

Biomechanics & Spine Research Group Newsletter - December 2018



We welcomed a new Director



[Professor Peter Pivonka](#) was appointed last year as Research Director of the Biomechanics and Spine Research Group (BSRG). Peter brings more than 20 years academic experience in a range of engineering fields including mechanics, materials and biomedical engineering. Peter leads biomechanics research across the Faculty of Science and Engineering with a focus on musculoskeletal (MSK) research in a multidisciplinary environment bringing together engineers, clinicians, surgeons and basic scientists. In the last year connections with national and international spine research groups were strengthened, in particular with Prof Achim Wilke from the University of Ulm and Prof Syn Schmitt from the University of Stuttgart. Furthermore, emphasis was placed on recruiting PhD students, Masters students and final year project students. The [Clayton Adam Florence Wilson Award](#) was established to support students with scholarships and travel bursaries.

CONFERENCES

26th Congress of the International Society of Biomechanics, Brisbane (July 2017)



The Biomechanics and Spine Research group attended this high calibre meeting which brought together internationally acclaimed speakers and delegates from all over the world. Our own Emeritus Professor Mark Percy was a key organiser for the event. Our Senior Research Fellow, Dr Paige Little ran a Spine Biomechanics session entitled, "An integrated multi-methodological approach to Spine Biomechanics". Professor Pivonka co-organised a workshop, "Elucidating the laws of biomechanics and mechano-biology using experimental and computational methods". The BSRG was well represented at this local event with Dr Paige Little ([Paper 1](#), [Paper 2](#)) and [Dr Caroline Grant](#) having podium presentations and a poster presentation by [Dr Nicolas Newell](#).

2018 Spine Society of Australia Meeting



BSRG had excellent representation at this year's Spine Society of Australia (SSA) meeting in Adelaide. SSA is Australia's largest spine event - this year attracting more than 400 participants from ten countries. There were many interesting presentations, three from our own BSRG team.

Senior Research Fellow, Dr Paige Little presented [Progressive coronal plane changes in vertebral and intervertebral disc height: Adolescent idiopathic scoliosis versus non-scoliotic controls](#). Clinical Fellow, Dr Thorbjorn Loch-Wilkinson presented [Quantifying anterior chest wall deformity in adolescent idiopathic scoliosis: Does it correlate with other deformity measure](#). Masters Student, Dr Pawel Sowula presented [Progression of anterior vertebral wedge angles in adolescent idiopathic scoliosis using MRI](#). In addition, spinal consultant, Dr Geoff Askin was an invited specialist speaker for the "Getting of Wisdom" session. This event also gave our researchers an opportunity to connect with our major industry partner Medtronic.

At the SSA meeting we remembered longstanding Spine Society of Australia member and Spine Research Group Director of 15 years Clayton Adam, who passed away in March this year. Clayton joined QUT in 1999 and dedicated his work to helping children with spinal deformity and disorders, and to improving treatment outcomes for patients who undergo spinal surgery. Clayton was an active researcher who published more than 80 scientific papers and attracted more than \$3.8 million in research income as well as a substantial bequest from a donor impressed by his work – the Florence Wilson Bequest. To honour Clayton's stellar contribution to spine research, as well as his impact on the academic community, QUT has created the [Clayton Adam Florence Wilson Award](#) for Spinal Research. Our vision is to ensure Clayton's work continues, by growing the fund to a level where it can perpetually support excellent students. [Vale Clayton James Adam](#). Please consider contributing to honour Clayton's contribution [DONATE HERE!](#)



8th World Congress of Biomechanics, Ireland



Professor Peter Pivonka and Emeritus Professor Mark Pearcy recently attended the World Congress of Biomechanics (WCB) in Dublin. Peter gave a keynote presentation "Multiscale Characterisation of 3D Ceramic Bone Grafts for Repair of Large Segmental Bone Defects". The WCB was an exciting meeting with over 4000 participants showcasing different branches of biomechanics. This is the largest meeting of its kind taking place every four years.

Clayton Adam Florence Wilson Award 2018

We are pleased to announce our first [Clayton Adam Florence Wilson Award](#) recipient, Miss Laura Meszaros. Laura commences her PhD studies on musculoskeletal biomechanics of the spine at QUT in March 2019. Laura recently finished her MSc degree at the University of Stuttgart under the supervision of Professor Syn Schmitt.

RESEARCH

Improved spinal health through research into mattress design



Our ongoing [collaboration](#) with Sealy Australia is progressing well with recruitment for the second, larger phase of the study well underway and our novel lab-based assessments of participant comfort recently commencing.

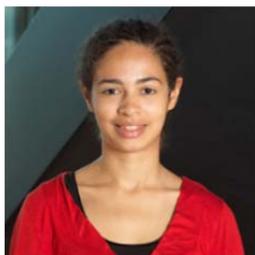
Sealy of Australia PhD Student [Lionel Rayward](#) is developing a system that uses live pressure mapping to alert nursing and medical staff when a patient is at risk of immediate pressure injury development.



Our Clinical Spine Fellow

Dr Deborah Lees is our current clinical spine Fellow with Dr Geoff Askin at the Queensland Children's Hospital. Dr Lees completed her medical degree and specialty training in Trauma and Orthopaedics in the UK and is a current fellow of the Royal College of Surgeons of England. She has assisted in a research project looking at fiducial surface markers in medical imaging with the BSRG team as well as continuing to work on her own research activities.

Joint Paris/Brisbane Students



As part of a joint PhD scheme between Universite Paris-Est and QUT Brisbane, PhD student, [Madge Martin](#) is working with the BSRG on a mechanobiological approach to bone remodelling. Ms Martin is being supervised by Professor Peter Pivonka, Dr Paige Little and Professor John Bell.

[Dr Simon Gatehouse](#), one of our spine orthopaedic surgeons has enrolled in a QUT Masters degree. He is analysing the effect of bracing on the adolescent spine of idiopathic scoliosis sufferers. His work is being generously supported by Queensland X-ray who are performing [low dose EOS](#) imaging on project participants.



Longstanding annual sponsorship by Queensland X-Ray of the QUT Clinical Masters position at the Queensland Children's Hospital in Brisbane, allows the BSRG to train the research active Orthopaedic Specialists of the future. Together with the support of Queensland Health, the two year [Master's Position](#) programme enrolls young medical officers in a Masters of Philosophy at QUT while also working in the Orthopaedic Department in the Hospital. [Dr Pawel Sowula](#) and [Dr Hardy Jennings](#) are our current candidates and we will welcome Dr Catherine Choi in 2019.



Robotic Musculoskeletal Simulator - Roland Bishop legacy

The BSRG team were recently awarded \$80,000 from the Roland Bishop Bequest Fund to support the development of a state-of-the-art ex-vivo biomechanical [Robotic Musculoskeletal Simulator](#). The first prototype robot will simulate the shoulder joint and in the future, spinal joints will be simulated using a modular approach.

Adelaide Spine Research Symposium

The Adelaide Spine Research Symposium brings together all of the specialist spine research groups in Australia and New Zealand to promote the exchange of ideas, foster collaborations and stimulate lively discussion between basic scientists and clinicians who share a common interest in disorders and deformity of the spine.

Our own Spinal Orthopaedic Surgeon, Dr Geoff Askin was the invited Keynote Speaker and spoke on the 'Contradiction of managing scoliosis deformity progression in the growing spine'. Presentations were also given by three BSRG researchers, [Paige Little](#), [Pawel Sowula](#) and [Maree Izatt](#).

ENGAGEMENT

BSRG supports children perfectly during Spine Surgery

When 10-year-old Chelsy Jones needed a lengthy operation to stabilise a progressing spinal deformity that was beginning to harm her spinal cord, our Spine Orthopaedic Surgeon, Dr Geoff Askin enlisted the help of our biomedical engineer, Dr Paige Little, to [custom design a support mattress](#) for the surgical table. Chelsy's unique chest, spine and ribcage shape meant she could not safely lie face down on the operating table for the 8-hour surgery she urgently needed. To avoid the development of pressure damage during surgery, a 3D custom made foam support mattress was required – something that had never been attempted. When Dr Little asked one of our current collaborators, Sealy of Australia for help, they were more than willing and developed the special mattress, based on Dr Little's exact 3D specifications, to fit Chelsy's chest and body shape exactly. Dr Askin and his surgical team reported that the custom support mattress was a huge success and prevented any tissue damage during the surgery.



3D Biomodels improving Patient Outcomes



Using our desktop 3D printing facility in the Spine Research Lab at CCHR, the BSRG continues to develop our capability in using 3D printing for clinical applications. We are using this facility to create our own 3D biomodels of patient's spinal bones, providing a physical replica of the spinal anatomy that our surgeons can use to plan complex deformity correction surgery as well as to help their patients to understand what their surgery will look like. In a [previous BSRG paper](#), Surgeons reported that the use of biomodels reduced operating time by a mean of 8% in tumour patients and 22% in deformity procedures. It also supported biomodelling as a useful, and sometimes essential tool in the armamentarium of imaging techniques used for complex spinal surgery. [Dr Little](#) looks forward to broadening this capability over the coming year through new collaborations with local clinicians.

Industry funding making a difference to spine deformity sufferers

Thanks to the long standing research grant support from Medtronic Australasia towards the BSRG's clinically driven [spine deformity research](#), we continue to contribute to improvements in the current understanding of spine deformity progression and to the surgical techniques used to correct and stabilise scoliosis in children and adolescents.



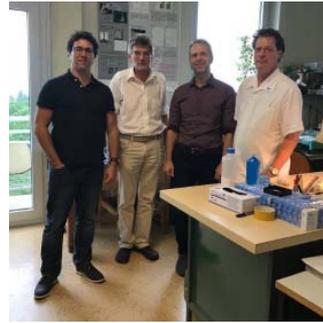
As part of the Australia-Germany Joint Research Cooperation Scheme, Professor Pivonka recently travelled to Germany to strengthen our collaborations with European researchers and research groups.



Prof Pivonka's visit to the University of Ulm, Germany, provided a great opportunity to continue our collaboration with Prof Hans-Joachim Wilke from the Institute of Orthopaedic Research & Biomechanics, who is a pioneer in spine research and a world leader in spine biomechanical testing techniques.



Our collaboration with Prof Aldo Boccaccini from the Institute of Biomaterials, University of Erlangen, Germany is investigating the vascularisation potential of 3D Bioglass scaffolds for tissue engineering of large bone defects using an innovative mechano-biological approach.



The assessment of vertebral bone quality and quantity in Adolescent Idiopathic Scoliosis sufferers requires analysis of vertebral bone cores extracted during surgery. The bone will be analysed using a number of techniques including, quantitative backscattered electron microscopy to assess bone mineral density distribution.



Collaboration with Professor Syn Schmitt involves the development of a new spine modelling capability which amalgamates osseoligamentous spine finite element models with muscle simulation software. This new approach will permit novel understanding of the loads in the spinal tissues during daily activities.

BSRG undergraduate student supervision

The BSRG continues to support the Engineering course at QUT through supervision and mentorship of undergraduate students in the VRES, WIL and Capstone projects, which they undertake as part of their Biomedical Engineering degree. The BSRG team values the opportunity to mentor the Biomedical Engineers of the future. Two of our 2018 Capstone students, Sheyanne Christenson and Ashley Ford (not pictured), have already secured full-time employment as graduate engineers, despite not yet officially graduating from their course until next month.

Fraser Labrom, a UQ undergraduate Biomedical Science student, worked with the BSRG throughout Semester 2 on a project entitled "Bone Metabolism Biomarkers in Adolescent Idiopathic Scoliosis" and was awarded the Best Poster prize at the UQ Science Undergraduate Research Conference (SEC), held at the University of Queensland, Brisbane on Saturday October 6, 2018.

Marlon Arthur and Rachel Chalmers (WIL, work integrated learning, students) are working with Dr Little to further test our subject-specific spine finite element models, discovering new information about how muscles load the spine. Erin Chapman and Corey Miller were awarded a place with Dr Little in the highly competitive QUT VRES program (VRES, Vacation Research Experience Students) and are discovering new information for our surgeons by describing how the internal organs and soft tissues have moved when patients are positioned laterally on the operating table for surgery.



Undergraduate students: Marlon Arthur, Erin Chapman, Fraser Labrom, Corey Miller

"Scoliosis correction surgery has changed my future"

Taylah, aged 14, kindly told the story of her scoliosis journey to the distinguished guests at the IHBI Pre-Gala event, October 23, after an informative interview of BSRG researchers Prof Peter Pivonka and Maree Izatt. "I felt really bad when my scoliosis kept getting worse and worse," said Taylah. "But now that I have had the surgery I look and feel so much better and know that I don't need to worry about it ever again. I am so grateful to have been involved in the scoliosis research programme and hope I may have helped other scoliosis sufferers in the future." Only a few select QUT research groups were invited to showcase their work at the IHBI Gala events and Maree and Peter did a wonderful job of shining a light on the important and life-changing scoliosis research being carried out by the BSRG researchers and surgeons. We thanked our collaborators and supporters, and the guests were delighted by a video message all the way from Hollywood in LA!



2018 Publications

Grant CA, Johnston M, Adam CJ, Little JP. The accuracy of 3D surface scanners for the clinical torso and spinal deformity assessment. *Medical Engineering & Physics*, ePub Nov 20, 2018 DOI - [10.1016/j.medengphy.2018.11.004](https://doi.org/10.1016/j.medengphy.2018.11.004)

Little JP, Loch-Wilkinson TJ, Sundberg A, Izatt MT, Adam CJ, Labrom RD, Askin GN, 2018. Anterior chest wall deformity in AIS: Correlations with clinical deformity measures before and after scoliosis correction surgery. *Spine Deformity*, Accepted Oct 1, 2018

Bouthors C, Izatt MT, Adam CJ, Percy MJ, Labrom RD, Askin GN, 2018. Minimising spine autofusion with the use of semi-constrained growing rods for early onset scoliosis in children. *J Pediatr Orthop* 38(10):e562-71 (ePub Sept 7 2018) DOI – [10.1097/BPO.0000000000001242](https://doi.org/10.1097/BPO.0000000000001242)

Timmi A, Coates G, Fortin K, Ackland D, Bryant AL, Gordon I, Pivonka P. Accuracy of a novel marker tracking approach based on the low-cost Microsoft Kinect v2 sensor. *Med Eng Phys*.59:63-69. DOI - [10.1016/j.medengphy.2018.04.020](https://doi.org/10.1016/j.medengphy.2018.04.020)

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Hitchens PL, Pivonka P, Malekipour F, Whitton RC. Mathematical modelling of bone adaptation of the metacarpal subchondral bone in racehorses. *Biomech Model Mechanobiol*. 17(3):877-890. DOI - [10.1007/s10237-017-0998-z](https://doi.org/10.1007/s10237-017-0998-z).

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Little JP, Pettet GJ, Hutmacher DW, Loessner D, 2018. SpheroidSim – preliminary evaluation of a new computational tool to predict the influence of cell cycle time and phase fraction on spheroid growth. *Biotechnology Progress* (ePrints Sept 9 2018) DOI - [10.1002/btpr.2692](https://doi.org/10.1002/btpr.2692)

We would like to thank our supporters

