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FRONT MATTER: EDITORIAL

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How hot is it Down Under?

This editorial introduces the 2-part special issue on *Temperature-related Sciences in Australia and New Zealand* within the journal *Temperature*°; **Part 1**: Volume 3, Issue 2 and **Part 2**: Volume 3, Issue 3. The question posed, *"How hot is it Down Under?,"* and indeed possible answer(s) can be construed in different ways depending on one's standpoint. For example, *Terra Australis* (Latin: "southern land") is the driest inhabited continent symbolised to many by the scorched Outback and *Uluru* (Ayer's Rock) or sun-drenched beaches such as Sydney's Bondi, while *Aotearoa* (te reo Māori: "land of the long white cloud") owes much of its varied and beautiful topography to high volcanic activity and geothermal fields. Alternatively, a search of PubMed using the terms "physiology," "body temperature" and "Australia/New Zealand" results in 2,251 entries of which >50% are listed within the last 2 decades, illustrating the prolific efforts in temperature-related sciences in the antipodes.

Despite indigenous people having inhabited Australia and New Zealand for at least 40,000 and 800 years, respectively, Australasia has remained geographically isolated until relatively recently, ensuring much of its biota is unique and native including more than 80% of its florae. In concert with its varied geography and climate, more than 80% of Australia's mammals are endemic including well-known marsupials such as the kangaroo, koala, and wombat. Weather patterns can restrict a species' energy intake and activity thereby determining continental distribution, something that Roberts et al.[1] explore by observing foraging and shade-seeking behavior in red and western gray kangaroo species while concurrently measuring local weather. They report that western gray kangaroos spend more time in the shade and foraging than do red kangaroos. Being less able to tolerate radiant heat forces greys to a greater absolute shade requirement. Similarly, the impact of climate and geography on the distribution of *Antechinus*, a shrew-like marsupial that inhabits a large altitudinal range, is investigated by Cooper et al.[2] who compare the thermal, metabolic, and hygric physiology as a function of ambient temperature in 4 species, 2 from low and 2 from high altitude. They find no differences in the basic physiology of the 4 species, which is similar to other non-alpine species, indicating that marsupials, in general, have adequate physiology for life in alpine environments. Several other papers within this special issue contribute findings from comparative/ecological and conservation physiology such as cold-defense in rats and torpor in desert bats.

From unique faunae to rare medical conditions: malignant hyperthermia (MH, incidence of 1: 5,000–100,000) is a life-threatening disorder that typifies a gene-environment interaction. A triggering agent used during general anesthesia causes a rapid and sustained rise in body temperature that, if left untreated, can be fatal. While MH susceptibility can be diagnosed by testing of skeletal muscle biopsy tissue, it would be advantageous to use DNA testing. However, only 35 of 400+ potential variants in the *RYR1* gene have been classified and can be used for DNA diagnostic tests. In this issue, Stephens et al.[3] identify that an additional variant should be added to the list of diagnostic mutations for susceptibility to MH. Although hyperthermia can be detrimental to health, it can also be therapeutically beneficial; heat is produced during physical activity, with recent evidence indicating that local and whole-body passive heat generates favorable arterial flow and vascular adaptations. However, only the upper limbs have been assessed, and therefore, Thomas et al.[4] compared lower-limb heating by hot-water immersion with the same duration treadmill exercise in young healthy adults. The hot-water immersion induced positive shear stress and cardiovascular responses in

vessels prone to atherosclerosis. The heating protocol was well-tolerated, leading Thomas et al.[4] to suggest that clinical populations whose exercise capacity is severely limited, such as patients with peripheral arterial disease and heart failure, stand to benefit from heat therapy. Several other papers within this special issue address the topic of extreme environmental temperature, and climate change, and how it impacts on human health.

Sport is an integral part of Australasian culture and identity. Between them, Australia and New Zealand have hosted 2 summer Olympic and 6 Commonwealth Games. Each has claimed the other's scalp in recently becoming world champions (cricket and rugby union), and given their island status it is unsurprising that swimming and swimming-related sports (e.g. triathlon) feature predominantly in their respective Olympic and world championship medal tallies. Readers are directed toward the cover image of this special issue, where 2 elite triathletes douse themselves with water from their bottles during the 2015 World Triathlon Series event on the Gold Coast, Australia. There has been intense research interest over the past decade concerning how cold drinks, and even 'slushies', can help cool athletes and improve performance. Two riddles for any reader wanting to pit their wits against some of Australasia's temperature experts: 1) when riding your bike on the road in a hot climate, how do you keep your drink bottle contents cool?, and 2) should you drink the contents or pour them over your head? (*hint*: look for special issue editorials). Heat stress can also be an occupational hazard, with a combination of factors, such as encapsulating personal protective equipment (PPE), high (enforced) work intensities and durations, and high ambient temperatures all increasing the risk of heat illness, and thereby compromising worker safety and productivity. In this issue, Hunt et al.[5] compare the 2 competing demands of operational capability with the need to protect personnel by examining heat strain and the risk of heat illness during a military activity that exceeds prescribed work duration limits. Their results demonstrate that the majority of personnel may be prevented from operations in hot environments due to these work duration limits, thus constraining the development of an optimized military. Without these limits in place, a minority of personnel would have progressed to dangerously high core temperature – a clear conundrum between protecting a workforce while ensuring operational preparedness. Further contributions discuss whether cooling beneath PPE reduces risk-taking behavior during conditions and practices similar to those encountered by medical personnel treating the Ebola outbreak in West Africa, and a review of occupational heat exposure and physiological strain across Australia's industries.

Should this editorial 'temperature-teaser' entice you toward reading this special issue of *Temperature*°, *Temperature-related Sciences in Australia and New Zealand*, we hope that you agree that no matter the interpretation of this special issue's title, the answer to the question "*How hot is it Down Under*?" is "*Very!*"

It is fitting that we close by paraphrasing an episode of Monty Python's Flying Circus entitled **Scott of the Antarctic**: "*…if you enjoy reading this issue half as much as we enjoyed editing it, then we've enjoyed it twice as much as you…*"!

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Toby Mündel
School of Sport and Exercise, Massey University
Private Bag 11-222, Palmerston North, New Zealand
t.mundel@massey.ac.nz

Eugene Nalivaiko
School of Biomedical Sciences and Pharmacy
University of Newcastle, Callaghan, NSW, Australia

Stephen Kent
School of Psychology and Public Health
La Trobe University, Bundoora, VIC, Australia

Shane K. Maloney
School of Anatomy, Physiology and Human Biology
The University of Western Australia, Crawley, WA, Australia

Irina Vetter
Institute for Molecular Biology
The University of Queensland, Brisbane, QLD, Australia