

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): Prof Lisa Stamp; A/Prof Nigel Anderson; Dr Aamir Raja;

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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):

Gout – diagnosis and monitoring using MARS spectral imaging

Project Description:

Introduction: The prevalence of gout is 10-15% in Maori and Pacific Island men, and 1-2% for European men. Diagnosis is usually made from detecting uric acid crystals in synovial fluid aspirated from the affected joint. Non-invasive diagnosis would facilitate faster and more effective treatment. Dual energy CT has some success in the detection and characterization of MSU crystals and gout. MARS *multi-energy* computed tomography is a novel imaging method developed in Christchurch which is much more specific than *dual-energy*_CT. MARS allows the characterization of materials based on X-ray attenuation differences at different energy levels. In a previous summer studentship, we have shown that multi-energy MARS imaging can identify MSU specifically, and measure its concentration in the laboratory. We wish to extend this work to identify and measure monosodium urate in synovial fluid. The key determinants will be ability to differentiate urate crystals from calcium based crystals, and measuring the concentration of MSU in crystals and synovial fluid. There are synergies with another proposed summer studentship titled "A new way to diagnose and measure calcium crystal arthritis with MARS imaging".

Aims:

1. To determine lowest detectable concentration of monosodium urate (MSU) found in crystal arthropathies using MARS imaging.
2. To distinguish MSU crystals in synovial fluid from uric acid dissolved in synovial fluid 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 corroborate the findings from the previous summer studentship with newer image processing techniques, perform the scans of phantoms containing different concentrations of MSU, and urate crystal, and analyze results. Stored samples of synovial fluid from gout patients will be assessed for crystal presence by microscopy, then uric acid/ MSU concentration determined by MARS scanning. A specimen of a human gouty finger may be scanned by the end of the project if the student has time. 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.

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 advance collaborations between UOC (Radiology and Rheumatology), and University of Auckland (Rheumatology) and CHUV, Switzerland (Rheumatology, and Radiology) to enable improved diagnosis and management of arthritis. These gains would be even more beneficial to Maori. The health and economic burden from gout 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 engage in post-graduate research with the team after their studentship.

Location: Bioengineering and Rheumatology at University of Otago, Christchurch 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.