facilitate the treatment and monitoring of patients with crystal arthropathy. MARS multi-energy computed tomography is a novel imaging method 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. We wish to extend this work to identify and measure calcium in commonly encountered crystal arthropathies. The key determinants will be ability to differentiate between crystal type, and determining the lowest detectable limit of calcium.

Aims:

1. To determine lowest detectable concentration of calcium commonly found in crystal arthropathies using MARS imaging.
2. To distinguish crystals containing calcium from those that do not using MARS imaging.

Method: The Rheumatology group and the MARS research team will provide the student with the relevant crystals, 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, analyze results. Existing stored samples of synovial fluid containing CPPD will be analysed for calcium concentration by MARS. 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).

The MARS spectral scanner for specimens and small animals is the first example of a new imaging modality developed in Christchurch. A human MARS spectral CT scanner is due to be built in Christchurch by 2020.

Significance: 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 more 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.

Location: Bioengineering and Rheumatology at UOC; and Physics, University of Canterbury.

Student Prerequisites (eg. Medical Student) if applicable:

Medical Physics or similar background. Prefer a student who would like to progress to PhD with the MARS research team.