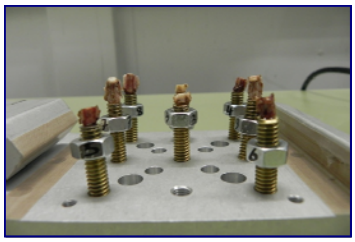
USING SYNCHROTRON ENERGY IN THE EARLY DETECTION OF OSTEOARTHRITIS -- SASKATOON, OR BUST!

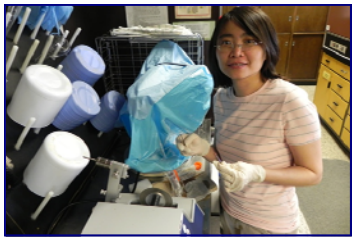
*Team OA's **Dr. MIKE DOSCHAK** and some of his trainees headed to Saskatchewan recently for some fascinating opportunities at the Canadian Light Source. Read on as Dr. Doschak provides us with a compelling tale of the experience.*

Over 5 days from May 17-21, three Team OA Alberta members from Project 2 in Edmonton journeyed to the National Canadian Synchrotron Facility in Saskatoon – the Canadian Light Source (CLS), in order to conduct research into elemental Strontium drug distribution in rat bones. With gasoline prices at an all-time high, and airfares to Saskatoon at a premium, it was a surprise to come across discounted Via Rail fares at $32 each from Edmonton to Saskatoon! In fact, too good to ignore, and Doctoral trainees Yuchin Wu and Arash Panahifar, along with their supervisor Mike Doschak, found themselves boarding the midnight "red-eye" in Edmonton at 11:45 pm in the evening, and arriving 8:00 am in the beautiful northern prairie city of Saskatoon 8 hours later.

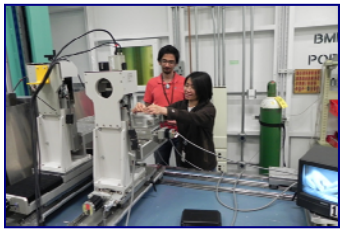


The University of Saskatchewan hosts Canada's National Synchrotron Facility. The synchrotron is capable of producing beams of tunable photon energy that can be directed to interact with samples for research and diagnostic purposes. In brief, an electron gun fires electrons through steel tubes under vacuum into the oval shaped booster ring, where they are accelerated using microwave energy. Periodically, they are injected into the central synchrotron storage ring, where magnets deflect the electrons, simultaneously resulting in the production of photons of pure energy. Beamlines capture and manipulate the photons through samples where they interact with the molecules to produce detailed physico-chemical analyses.

Our Team OA research aimed to employ a technique known as K-edge subtraction to examine 3-Dimensional micro-Computed Tomography (micro-CT) images of rat bones that had been dosed with known amounts of a bone drug containing elemental Strontium. Research in the Doschak laboratory involves administering brief pulses of this Strontium drug to animal models of bone disease (such as Osteoporosis and Osteoarthritis), in order to dynamically label regions of bone turnover. The K-edge subtracted data generate stunning high resolution 3-D images of bone with visible "seams" of strontium drug at trabecular and cortical sites of bony adaptation – that can be employed to help diagnose OA pathology (such as osteophytosis, or subchondral bone sclerosis) or assist in quantifying the degree of turnover during the coupled resorptive-formative bone remodeling cycle.



Arriving 3 days prior to our scheduled three 8-hour shifts (i.e., 24 consecutive hours of beam-time!) gave us just enough time to check into accommodation, find our way about the U of S campus, take the necessary user and safety training, and prepare our rat bone samples for the non-stop "load, scan and analyze" cycle that would be repeated later that week. Several competitively priced student lodges were available right on the U of S campus, and true to name, "Laura's Lodge" served as our "Home away from home!" Our task was made possible in great part due the collaborative support we were given by the Cooper lab at the U of S. David Cooper, a former U of C graduate from the Hallgrimsson lab, and now an Assistant Professor on faculty with the Dept of Anatomy and Cell Biology, was a key part of the research process, and provided on-site support for the many loose ends that needed attention prior to the scheduled scanning time. The CLS assigned one of their synchrotron engineers to assist in the experimentation, and we were privileged to get to know Dr. George Belev, and benefited greatly from his knowledge with physics principles, and from his patience! What ensued was an onslaught of sample adjustment in submarine-like steel chambers, computational alignment, data acquisition, post-analysis, and then repeating the entire process another dozen times until all samples and standards were completed. After a lengthy data transfer process, the week concluded with a rushed departure from the Saskatoon Via Rail station back to Edmonton, to catch up on lost sleep over the weekend.



Our results have proven exciting to date, and we look forward to presenting them further at the upcoming full Team OA meeting in Edmonton October 5-6, 2011. Our thanks to Alberta Innovates and to the NRC synchrotron facility for enabling this novel research into Osteoarthritis and related bone conditions.