

Christine and T.J. Martin Research Travel Grant 2013 -Final Report -

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Dear members of the ANZBMS Council,

I would like to take advantage of this report to acknowledge the ANZBMS for awarding me the 2013 Christine and T.J. Martin travel award. I have been truly honoured to receive this grant and when I see who received it earlier, I do think that it helps a lot to create strong collaborations across the globe...As a fun fact and to illustrate my point, I had the privilege to work with Prof. Mark Forwood (Griffith University, Gold Coast, QLD) when he was in Lyon, France, thanks to the Christine and T.J. Martin Research Travel Grant he obtained in 2006. This grant was certainly one of the achievement of my 3 years stay as a postdoc in Prof. Ego Seeman's group. This grant allowed me to stay in the Department of Engineering, Cambridge University, UK where I was trained by Dr. Graham Treece to use a recent image processing pipeline to quantify cortical thickness of the proximal femur from standard QCT images. Dr. Graham Treece's close collaboration with Dr. Ken Poole from the University of Cambridge Department of Medicine has provided the community with new insights in the understanding of the morphometric bases of bone hip fragility and the effect of some anti-osteoporotic therapies. In addition, the travel grant allowed me to attend the ASBMR meeting in Austin, Tx, USA during September 2014. Finally, the grant greatly helped me to participate to two other meetings, the 44th Sun Valley Workshop, ID, USA, organized by Prof. David Burr and the Advances in Mineral Metabolism (AIMM) meeting in Snowmass, CO, USA.

Laboratory Visited:

During November 2014, I spent time in the department of engineering supervised by Dr. Graham Treece. To give a bit of background about the project that, we aimed to determine the age-related changes in the proximal femur cortex thickness. To do so, I had the chance to collaborate with Prof. John Clement and Mr. David Thomas (Melbourne Dental School, The university of Melbourne, Australia) who allowed me to draw some autopsy human proximal femurs from the Melbourne Femur Collection. This unique collection, includes for each sample the anthropometric data and medical history allowing the construction of a 'reference population' excluding samples from bodies of persons who had pathologies and/or treatments known to affect bone metabolism. Thanks to the help of Ali Ghasem-Zadeh and Jia Wei Teo from prof. Ego Seeman's group, I managed to image the 100 proximal femurs selected (50 males and 50 females aged from 20 to 100 years) using High-Resolution pQCT (ExtremCT, Scanco Medical, Brüttisellen, Switzerland). This step led us with a massive and unique dataset of proximal femur images with a voxel size allowing accurate quantification of bone microstructure.

Dr. Graham Treece, Dr. Andrew Gee and colleagues developed a suite of software allowing "quite simply" the analysis of biomedical images producing 3D maps of cortical thickness (see Treece et al, Medical Image Analysis 2010 and Treece et al, JBMR 2015 for details). During

the different steps of image processing I had the chance to benefit from Dr. Treece's precious advices that permit me to generate the data to then statistically test the significance of local differences. We did not only observe changes in cortical thickness on the overall proximal femurs but also focal spots of highly significant differences (see figure). These focal and intense area of bone loss could, at least partially, explained the fragility in the femoral structure that raises with ageing by destabilizing the dispersion of the loads during a fall. To extend this project from the mechanical point of view, I have started from France (where I am currently working) a collaboration with Dr. Saulo Martelli (School of Computer Science, Engineering & Mathematics, Flinders University, Adelaide, SA, Australia) and A/Prof. Peter Pivonka (St. Vincent's Department of Surgery, The University of Melbourne, Melbourne, VIC, Australia.) to use computational modelling to estimate bone strength from the CT images. This will permit us to investigate the role of these local deteriorations in proximal femur estimated strength and risk of fracture.

In Summary, this grant allowed me to initiate a collaborative network with people from UK and Australia. It has been a chance to do so during my postdoc, probably the most important time in a career to be supervised by- and collaborate with great researchers. This comes on the top of having learned new techniques in the biomedical imaging field that I will certainly use in my future research.

Conference Attendance:

I attended in 2014 the ASBMR meeting in Houston, Tx, USA. This is probably the most important congress in our field (after the ANZBMS of course..!) in term of size and scientific excellence. I presented here a plenary poster about morphometric changes during growth and ageing and how these changes influence fragility fractures across lifetime. I had great discussions and advices about this topic during the meeting, that probably helped the preparation of the related manuscript (recently published in the JBMR). The grant also helped my participation in two 'smaller' (by size and certainly not by the scientific quality..!!) meetings. The first one was the 44th Sun Valley Workshop, ID, USA, organized by Prof. David Burr and the second, the Advances in Mineral Metabolism (AIMM) meeting in Snowmass, CO, USA. Both of these meetings are organized to help young investigators to present their work in front of great senior researchers who clearly make our field...By the way, I must admit that either Sun Valley or Snowmass are great places to share about science and have good time with great people!

Overall Outcomes:

I am extremely grateful to AMGEN and ANZBMS for this travel grant. It was a great help during my postdoc, it helps me to attend relevant conferences to present my work, to discuss about it and to get a critical opinion from my peers. Moreover, I have been able to learn new techniques in image processing with the people who created it and I am currently applying it in my new position. Finally, what an honour to be awarded with a grant entitled 'Christine & T. Jack Martin Research Travel Grant', Prof. Martin's tremendous work has a huge influence on my work, on my thinking...His papers and reviews are always a great pleasure to read...This one of the author whose papers are always insightful, you can read them again and again and you will systematically learn something new.

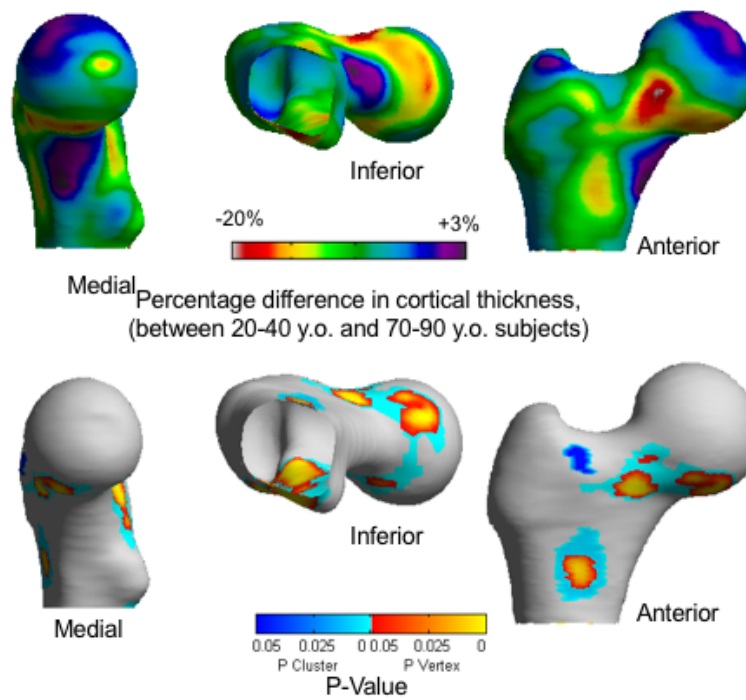


Figure: Example of results obtained comparing the cortical thickness between young (from 20 to 40 years old subjects) and older (from 70 to 90 years old subjects). The upper panel, highlights that in this population increasing age was associated with a local decrease in cortical thickness close to the junction between femoral head and femoral neck producing highly significant differences (lower panel).