

# Macquarie University Biomechanics, Physical Performance, and Exercise (BioPPEX) Research Group

2020 ANNUAL REPORT



**BioPPEX**  
Biomechanics  
Physical Performance  
**Exercise**  
Research Group

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# BioPPEX Annual Report

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## Note from Director Tim Doyle, PhD

Welcome to our first year, and first annual report of the Biomechanics, Physical Performance, and Exercise (BioPPEX) Research Group. I don't think any annual report could be written this year without mentioning COVID-19... Personally, I was in the US/Canada from early February for OSP/Sabbatical. After presenting at an international conference in Canada, I headed down to the University of Pittsburgh where I spent about four weeks. It was towards the end of this time that COVID-19 really started having a global impact, and I cut my OSP trip short and headed back to Australia. But, as we should during trying times, I looked for opportunities about what I could get done. With that, I decided to bring forward the formation of the BioPPEX and thankfully all group members were willing to come on board. It has meant that the year has perhaps been quieter than what it normally would have been and opportunities for collaborative projects have been less than what they might otherwise have been. In spite of all of this, when I look over the group's outputs and achievement, it's clear that people have not stood still and it's great to see that we all seem to have found new opportunities and/or ways to do things differently.



In particular, what I have been very pleased to see is how well the HDR group has come together in a very mixed environment, with a blend of Sydney-based, interstate, and overseas students. The regular meetings that are held are well attended, despite not being physically co-located, and I get a good sense that an HDR community is developing. I look forward to seeing this grow even further.

As we move into 2021, let's look for further opportunities to collaborate. Consider drawing in expertise to a project that you wouldn't normally; take a look around our group and see what expertise exists. As we do this then we should expect our research breadth and impact will grow. I look forward to our relationships growing as we move forward.

Regards,

A handwritten signature in blue ink, appearing to read 'Tim Doyle', written over a light blue grid background.

Tim.

## Lab-Wide Accomplishments

As unpredictable as 2020 has been, Macquarie University's BioPPEX Research Group has accomplished many things worth celebrating. Here are some of the highlights, including faculty promotions, awards, and grants that have been awarded to further the group's research efforts.

### BIOPPEX FACULTY PROMOTIONS

**Tim Doyle, PhD** was promoted to Associate Professor in the Department of Health Professions in the Faculty of medicine and Health Science at Macquarie University. Tim, a previous winner of the Endeavour Executive Fellowship, earned his PhD from Edith Cowan University in Biomechanics. His ability to foster local, national and international partnerships and collaborations have brought both funding and research opportunities to the BioPPEX research group. Tim researches biomechanics and physical performance, with a particular interest in injury prevention and physical training in athletes and tactical populations.

**Joel Fuller, PhD** was promoted to Senior Lecturer in the Department of Health Professions. Joel, a Fulbright Scholar (University of Massachusetts), received his PhD from University of South Australia researching running footwear, focusing on its influence on performance and risk of injury. His education, experience and accomplishments, including the 2019 Research Rising Star Award from the Macquarie Department of Health Professions, highlight the important role Joel plays within the BioPPEX research group. His research interests include prevention and treatment of sporting injuries, and optimisation of sports performance.

## **AWARDS AND GRANTS**

***Increasing combat effectiveness through the development of environmentally-relevant mental models from scenario-based affordances, inferences, and action under variable levels of stress.*** Doyle, T., Wiggins, M. Funding Body: Department of Defence (Australia).

***Musculoskeletal injury prediction and modelling of military personnel.*** Doyle, T., Wills, J. Funding Body: VALD Performance (Industry Partner Funded Research).

***Validation of mRNA biomarkers of mTBI with traditional performance measures.*** Doyle, T., Sowman, P. Australian Postgraduate Research (APR) Internship.

***An Australian Imaging Service: Melding the Clinical and Academic using a Distributed Federation of Enhanced XNATs, Australian Research Data Commons (2020-2021).*** Sullivan, R., Calamante, F., Bellgard, M., Abramson, D., Ward, N., Galloway, G., Close, T., Betbeder- Matibet, L., Rae, C., Ross, S., **Sowman, P.**, Nairnsey, J., Mehnert, A., Ebert, M., Lewis, R., Marcus, D. S. & Olsen, T.

***Listen and Learn – Statistical Learning and the Adapting Auditory Brain, ARC Discovery Project [DP 180102524] (2018-2020).*** McAlpine, D., Badcock, N., **Sowman, P.**, Chait, M., Todd, J., Monaghan, J., Undurraga, J., & Harper, N.

***New generation magnetoencephalography: imaging the brain with non-invasive wearable quantum devices, 2020 – 2021: CIBF Strategic Initiative Project Grant.*** M. Garrido, A.N. Burkitt, D.B. Grayden, S. Lin, G. Barnes, **P. Sowman**, W. Woods.

***Hallucinogen Persisting Perception Disorder (HPPD) Protocol: Multimodal Neuroimaging to uncover neurobiological pathogenesis, The Institute for the Clinical Advancement of Neuroplasticity & Macquarie University (2020- 2022),*** He, W. & **Sowman, P.**

***Soldier Physical Performance Enhancement, Defence Innovation Network (DIN) (2019-2023)***  
Doyle, T., & Sowman, P.

***A fresh look at the automaticity of reading: Bridging theory and the brain, Macquarie University Safety Net Scheme.*** Kinoshita, S. & **De Wit, B.**

***Field-side assessment of brain health and concussion in football players using EEG, Research Seeding Grant.*** **De Wit, B.** & Kaplan, D.

***Global Partnerships: Visiting International Academic Fellowship, University of Exeter, Exeter, England.*** Van Beurden, S. & **de Wit, B.**

## **OTHER WORK AND COLLABORATIONS**

Prior to travel restrictions, Associate Professor Dr. Tim Doyle took sabbatical wherein he attended the 5th International Congress on Soldiers' Physical Performance (Quebec City, Quebec, CAN) with fellow faculty member Dr. Jodie Wills. This conference covered a wide range of topics specific to tactical populations, research interests of both Dr. Wills and Dr. Doyle. Topics ranged from physical training programs and adaptations, to data analytics and technology, to biomechanics and load carriage.

Shortly thereafter, Tim also visited the University of Pittsburgh's Warrior Human Performance Research Center (WHPRC), a current and previous collaboration partner of Macquarie's BioPPEX group. Parallel to

research interests of the BioPPEX group, WHPRC's focus is prevention of musculoskeletal injuries and optimization of human performance. As such, it is an important international research relationship and collaboration space. Unfortunately, Tim's time visiting at the University of Pittsburgh was cut short due to COVID-19.

## BioPPEX Faculty



**TIM DOYLE, PHD (BIOPPEX DIRECTOR)** is a biomechanics and physical performance researcher and associate professor in Macquarie University's Department of Health Professions. He is also an adjunct Associate Professor with the Centre for Musculoskeletal Research at Griffith University. Tim was previously employed as a human performance scientist by the Australian Department of Defence, researching military performance, injury screening, and employment standards. He earned his PhD in Biomechanics through Edith Cowan University, his Master of Science at Ball State University (USA), and his Bachelor of Science in Human Movement Studies at the University of Queensland. He is an accredited Professional Strength and Conditioning Coach and Specialist with

Australian Strength and Conditioning Association, and the National Strength and Conditioning Association, respectively. Tim is also an accredited level 2 Sport Scientist and Exercise Scientist with Exercise and Sport Science Australia. His professional and academic collaborations extend locally and internationally, including professional sports and tactical populations. Tim was a recipient of the Endeavour Executive Fellowship, providing him the opportunity to spend time at The Mayo Clinic and Stanford University, fostering international relationships. Tim's research interests include neuromuscular biomechanics, injury prevention, and physical preparation in athletic and tactical populations.

**BIANCA DE WIT, PHD** is a lecturer and Director of Undergraduate Studies in the Department of Cognitive Science. She is active in the Department of Cognitive Science, acting as chairperson for the portable human neuroimaging and virtual reality teaching labs, and lab manager for the ERP and portable physiology labs. Additionally, Bianca is the Cognitive Science Representative in the Faculty of Medicine, Health, and Human Sciences, and is an academic representative for the Faculty Education and Individual Cases Committees within the Faculty of Medicine, Health and Human Sciences. Bianca earned her PhD in Cognitive Science from Macquarie University, and both her Master of Science degree in Biological and Cognitive Psychology and her Bachelor of Science degree in Psychology at Erasmus University Rotterdam (Netherlands). While earning her doctorate at Macquarie University, Bianca received multiple scholarships and awards, including the International Macquarie University Research Excellence Scholarship. Prior to her time as a lecturer at Macquarie University, she acted as a Research Officer in the Department of Cognitive Science. Bianca is an Associate Member at Macquarie University's Centre for Reading and in the Australasian Cognitive Neuroscience Society, as well as the Associate Investigator at the Perception and Action Research Centre. Bianca's research interests are in integration of research in neuroscience education, brain health in sport, and the automaticity of reading. Specifically, she is interested in how recent technological advancements may be utilized to research the aforementioned topics in a novel and innovative angle.





**JOEL FULLER, PHD** is a physiotherapy and biomechanics lecturer in the Faculty of Medicine, Health and Human Sciences at Macquarie University. Joel received the 2019 Research Rising Star Award in the Department of Health Professions. He earned his PhD from the University of South Australia by investigating the effects of footwear on running performance and injury risk in collaboration with the Australian Institute of sport. Joel is a Fulbright Postgraduate Scholar, completing research on stride variability and its links with risk of injury in runners at the University of Massachusetts. Joel's research has been published in high-ranking sports science journals and presented at national and international conferences. Joel's research interests include prevention and treatment of sports-related injuries and optimisation of sports performance.

Going forward, Joel believes BioPPEX has an opportunity to address research gaps in the optimization of wearable technology applications for athlete monitoring, to inform performance enhancement and injury prevention in both recreational and elite level athletes.



**DANIEL GLASSBROOK, PHD** is a casual academic in the Department of Health Professions at Macquarie University. Daniel recently earned his PhD in Health Professions from Macquarie University wherein his doctoral research focused on the biomechanical relationship between wearable technology and professional rugby league match-play. This research enabled him to work closely with the South Sydney Rabbitohs NRL team and their High Performance Manager, honing his practical skills associated with sports science and performance, including strength and conditioning. Daniel earned both his Master of Sport and Exercise and Bachelor of Sport and Recreation from Auckland University of Technology. Prior to his time at Macquarie University, Daniel was the head strength and conditioning coach at the North Harbour Rugby Union Academy as well as the Rangitoto College Athlete Performance Academy, both in Auckland, New Zealand. Daniel is a current member of the Australian Strength and Conditioning

Association, Exercise and Sport Science Australia, Australian and New Zealand Society of Biomechanics, and the International Society of Biomechanics. His research interests are in biomechanics, sports science and human movement.

**PRASHANT JHALA, MSPORTSPHTY** is a physiotherapy lecturer in the Faculty of Medicine, Health and Human Sciences at Macquarie University and early career researcher. Prashant received his Master of Sports Physiotherapy from Latrobe University in 2019 following his Bachelors of Physiotherapy and Graduate Certificate in Health Professional Education from Monash University. He has worked as a Sports Physiotherapist with several sports including cricket, rowing, rugby league and rugby union from junior school level through to international level. As a practicing clinician, he has significant clinical experience in the assessment and management of complex spinal injuries in athletes and concussion. Prashant collaborates with several organisations including Rugby Australia and NSW private schools for his research work. His work has been presented at national level, including the Australian Physiotherapy Association Conference and Sports Medicine Australia Conference. Prashant's research interests include the epidemiology of sport-related concussion in adolescents, returning to learn following sports related concussion and optimisation of rehabilitation following sport-related concussion. Prashant believes the BioPPEX group can address gaps in the Australian sport-related concussion research and evaluate the immediate impact of sustaining a concussion on learning ability.





**REIDAR LYSTAD, PHD** is a Research Fellow at the Health Outcomes Stream at the Australian Institute of Health Innovation in the Faculty of Medicine, Health and Human Sciences, Macquarie University. Reider is an injury epidemiologist, with a particular interest in traumatic brain injury, spinal injury, paediatric trauma, and sports injury. His research is centred around conducting large population-based studies using data linkages of administrative data collections to investigate health outcomes following injury and to guide improvements in health service delivery and health policy. Reidar earned his PhD from Macquarie University, his Master of Public Health from University of Sydney, and both his Master of Chiropractic and Bachelor of Chiropractic Science from Macquarie University. Reidar is a member of Sports Medicine Australia Scientific Committee, including the 2020 Conference Organizing Committee. He is also a Fellow of the Royal Society of Medicine, and a Fellow

ECSS. Reider's research interests include epidemiology, neuroepidemiology, Traumatic Brain Injury, concussion, spinal injury, sports-related injuries and combat sports. He believes the BioPPEX group can help inform combat sport regulations in Australia, concussion surveillance in school rugby, biomarkers for traumatic brain injury and concussion, and health outcomes following such injuries.

**PAUL SOWMAN, PHD** is an associate professor and Director of Higher Degree Research in the Department of Cognitive Sciences, wherein he also acts as the Deputy Head of the department. Paul is also the acting Chairperson for both the KIT-Macquarie Brain Imaging Laboratory and the Brain Stimulation Laboratory at Macquarie University. He acts as the Deputy Chair of the Perception in Action Faculty Research Centre, and Member of the Perception and Action Laboratory Oversight committee. Additionally, Paul is a collaborative professor in the Department of Medicine at Kanazawa University (Japan). Of note, Paul was a 2019 finalist for the Jim Piper Research Leadership Award. Paul earned his PhD in Physiology from the University of Adelaide, receiving the Excellence in Postgraduate Research Award during his doctoral studies. Paul also holds a Post Graduate Diploma in Health Science from the University of Auckland, and his Bachelor of Physiotherapy from the University of Otago (New Zealand). Paul has broad collaborative relationships on local and global scales, spanning across multiple disciplines, bringing many research and funding opportunities to the BioPPEX group.



**MARK WIGGINS, PHD** is Professor of Organisational Psychology in Macquarie University's Department of Psychology. He earned his PhD in Psychology from the University of Otago (New Zealand). Mark is currently Director of Partnerships and External Engagement at the Centre for Elite Performance, Expertise, and Training at Macquarie University. He is a Fellow of the Australian Psychological Society, and a Registered Psychologist in Australia with an endorsed area of Organisational Psychology. He has led a number of national and international research projects in various domains including transportation, energy transmission and distribution, medicine, and software engineering. Together with his students, he developed the EXPERT Intensive Skills Evaluation (EXPERTise 2.0) software, used to assess the diagnostic skills of various practitioners, ranging from medical professionals to pilots. He has acted as an advisor to the United States Federal Aviation Administration, the Civil Aviation Safety Authority, the Australian Transport Safety Bureau, the Victorian Department of Infrastructure, Energy Queensland, the NSW Clinical Excellence Commission, the Australian Rail Track Corporation, and Transport for NSW. Mark's research interests lie in the assessment and development of expert performance in the context of cognitive skills, including sensemaking and situation assessment.

Corporation, and Transport for NSW. Mark's research interests lie in the assessment and development of expert performance in the context of cognitive skills, including sensemaking and situation assessment.

**JODIE WILLS, PHD** is a biomechanics lecturer and an early-career researcher in the Department of Health Professions at Macquarie University. Jodie earned her PhD from Macquarie University, focusing on neuromuscular and biomechanical sex-specific adaptations to targeted physical training for military load carriage. During her doctoral studies, she was a 3-Minute Thesis University Finalist, a New South Wales semi-finalist at the Fame Lab live Scientific Communication Competition and was the student representative for the Australian and New Zealand Society of Biomechanics for 3 years. She has a Master of Research degree in Sport Science and a Bachelor of Science degree with honours in Sport and Exercise Science, both from Nottingham Trent University (England, UK). She is also an accredited level 2 Strength and Conditioning Coach. Jodie's research interests are in the optimisation of physical training, and neuromuscular and biomechanical sex dimorphism in military and sporting applications. She aims to incorporate machine learning approaches to injury predication and performance enhancement into future BioPPEX research.



## BioPPEX HDR Students

**ALEXANDER ALVERAS, MCHIRO** is a Master of Research candidate in the Australian Institute of Health Innovation in the Faculty of Medicine, Health and Human Science. Alexander earned both his Master of Chiropractic and Bachelor of Chiropractic Science degrees from Macquarie University. His Master of Research work includes researching the total injury burden within amateur and professional boxing, with a goal of improving boxing competition performance through injury prevention strategies. He currently works as a chiropractor at Your Health Sport and Spine and Westpoint Health. Alexander is a current member of, and qualified Level 2 Sports Trainer in, Sports Medicine Australia. Alexander plans to further his academic career by developing in his research interests of boxing, epidemiology, sports injury prevention and performance.



**NICHOLAS COONEY, MRES** is a Macquarie University Research Excellence Scholarship PhD student in the Department of Cognitive Science. In addition to the MQRES scholarship, he is also the recipient of a Defence Innovation Network top-up. His current research, funded through the Defence Innovation Network, involves mild traumatic brain injury diagnosis and treatment, focusing on the associated biomechanics and neurophysiology. Nicholas earned his Master of Research and Bachelor of Engineering (Hons) with the degree of Bachelor of Science in the Faculty of Science and Engineering at Macquarie University. His undergraduate studies were focused on electronics engineering and biomolecular science. For his MRes degree, wherein Nicholas was a recipient of the Australian Government Research Training Program Scholarship, his research was on

biomedical and electronics engineering. He has published several conference papers based on his previous work in the development and testing of wearables for activity tracking. Nicholas' research interests are in biotechnology, biomedical engineering and clinical science. He aims to use his technical background in engineering in conjunction with his research experience in cognitive science to solve research and development problems within the medical technology industry.

**DANIEL COOPER, MS** is a PhD student in the Department of Health Professions. Daniel's research, funded in-part by the Australian Defence Force School of Special Operations, is on practical preparation methods to improve performance in high-stress situations. Daniel was awarded the Macquarie University Research Excellence Scholarship for his Master of Research degree, studying the influence of cognitive endurance training on endurance testing performance. He also holds a Post-graduate Certificate in Elite Athlete Mentoring from Australian College of Applied Psychology, as well as a Master of Science in Strength and Conditioning degree and a Bachelor of Science in Exercise and Sport Science degree, both from Edith Cowan University. Daniel is an 18-year veteran of Australian Special Operations with extensive experience on combat operations throughout his career. He has paralleled his passion for human performance with academic knowledge, and has developed human-performance programs within special operations and elite sport. Daniel is a certified Professional-Level Coach and Level 2 Strength and Conditioning Coach through the Australian Strength and Conditioning Association. He is also a Certified Strength and Conditioning Specialist and Tactical Strength and Conditioning Facilitator through the National Strength and Conditioning Association. Daniel's research focus is evidence-based practice for developing optimal behaviours to maximise accurate information processing, response selection and stress resilience in high consequence, complex and adaptive environments.



**EOIN DOYLE, MS** is a Macquarie University Research Excellence Scholarship PhD candidate in the Department of Health Professions. Eoin's PhD research focus is on running gait retraining and its effects on biomechanics, performance and injury. He has completed Doctor of Physiotherapy at Macquarie University, a Master of Science in Sports Biomechanics through Loughborough University (England), and Bachelor of Science in Sports and Exercise Science at the University of Limerick (Ireland). Eoin is a Registered Physiotherapist and Accredited Exercise Physiologist with clinical experience both nationally and internationally. He has practically applied his academic background by gaining professional experience at various state and national sports institutes, professional rugby league clubs, and private sports clinics. Eoin is a current member of the Australian Physiotherapy Association, Exercise and Sports Science Australia, Sports Medicine Australia, International Society of Biomechanics, and the Australian and New Zealand Society of Biomechanics. Eoin's research interests lie in the assessment and treatment of running-related injuries.

**AURALEA FAIN, MS** is an International Macquarie University Research Excellence Scholarship PhD student in the Department of Health Professions. AuraLea earned her Master of Science degree in Kinesiology from Boise State University (USA), and Bachelor of Science degree in Exercise Science from the University of Utah (USA). Prior to attending Macquarie University, AuraLea worked for the United States Department of Defense at the Center for the Intrepid (Joint Base San Antonio, Texas), researching the optimization of rehabilitation protocols for individuals with limb trauma and functional/anatomical limb loss. While at the CFI, she received the Milton S. Thompson, M.D. Award for outstanding research in neuromusculoskeletal rehabilitation. AuraLea was a research assistant at BSU's Center of Orthopaedic and Biomechanics Research during her Master of Science studies, receiving the Presidential Award in Research, Scholarship and Entrepreneurship and 2<sup>nd</sup> place in the 3-Minute Thesis competition for her research on the influence of sex, limb and body borne load on performance of a single-leg cut. She is a Certified Strength and Conditioning Specialist through the National Strength and Conditioning Association, and a member of the American Society of Biomechanics, the International Society of Biomechanics, International Society of Biomechanics in Sports,



and the National Strength and Conditioning Association. AuraLea's research interests are identifying neuromuscular and biomechanical sex dimorphism in athletic and tactical populations, with the goal of mitigating risk of injury, particularly in females compared to their male counterparts.

## Invited Speaking Engagements

***Injuries in combat sports & sports-related concussion***, September 2020.

Reidar Lystad, PhD

Macquarie University, guest lecture.

***Changing up undergraduate neuroscience education with the use of commercial technology***, May 2020.

Bianca De Wit, PhD

MQ Learning Technology Research Cluster and School of Education Research Seminar Series

## Presentations by BioPPEX Faculty and HDR Students

***International Congress of Soldiers' Physical Performance February 12<sup>th</sup>, 2020. Quebec City, Quebec, Canada.***

- "Biomechanical responses during a standardized load carriage task are sex-specific,"  
Jodie Wills, PhD.
- "Males and females respond differently over a 5 km loaded march and after 10 weeks of training,"  
Tim Doyle, PhD.

## Peer-Reviewed BioPPEX Publications

Bennett H, **Fuller JT**, Milnese S, Jones S, Moore E, Chalmers S. The relationship between movement quality and physical performance in elite Australian football players. *J Strength Cond Res*. Accepted October 10, 2020.

Bonacci J, Fox A, Hall M, **Fuller JT**, Vicenzino B. Effect of gait retraining on segment coordination and joint variability in individuals with patellofemoral pain. *Clin Biomech* 2020; 80: p.105179. Doi: <https://doi.org/10.1016/j.clinbiomech.2020.105179>

Bonacci J, Fox A, Hall M, **Fuller JT**, Vicenzino B. Footwear and cadence effect gait variability in runners with patellofemoral pain. *Med Sci Sports Exerc* 2020; 52(6): p.1354-1360. Doi: <https://doi.org/10.1249/MSS.0000000000002267>

Brown, TN, **Fain, AC**, Seymore, KD, Lobb, NJ. Sex and Stride Impact Joint Stiffness during Loaded Running. *J Appl Biomech* 2020, IN PRESS. Doi: <https://doi.org/10.1123/jab.2020-0135>

Burianova, H, Marstaller, L, Rich, A, Williams, MA, Savage, G, Ryan, M, **Sowman, PF**. Motor neuroplasticity: A MEG-fMRI study of motor imagery and execution in healthy ageing. *Neuropsychologia* 2020; 146: p.107539. Doi: <https://doi.org/10.1016/j.neuropsychologia.2020.107539>

de Campos TF, Maher CG, **Fuller JT**, Steffens D, Attwell S, Hancock MJ. Prevention strategies to reduce future impact of low back pain. A systematic review and meta-analysis. *Br J Sports Med*, 2020. Doi: <https://doi.org/10.1136/bjsports-2019-101436>

**Doyle, E**. Appraisal of Clinical Practice Guideline: Patellofemoral Pain: Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability and Health From the Academy of Orthopaedic Physical Therapy of the American Physical Therapy. *J Physiother* 2020; 66(2): p.134. Doi: <https://doi.org/10.1016/j.jphys.2020.02.008>

**Fain, AC**, Lobb, NJ, Seymore, KD, Brown, TN. Lower Limb Biomechanics Differ between Sexes during Maximal Loaded Countermovement Jumps. *J Strength Cond Res* 2020, IN PRESS. Doi: <https://doi.org/10.1519/JSC.0000000000003889>

Fajardo Pulido D, **Lystad RP**. Epidemiology of injuries in ultimate (frisbee): A systematic review. *Sports* 2020; 8(12): 168. Doi: <https://doi.org/10.3390/sports8120168>

- Faris M, **Lystad RP**, Harris I, Curtis K, Mitchell RJ. Fracture-related hospitalisations and readmissions of Australian children 16 years: A 10-year population-based cohort study. *Injury* 2020; 51(10): p.2172–2178. Doi: <https://doi.org/10.1016/j.injury.2020.07.032>
- Fuller JT**, Lynagh M, Tarca B, Zacharia A, Townsley A, Gleeson C, Milanese S, Chalmers S. Functional Movement Screen pain location and impact on scoring has limited value for junior Australian football injury risk estimation. *J Orthop Sports Phys Ther* 2020; 50(2): p.75-82. Doi: <https://www.jospt.org/doi/10.2519/jospt.2020.9168>
- Glassbrook DJ**, **Fuller JT**, Alderson JA, **Doyle TLA**. Foot accelerations are larger than tibia accelerations during sprinting when measured with inertial measurement units. *J Sports Sci* 2020; 38(3): p.248-255. Doi: <https://doi.org/10.1080/02640414.2019.1692997>
- Glassbrook DJ**, **Fuller JT**, Alderson JA, **Doyle TLA**. Measurement of lower-limb asymmetry in professional rugby league: a technical note describing the use of inertial measurement units. *PeerJ* 2020; 8: e9366. Doi: <https://doi.org/10.7717/peerj.9366>
- Glassbrook DJ**, **Fuller JT**, Wade JA, **Doyle TLA**. Not all physical performance tests are related to early season match running performance in professional rugby league. *J Strength Cond Res* 2020; IN PRESS.
- Hirosawa, T, Kikuchi, M, Fukai, M, Hino, S, An, K-M, **Sowman, PF**, Takahashi, T, Yoshimura, Y, Miyagishi, Y & Yoshio Minabe, Y. Relationship between epileptiform discharges and social reciprocity or cognitive function in children with and without autism spectrum disorders: an MEG study. *Psychiatry Clin Neurosci* 2020; 74(9): p.510-511. Doi: <https://doi.org/10.1111/pcn.13093>
- Jhala, P**. Appraisal of Clinical Practice Guideline: Centers for Disease Control and Prevention Guideline on the Diagnosis and Management of Mild Traumatic Brain Injury Among Children. *J Physiother* 2020; 66(1): 60. Doi: <https://doi.org/10.1016/j.jphys.2019.11.003>
- Jones S, **Fuller JT**, Chalmers S, Debenedictis TA, Zacharia A, Tarca B, Townsley A, Milanese S. Combining physical performance and Functional Movement Screen testing to identify elite junior Australian Football athletes at risk of injury. *Scand J Med Sci Sport* 2020; 30(8): p.1449-1456. Doi: <https://doi.org/10.1111/sms.13686>
- Lundquist M, Nelson MJ, Debenedictis T, Gollan S, **Fuller JT**, Larwood T, Bellenger CR. Set distance time-trials for predicting maximal aerobic speed in female Australian Rules Footballers. *J Sci Med Sport* 2020; IN-PRESS. Doi: <https://doi.org/10.1016/j.jsams.2020.10.002>
- Lystad RP**, Brown BT, Swain MS, Engel RM. Service utilisation trends in the manual therapy professions within the Australian private healthcare setting between 2008 and 2017. *Chiropr Man Therap* 2020; 28: 49. Doi: <https://doi.org/10.1186/s12998-020-00338-1>
- Lystad RP**, Curtis K, Soundappan SVS, Mitchell RJ. Trends of traumatic spinal injury-related hospitalizations in Australian children over a 10-year period: A nationwide population-based cohort study. *Spine J* 2020; 20(6): p.896–904. Doi: <https://doi.org/10.1016/j.spinee.2020.01.002>
- Lystad RP**, Augustovicová D, Beskin K, Harris G, Arriaza R. Epidemiology of injuries in Olympic-style karate competitions: Systematic review and meta-analysis. *Br J Sports Med* 2020; 54(16): p.976–983. Doi: <http://dx.doi.org/10.1136/bjsports-2020-101990>
- Lystad RP**, Fajardo Pulido D, Peters L, Johnstone M, Ellis LA, Braithwaite J, Wuthrich V, Amin J, Cameron CM, Mitchell RJ. Monitoring health and well-being in emerging adults: Protocol for a pilot longitudinal cohort study. *JMIR Res Protoc* 2020; 9(4): e16108. Doi: <https://doi.org/10.2196/16108>
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## Outreach

### IN PRESS AND MEDIA

#### Olympic Combat Sport Injuries

Dr. Reidar Lystad, research.

November 28<sup>th</sup>, 2020.

#### Repetitive Head Trauma and Long-Term Health Outcomes

Dr. Reidar Lystad, expert comment.

November 21<sup>st</sup>, 2020

### APPLIED BIOMECHANICS – FROM THE FIELD TO THE FUTURE ONLINE SYMPOSIUM

In July 2020, the BioPPEX group organised and hosted an open online symposium sponsored by the Australian and New Zealand Society of Biomechanics (ANZSB). Initially this symposium was intended to be an in-person gathering at Macquarie University, but due to COVID restrictions at the time this event was held virtually. The event was attended by around 60 individuals, with some joining us from the US and UK!



#### ANZSB Online Symposium 2020:

- Applied Biomechanics -

From the Field to the Future

July 2<sup>nd</sup>, 2020 | 6 pm – 8 pm

Registration required prior to the symposium: <https://bit.ly/2BlaUMZ>



MACQUARIE  
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BioPPEX  
Biomechanics  
Physical Performance  
Exercise  
Research Group



#### Associate Professor Tim Doyle

“From sports to military: How biomechanics and sports science can help”

Associate Professor Tim Doyle is a biomechanics and physical performance researcher. He was previously employed as a human performance scientist by the Australian Department of Defence, with published research covering military performance, injury screening, and employment standards. He is an accredited Professional Strength and Conditioning Coach with the Australian Strength and Conditioning Association, a Certified Strength and Conditioning Specialist with the National Strength and Conditioning Association, and an accredited level 2 Sport Scientist, and Exercise Scientist with Exercise and Sport Science Australia. His professional and academic collaborations extend both locally and internationally, including professional sports (Rugby Union and League), and Military and Law Enforcement agencies. His research involves neuromuscular biomechanics, injury prevention, and physical preparation in athletes and tactical populations.



#### Daniel Glassbrook

“Lower-limb asymmetries can be measure in professional rugby league match-play with inertial measurement units”

Daniel is in the final two months of an industry-based PhD, with Macquarie University and the South Sydney Rabbitohs. His doctoral studies are focused on external mechanical load monitoring in professional rugby league.



#### Dr. Suzi Edwards

“Using biomechanics to challenge long held coaching beliefs in rugby-style tackling”

Dr Suzi Edwards is an experienced applied biomechanist with \$1.5M in competitive grants. She currently is led CI of a US\$295k myotendinous injury grant awarded and a CI of a US\$207k tendinopathy grant awarded by General Electric and National Basketball Association Orthopaedics and Sports Medicine Collaboration; these grants were only 1 of 4 or 6 grants awarded worldwide and the only successful Australian applicant. Her research engages a multi-disciplinary approach encompassing five STEMM research areas, including the science and medicine of musculoskeletal injuries, inertial sensor-based technology, and non-linear mathematical tools to investigate the role of human movement variability within biological systems during movement. Dr Edwards in collaboration with A/Prof Andrew Gardner and Prof Gary Strangman obtained \$8k of seed funding from the National Rugby League to conduct a pilot study on the tackling technique.



#### Dr. Gavin Lenton

“A framework for creating the Digital Athlete”

Dr Gavin Lenton is a research fellow within Menzies Health Institute Queensland and the Griffith Centre for Biomedical and Rehabilitation Engineering, Griffith University. He obtained his PhD from Griffith University, in which he collaborated with Defence Science and Technology Group to examine the effect of wearing different body armour configurations on lower-limb joint loading and power production in soldiers. His current research focuses on extending novel methods for real-time assessment of joint loading, and creating personalised, digital representations of our musculoskeletal systems and wearable devices. He is also interested in developing field-based technologies that enable high fidelity measurement of motion in the real world.

### ABC REGIONAL SYDNEY 2020

The Australasian Biomechanics Conference (ABC) is ANZSB's scientific meeting held every two years and helps to connect biomechanists from Australia, New Zealand and the Asia-Pacific region. Following the postponement of ABC 12 Adelaide to 2021 due to ongoing uncertainty, a number of regional ABCs were organised to facilitate local meetings in 2020. These events were hosted by a number of ANZSB members from Brisbane, Sydney, and Canberra to provide a platform for students and ECRs to gain an in-person conference like presentation experience.

The ABC Regional Sydney was held at Macquarie University on December 8<sup>th</sup>, 2020. It was a very welcomed event that enabled local researchers to connect after a few trying and uncertain months. Importantly, it also provided an opportunity for student and early-career researchers to present their work, particularly for those students where this year was their final and only year to do so. It was fantastic to see so many familiar and new faces at the event!

Fifteen presentations, including 12 student presentations and 3 ECR presentations, were given over the course of the day and covered a wide range of topic areas. All speakers delivered wonderful talks, particularly the speakers who were participating in their first in-person conference presentation experience! The conference program, including all presentation abstracts, is available to download via: <https://www.mq.edu.au/research/research-centres-groups-and-facilities/groups/biomechanics-and-physical-performance-of-exercise/events/abc-regional-sydney-2020>

Due to the success of the event, it is intended that these meetings will continue to take place in future years to provide ongoing engagement, support, and opportunities for students and ECRs in the Sydney Region. Thank you to ANZSB for their support of this event and the 'Best Student Presentation Award'. To all the speakers thank you, as this event would not have been possible without you. We also wish to thank Vicon and iMeasureU for their support of the networking function.

**ABC Regional Sydney 2020 Organising Committee**

Associate Professor Tim Doyle, Macquarie University

Dr. Jodie Wills, Macquarie University

Dr. Elizabeth Clarke, University of Sydney

Dr. Carina Blaker, University of Sydney

Dr. Bart Bolsterlee, Neuroscience Research Australia



*Macquarie University is a vibrant hub of intellectual thinkers, all working towards a brighter future for our communities and our planet.*

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Macquarie is uniquely located in the heart of Australia's largest high-tech precinct, a thriving locale which is predicted to double in size in the next 20 years to become the fourth largest CBD in Australia.

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