In 2010, as a part of TORU’s strategic planning process, a set of goals was developed as a way of measuring TORU’s progress as a research unit. One of these goals focussed on quantifying and tracking the number of research papers produced by the unit each year. Another goal focussed on quantifying the number of conference papers produced by TORU (both published and unpublished), and the number of invitations TORU received to write review articles. TORU reviewed its progress against these goals at the 2011 TORU strategic planning day which was held at Lanyon Homestead in April.

An evaluation of the first goal incorporated both a summation of the number of articles submitted for publication over recent years, as well as the average impact factor of the journals, and the total number of TORU journal citations. It was shown that between 1998-2010 there was a progressive increase in the rate of TORU’s journal publication, culminating in 2010 being particularly productive with a total of 19 published articles. The average impact factor of the journals in which TORU articles were published remained relatively consistent, ranging from 1.22 to 3.07, and the largest number of citations was 56 (in 2006). While there was some variation in the total number of proceedings produced each year, the number of published proceedings consistently increased, culminating with 13 out of a possible 14 being published in 2010. Further, in the last three years TORU received more conference invitations and invitations to review papers than in previous years.

These goals have provided TORU with clear indicators against which it can measure elements of its progress as a research unit on an ongoing basis. TORU looks forward to making further progress as its current research projects reach maturity and new orthopaedic research is embarked upon.
Biomarker in Bone Diseases

Identifying and validating molecules that reflect clinical disease activity or disease progression would greatly facilitate the development of more accurate diagnostic markers and effective therapeutics. TORU Laboratory researchers continue to uncover more about biomarkers for monitoring disease activity and predicting clinical outcomes.

A recent major update of the TORU laboratory research topic Heparanase as a Potential Predictive Marker in Rheumatoid Arthritis (RA) outlines some of the recent findings from the TORU laboratory. TORU researchers have studied RA patients’ synovial fluid and tissue and found that heparanase is associated with angiogenic genes and RA progression, which may be a potential biomarker for monitoring the progress of disease and be a potential therapeutic target for RA. As a Section Chair and Speaker, Dr Rachel Li, TORU Laboratory Research Coordinator, presented the research results to date to the International Molecular Medicine-Biomarker Annual Congress 2010.

Nano-osteimmunology Research in Biomaterial Surface and Implant Sciences

Wear is an inevitable consequence of total hip replacement (THR). The size of wear particles derived from the prosthesis at joint replacement interfaces is critically important to the interfacial properties and the responses of the osteoimmunological environment. Whilst Australia has a similar THR revision rate to other countries, TORU laboratory researchers are doing significant work in wear particle research and exploring potential new mechanisms for prevention and/or treatment.

A recent major update of the TORU laboratory project Nano-osteimmunology as an important consideration in the design of future implants revealed that exposure to nanoscale UHMWPE wear particles induced dendritic cells (DC) activation and consequently increased cytokine IL-6 and IL-1β secretion. Direct exposure to nanoscale UHMWPE wear particles promoted osteoclast cells (OC) maturation, resulting in a suppression of osteoblast cell (OB) growth in established OB and OC co-cultures. Associate Professors Paul Smith and Rachel Li presented these findings to the 12th Combined Meeting of Orthopaedic Associations 2010. The article is now published online at: http://dx.doi.org/10.1016/j.actbio.2011.04.011.

Anabolic and Antifracture Therapies in Hope

“Seeing what everyone else has seen, but thinking what no one else has thought” (Albert Szent-Gyorgyi, Nobel Prize laureate) has inspired generations of medical researchers in the field of drug discovery. For the first time the TORU laboratory has reported (in a recent issue of the Journal of Orthopaedic Research) that heparanase exists in osteoblasts (bone forming cells) and that this molecule is under-expressed in osteoporotic osteoblasts. This discovery opens a new research avenue for improving drug treatments of fracture and osteoporosis. With support from the Australian Orthopaedic Association Research Fund and the Canberra Hospital’s Private Practices Fund, the TORU laboratory has systematically studied heparanase for its anti-osteoporotic and anti-fracture potential in vitro and in vivo, and has gained a greater understanding of the role of heparanase as an angiogenic factor helping regulation of osteogenesis and angiogenesis during fracture repair.

Translational Medicine - Development of CARs (Computer Assisted Reaming and Suction)

Instrumentation of the intramedullary canal during long bone fracture fixation causes elevation in intramedullary pressure and extravasation of intramedullary contents (including fat) into the venous blood system, which contributes to fat embolism syndrome (FES).

With support from the Australian Orthopaedic Association Research Fund and the Canberra Hospital’s Private Practices Fund, the TORU laboratory has developed a novel medical device, CARs, which can effectively control intramedullary pressure elevation during reaming by a suction system which provides direct feedback to the operating surgeon. CARs also has a build-in print unit providing a real-time print out or record of the surgical procedure which can be used as a reference for diagnosis and treatment post-surgical FES. This creative idea and research results have been reported in Injury Extra and the Journal of Orthopaedic Research.

To converting creative ideas into safe and effective products or clinical practice that makes a difference in patients’ lives is the focus of TORU laboratory research. The TORU laboratory has recently tested the CARs device on a large animal, a sheep fractured femur model, and the results provide supporting evidence that the CARs device can effectively prevent FES during fracture fixation. (Paper accepted by Clinical Orthopaedic and Related Research).
Xinghuo Wu

The Endeavour Awards is the Australian Government’s internationally competitive, merit-based scholarship program which provides opportunities for citizens of the Asia Pacific, the Middle East, Europe and the Americas to undertake study, research and professional development in Australia. Endeavour Awards are also available for Australians to undertake study, research and professional development in other countries.

Dr Xinghuo Wu won an Endeavour Award and has commenced collaborative research in the Trauma and Orthopaedic Research Unit of Canberra Hospital and the John Curtin School of Medical Research at ANU.

Dr Wu graduated from the Tongji Medical College of Huazhong University of Science and Technology in China, and achieved his doctoral degree (MD, PhD) in June 2009. After graduating, he stayed to work in the Department of Orthopaedics at the Union Hospital, the first hospital affiliated with Tongji Medical College. Dr Wu is now a doctor (surgeon-in-charge) and clinical teacher (lecturer) at the Tongji Medical College.

Dr Wu has done both clinical and basic science research over the past few years. His research has included investigating the prevention and treatment of osteonecrosis, and the potential for G-CSF/CSF mobilized bone marrow-derived stem cell (BMSC) to repair steroid-associated osteonecrosis. His study showed that the mobilized BMSC, following G-CSF/CSF administration, may favor the homing of immature cells in the necrotic zone where they may contribute to tissue regeneration (osteogenesis and angiogenesis). Dr Wu has also published many articles about osteonecrosis in international Journals.

During Dr Wu’s time with TORU and the John Curtin School of Medical Research at ANU, he will investigate the regulatory function and mechanisms of T cells on osteogenic differentiation of mesenchymal stem cells (MSCs). Dr Rachel Li, TORU’s laboratory research coordinator, will supervise Dr Wu’s work in this area. Dr Wu will also attend clinical observations one day per week, under the supervision of TORU director, Associate Professor Paul Smith.

The Australian National University is one of the world’s foremost research universities, and the collaborative work between Dr Wu and TORU researchers will contribute significantly to orthopaedic research as well as Dr Wu’s own professional development. It is expected that the project will also foster closer links between Australia and China with respect to collaborative clinical practice, medical education and research in the field of orthopaedics.
Is there a relationship between knee joint and leg stiffness and ACL injury potential?

Ben Serpell, PhD candidate

Anterior cruciate ligament (ACL) injury is a serious knee injury which may impair functional ability (Bjordal et al. 1997; Dallalana et al. 2007; Muaidi et al. 2007; Scarvell et al. 2005; Scarvell et al. 2006; Tashman et al. 2007) and is relatively common amongst active people worldwide. At the turn of the century Griffin et al. reported an incidence of 80,000 ACL injuries per annum in the United States of America (Griffin et al. 2000). More recently, an International Olympic Committee current concepts statement reported on similar data from European and Scandinavian nations, estimating an incidence of 34 to 80 non-contact ACL injuries per 100,000 persons in the general population over an 18 month period (Renstrom et al. 2008).

Comparable data from New Zealand was also recently published (Gianotti et al. 2009). This data suggests ACL injury incidence has not changed appreciably over time, and the notion is supported by data from the National Collegiate Athletics Association in the United States of America. In the mid-90s an ACL injury rate of 0.13 and 0.31, and 0.07 and 0.29 per 1000 athlete exposures was observed (Mihata et al. 2006).

Repeat studies conducted approximately 10 years later revealed similar results: an ACL injury rate of 0.11 and 0.27, and 0.11 and 0.27 per 1000 athlete exposures in men and women in basketball and soccer respectively was reported (Arendt & Dick 1995). Repeat studies conducted in another published in 2006 (Agel et al. 2005), and in another published in 2006 an incidence rate of 0.08 and 0.28, and 0.11 and 0.32 per 1000 athlete exposures was observed (Mihata et al. 2006).

Given the apparently unchanged incidence and injury rates, the need to investigate novel methods to prevent ACL injuries is paramount. To do so effectively requires first evaluating ACL injury risk factors (Orchard et al. 2001). Anterior cruciate ligament injury in athletic populations is more common than in the general population (Gianotti, Marshall 2009; Renstrom, Ljungqvist 2008; Wojtys et al. 1998); and they more commonly occur in field and court sports than in snow sports (Friden et al. 1995; Natri et al. 1995; Wojtys, Huston 1998).


In my research I will be examining if a relationship exists between knee joint and leg stiffness and the biomechanics which are believed to stress the ACL. If a relationship exists I also aim to determine if it is positive or negative to hopefully be able to make recommendations on novel methods which may be used to prevent non-contact ACL injury in adult athletes who engage in field and court sports. I currently have one literature review under review by an internationally peer reviewed journal and another literature review manuscript in progress. Ethical approval has been granted for several projects which I intend to complete in the next two years and two more applications will be reviewed shortly. Should those two applications be approved then ethical approval for data collection for my entire PhD will be complete, enabling me to commence data collection within the next few months.

Rehabilitation after elective total hip replacement

Corinne Coulter, Masters of Philosophy (Research) Candidate

The aim of this study is to determine the value of physiotherapy rehabilitation after total hip replacement. There is current uncertainty in practice and throughout the literature regarding physiotherapy for patients after discharge from hospital after total hip replacement, and this study’s aim is to determine the benefit of physiotherapy post total hip replacement by looking at two rehabilitation interventions: a supervised or unsupervised program.

This randomised control trial is in the participant recruitment phase. This was commenced in June 2010 and is still continuing with ideal participant numbers aimed at 120. Recruitment has been slower than expected and current trends predict that data collection will be completed by December 2012.

Outcomes to be evaluated during this study are the WOMAC (Western Ontario and McMasters University Osteoarthritis Index) and SF36 (Short form 36) questionnaires; standardised quality of life measures and a functional timed walking measurement.
The results of a study conducted as part of the thoracic hyperkyphosis project (see November 2010 TORU newsletter) have recently been published in the Journal of Biomechanics (Perriman et al. 2011). This study found that thoracic erector spinae (TES) activity cannot be directly measured with surface electromyography (SEMG) because of interference from the more superficial muscles (crosstalk).

The TES are completely covered by the trapezius muscle and, to a lesser extent, the latissimus dorsi muscle. However, although the possibility of crosstalk has long been recognized (Floyd and Silver), for the past 20 years the TES have been ‘recorded’ 5 cm adjacent to T9 (the ninth thoracic vertebra). The validation study which established this site was reported in conference proceedings in 1988 (Lafortune et al) and this paper has been repeatedly cited as justification for its use. However, the method used was not ideal and the conclusions reached are open to reinterpretation. A recent anatomic paper suggested that recording at this T9 site would capture latissimus dorsi muscle activity only. The authors suggested a site adjacent to the T3 spinous process because the trapezius muscle attaches to the spinous processes via an electrically silent aponeurosis wide enough to position a recording electrode at this site. The lumbar erector spinae (LES) are recorded through the latissimus dorsi aponeurosis in much the same way.

We used real-time ultrasound to image the aponeurosis during rest and active extension from prone lying and found that, in vivo, the aponeurosis was significantly smaller than had been reported in the cadavers and that it decreased further during extension to almost nothing (Figure 1). Interestingly, although the mechanism was different, in some cases the lumbar recording site which is typically 3 cm adjacent to L4 (the fourth lumbar vertebra), was found also to be at risk of ‘crosstalk’ from the latissimus dorsi muscle. The paper concludes that measurement of TES activity needs to be made in other ways. Needle electromyography is an option but it does not measure whole muscle depolarization, can come loose during movement and can be painful. Surface EMG could be used if a reliable method of multiple electrode recording using subtraction techniques were established. Thus far this has not been reported. Also an LES recording site of no more than 2 cm lateral to L4 was recommended. Finally, caution when extrapolating ex vivo findings to live subjects was advised.

![Ultrasound image of the area adjacent to the T3 spinous process at rest (left) and during extension (right). The trapezius muscle is seen to insert into the spinous process (highlighted as a grey triangle) via a thin aponeurosis at rest but during extension the muscle fibres are seen to thicken and insert via a deep muscular attachment. Trap = trapezius muscle. Rhom = Rhomboid muscle. TES = thoracic erector spinae muscles, T3 = Third thoracic vertebra. The depth scale is marked in cm.](image)

Diana Perriman, PhD Candidate
TORU Medical Students Project Group

Each year a small group of medical students choose to complete their research projects at TORU. From the class of 2009-10 two papers were chosen for presentation at the Australian Orthopaedic Association ACT Branch Annual Scientific Meeting.

Jon Anderson presented his study Surgical planning films in standing provide better acetabular alignment outcomes in total hip replacement than lying films. A pilot study, supervised by Assoc Prof Paul Smith and Dr Jennie Scarvell.

Total hip replacement (THR) represents one of the most common surgical procedures in an ageing population and is also one of the most successful operations for improving quality of life outcomes. Assessing the relevant anatomic parameters assists surgeons in pre-operative planning and has implications for patient outcome post-THR. This pilot study aimed to measure pelvic angles using computer assisted technology to compare standing and lying postures in patients indicated for THR and ultimately make a recommendation for pre-operative planning.

Measurement of pelvic angles from X-ray films (AP and LAT) from 12 subjects (mean age 66.12 years SD ± 14.13 years; 7 females and 5 males) were recorded. Using the relevant lateral (LAT) films, seven reference points were used to derive four pelvic angles. Inter-rater reliability was conducted to assess consistency of measurements ICC(2,1) 0.985. Associations between the relevant angles measured were used to derive four pelvic angles.

Pelvic tilt is greater in standing than lying positions pre-operatively by a mean difference of 2.90 ± 2.2 and remains largely unchanged (2.80 ± 0.6) in post-operative evaluation. Associations of the angles measured demonstrate that the strongest correlations come from assessment of the standing films. This pilot begins to suggest that pre-operative planning be based on standing lateral x-rays.

Emily Sikorski presented her study Analysis of reasons for failure of joint prostheses revised in Canberra over a 10 year period, supervised by Assoc Prof Paul Smith and Dr Jennie Scarvell.

The most common reason for failure of hip and knee prostheses is aseptic loosening [1-6], which in Australia, is reported in 56.4% of all hip revisions and 43.5% of all knee revisions [2]. In order to review arthroplastic surgery outcomes of a specific subset of patients, it is important to determine whether these patients have reasons for prosthesis failure that are consistent with those that the NJRR reports for that state. The aims of this study were to characterise reasons for failure of retrieved implants for a group of patients in the Australian Capital Territory (ACT), to determine the failure rates of prosthetic joints for this group, and also to explore patient factors that may have influenced the rate or cause of prosthetic failure.

This study involved retrospective analysis of the Canberra Hospital Implant Retrieval Database. The database contained 289 retrieved knee, hip and other implants.

Of the 289 implants in the catalogue, 149 implants were included in the study and of these, 111 were hip implants and 38 were knee implants. Hip implants failed due to aseptic loosening (57.7%), dislocation (14.4%), infection (9.0%) and instability (4.5%). Whereas, knee implants failed due to aseptic loosening (42.1%), instability (13.2%), progression of disease (10.5%), infection (7.9%) and component fracture (7.9%). Older age at primary arthroplasty was found to be associated with reduced implant lifespan when compared to all other reasons for failure (F (1, 102) = 19.59, P < .000). These findings were consistent with the Australian National Joint Replacement Register.

Characterising failure reasons informs surgical techniques and highlights potential areas for improving patient outcomes

Phil Jaksa and Stefanie Orlik also completed research projects at TORU, on total hip replacement outcomes and knee kinematics relevant to ageing, respectively.

The medical students research group for 2010-11 comprises Russell Wang, Leo Lam and Georgia White.

Among their studies for this year will be Russell’s which will examine the reliability of the Trendelenberg test for torn hip tendons.

Continued page 7
For TORU PhD candidate, Angie Fearon’s research, a series of videos of patients walking was recorded. Russell will be blind to which ones have tendinopathy of the hip, osteoarthritis of the hip, and healthy control subjects. His video judgement will be compared to that of a physiotherapist and a surgeon for an analysis of reliability, and to test whether walking and single leg standing are effective screening tests for hip osteoarthritis and greater trochanteric pain syndrome.

Georgia White will determine the outcomes of tibial plafond fractures, by conducting a medical records audit. A recent mechanical testing study determined the fatigue and failure of two plating systems for these complex ankle fractures. This clinical review of the past 200 patients, or 7 years, will record how these patients fared in terms of time to weight bearing and incidence of malunion, non-union and gait problems.

And Leo Lam’s study asks can you remember pain? How accurate is the account of pre-operative pain in patients following total joint replacement? Many studies have not recorded prospective and preoperative pain and function levels, but have asked participants to recall their pre op pain. Questionnaires will be sent out to people and compared to what they actually reported pre-operatively, utilising the Canberra Primary Joint Replacement Outcomes database.

Australian Orthopaedic Association – ACT Branch
Annual Scientific Meeting
Canberra Hospital
Friday 25 November 2011

Following on from the success of the previous meetings, it is with great pleasure that we announce details of the Australian Orthopaedic Association – ACT Branch Annual Scientific Meeting to be held on 25 November 2010 at the Canberra Hospital.

Each year the number and quality of abstracts submitted for presentation increases, and the job of the scientific committee gets harder. Registrars wishing to present are encouraged to start their projects early, and seek advice from surgeons and researchers on project design and abstract preparation. Due to increasing numbers of papers each year, it is not possible to ensure a place for each registrar on the program, and competition for these places is keen. Abstracts close on Monday 24 October 2011. Posters are also welcome and will be displayed in the hospital mezzanine for public viewing.

The Annual Scientific Meeting will have a strong presence from the orthopaedic industry. The conference dinner this year will be held at the Commonwealth Club.

Enquiries: Trauma and Orthopaedic Research Unit, Canberra Hospital
Email: kylie.mckay@act.gov.au, Phone: (02) 6244 3858
Conference Papers (selected papers 2011-2008)


Fearon AM, Scarvell JM, Cook JL, Smith PN. ‘Fat female and over forty’, Australian Orthopaedic Association Annual Scientific Meeting, ACT 2009.

Fearon AM, Stephens S, Scarvell JM, Cook JL, Smith PN. ‘When eyeballing x-rays is not good enough’, Australian Orthopaedic Association Annual Scientific Meeting, ACT 2009.

Fearon AM, Stephens S, Scarvell JM, Cook JL, Smith PN. ‘When eyeballing x-rays is not good enough’, ACT RACS, ACT 2009.


Journal Articles  (selected papers 2011-2009)


A/Prof Paul Smith, BMBS FRACS (Ortho). Director

Associate Professor Smith is an orthopaedic surgeon at the Canberra Hospital and at Calvary John James Hospital in Canberra. He is also Co-Director of the Trauma and Orthopaedic Research Unit at the Canberra Hospital. Assoc. Prof Smith is also president of the Arthroplasty Society of Australia, and Clinical Director of Orthopaedic surgery at the Canberra Hospital.

A/Prof Smith received his medical and surgical training in Adelaide before specialising in hip and knee joint reconstructive and replacement surgery. He was a Royal Australasian College of Surgeons Travelling Fellow in 1996 and 1997 with Fellowships in joint replacement surgery at the University of Western Ontario in Canada and at The Princess Elizabeth Orthopaedic Hospital in England. He has recently been honoured by The Knee Society, receiving the inaugural John N Insall Travelling Fellowship in knee surgery and has been appointed as Associate Professor in Orthopaedic Surgery at the ANU Medical School. A/Prof Smith's particular clinical interests are in reconstruction and replacement surgery of the hip and knee, complex revision joint replacement surgery and management of pelvic and acetabular injuries.

Contact: smithadmin@co.net.au

Dr Damian McMahon, MB BS FRACS. Director

Dr McMahon is the Director of the Shock Trauma Service, Senior Staff Specialist in surgery and Co-Director of the Trauma and Orthopaedic Research Unit at the Canberra Hospital. In addition, Dr McMahon is the Director of the Clinical Skills Centre and Senior Lecturer in surgery at the Australian National University Medical School.

Dr McMahon received his medical and surgical training in Melbourne where he specialised in Trauma Surgery. He became Trauma Service Coordinator at Preston and Northcote Community Hospital in 1993 and from 1994 until 1997 he worked as Trauma and Surgical Critical Care Fellow and Attending Traumatology surgeon at the Hospital of the University of Pennsylvania, Philadelphia PA. In 1997 Dr McMahon took up his position as co-joint academic/senior staff specialist at the Canberra Hospital.

Dr McMahon was instrumental in establishing the Snowy SouthCare Helicopter retrieval service to service the region with medical and specialist support. He achieved recognition for the hospital as the first accredited Trauma Centre in Australia.

Contact: damian.mcmahon@act.gov.au

A/Prof Rachel Wei Li, MD, PhD. Laboratory Research Co-ordinator

Associate Professor Li obtained a Bachelor of Medicine from China Medical University in 1982 and worked as a surgeon and senior infectious diseases specialist at China Medical University from 1982-1996. Her Master project was on immune responses to viral infection. She led a number of clinical trials in anti-viral and anti-inflammatory drugs and successfully transferred an intellectual property to pharmaceutical industry. In 2002 A/Prof Li completed her PhD in pharmacology at Southern Cross University and gained her postdoctoral research experience in molecular pharmacology in the University of Hawaii School of Medicine.

A/Prof Li returned to Australia in 2006 joining TORU and has established TORU laboratory with a focus on osteoimmunology. She has developed a range of laboratory capabilities to determine the effects of therapeutic, surgical and physiotherapeutic treatments on biomedical markers using human primary cell culture and large animal models.

In addition to her research work, she is an Adjunct Associate Professor at the University of Canberra teaching and supervising the students in Master of Pharmacy Program.

Contact: rachel.li@anu.edu.au
Dr Jennie Scarvell, PhD. Clinical Research Co-ordinator

Dr Scarvell’s recent research studied the incidence of osteoporosis in people over 40 with minimal trauma fractures. A career as clinical physiotherapist lead Dr Scarvell to a PhD on knee kinematics and the role of aberrant motion in degenerative change using a model of ACL injury. Exciting projects currently in train include collaborations with Mark Pickering at UNSW@ADFA in 2D fluoroscopy to 3D CT image registration for kinematic analysis to provide 3D modelling of motion, and with Heiko Timmers for radioisotope labelling of polyethylene to measure wear in total knee replacement. Dr Scarvell was one of the inaugural Master of Physiotherapy program staff at the University of Canberra 2004-2007. She wrote and taught curriculum, and developed the clinical education program. Dr Scarvell is a registered physiotherapist and convener of the APA ACT Symposium. She is an affiliate Senior Lecturer at University of Canberra and at ANU.

Contact: jennie.scarvell@act.gov.au

Angela Fearon
BAppSc(Physio), MPhysio. Angie completed her Bachelor of Physiotherapy at Lincoln Institute of Health Sciences and her Master’s degree in 2001. She has been a clinical physiotherapist since 1986 and established her own practice in Canberra. Angela’s PhD thesis looks at tendinosis, enthesopathy and Greater Trochanteric Pain Syndrome. Contact: angie.fearon@anu.edu.au

Diana Perriman
BAppSc(Physio), MSc. Diana attained her physiotherapy degree from Sydney University in 1982 and her Master’s degree at the University of East London (UK) in 1995. Her Masters research investigated the effect of orthotics on the hemiplegic ankle using electrogoniometry. Diana’s PhD thesis at ANU involves an investigation of kyphotic thoracic posture in normal adults and people with stroke. Diana is an NH&MRC Dora Lush Biomedical scholar. Contact: diana.perriman@anu.edu.au

Susannah Littleton
M.Public Health, Cert. Critical care nursing, RN. Susannah has been a member of TORU through her work on the Accident Care Evaluation study, sponsored by the NRMA ACT Road Safety Trust. Susannah’s PhD program explores clinical pathways for people with musculoskeletal injuries following road accidents. Contact: susannah.littleton@acec.biz

Jonathon Slater
Jonathon is an MBBS/PhD student at ANU. His thesis looks at side impact motor vehicle collisions.

Mingming Chen
BSc, PhD. Mingming is an NH&MRC scholar investigating osteoclast and osteoblast co-culture at JCSMR and TCH labs. Contact: Mingming.Chen@anu.edu.au

Corinne Coulter
B(App)Sc, Physiotherapy. Corinne is doing her research Master’s degree with an RCT to explore efficient and effective rehabilitation post total hip replacements. Contact: Corinne.coulter@anu.edu.au

Ben Serpell
B.HSc, B(App)Sc OT (hons). Ben’s PhD asks “Is there a relationship between hamstring and quadriceps strength, and the knee joint kinematics which predict anterior cruciate ligament injury?” We look forward to collaboration with the AIS and UC.

Camilla Smith
B. Medicine B. Surgery (MBChB): Camilla graduated from the University of Cape Town in December 2009. She is currently working on the R-Cardiac Trial; researching cardiac surgery patients undergoing coronary artery bypass grafting.

Elizabeth Bennett
BA (Hons), M Ex Sci (Strength and Conditioning). Elizabeth did her BA (Hons) at the Australian National University and her Masters in Exercise Science at Edith Cowan University. Part of her Masters research focussed on plyometrics for marathon runners. Elizabeth is the TORU researcher for the Journey knee replacement study and the R3 hip replacement project. She also manages the bone retrieval database and prepares TORU research papers for publication. Contact: elizabeth.bennett@act.gov.au

Kylie McKay
is the Office Manager for TORU. Contact 02—6244 3858 kylie.mckay@act.gov.au

John Warmenhoven
B Coaching Sci. John is a graduate of University of Canberra and is currently working on his honours thesis for his Bachelor of Sports Studies (hons) in biomechanics at the Australian Institute of Sport. John is studying the kinematics of rowers. He is a recipient of the AIS prize, and has a keen interest in swimming. John manages the TORU pelvic fractures database and assists with data management of the total knee and hip replacement study. Contact john.warmenhoven@act.gov.au Phone 6244 3602
Interested in Studying with TORU in 2011?

TORU is affiliated with the Australian National University and works closely with UNSW@ADFA and University of Canberra as well. Prospective higher degree students are encouraged to consider possible research opportunities at TORU in 2011. Contact TORU or prepare a 1-2 page research proposal for TORU to consider. TORU is committed to progressing research in trauma and orthopaedics, and to developing young researchers.