

## EDITORIAL | OPEN ACCESS

# Exercise, exercise-like stimuli, and conditioning medicine

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Clinical and biomedical research efforts will be directed at the prevention and treatment of chronic diseases for the remainder of human history. Of the leading causes of death in industrialized and developing countries, 5/6 (heart diseases, cancers, respiratory diseases, stroke, and diabetes) are directly or indirectly influenced by lifestyle factors. To this end, the various sub-fields of conditioning medicine explore strategies to precondition the body, organs (and organ systems), and tissues against the pathological stressors that underpin lifestyle-related diseases. Among the leading approaches to lifestyle medicine is the application of regimented exercise, in addition to intentional physical activity, for improved health outcomes. Indeed, public health findings indicate that physical inactivity is among the leading causes of morbidity and mortality, while being physically active (if not physically fit) is among the most potent interventions for preventing or treating most chronic diseases.

The current issue of *Conditioning Medicine* includes the first part of a two-part special issue addressing several topics of exercise preconditioning as a means of understanding disease prevention and treatment. While exercise physiology is an applied science, by definition, modern approaches to exercise preconditioning are fundamentally aligned with the sound reductionist practices of biomedical science. In this regard, McGinnis and Quindry provide a novel rationale by which exercise influences circadian biology in a way that counters ischemic challenges. Similarly, Miller and Quindry review one of the most well-established forms of exercise-based preconditioning, exercise induced cardioprotection against ischemia reperfusion injury. The health benefits derived from exercise, independent of the disease condition or clinical outcome, are the result of inseparable cellular stimuli including, heat,  $Ca^{2+}$  transients, and bioenergetic strain (aerobic and anaerobic). In this regard, the second

part of the two-part special issue will be published in the subsequent volume of *Conditioning Medicine* and will feature an original science investigation by Shanely and colleagues, which investigates the role of thermal preconditioning against contusion injury. Finally in this same issue, Ballmann and colleagues will provide a comprehensive review of dietary quercetin supplementation as a potential therapeutic against a host of chronic diseases. While the Ballmann review may not appear to be exercise-related at first glance, understanding of quercetin treatment efficacy appears to be linked to the fact that the compound is, when delivered at therapeutic doses, like exercise, a potent stimulator of SIRT1-PGC1 $\alpha$ . Moreover, chronic quercetin treatment consistently produces endogenous antioxidant and immunoregulatory benefits that parallel those observed with healthful exercise training.

As a final consideration, it is worth admitting to exercise naysayers that virtually every person on Earth is freely capable to exercise as part of a healthy lifestyle, but for reasons that have not been fully elucidated, choose not to be sufficiently active. While it may be tempting for some to regard this latter fact with contempt, dismissing the salubrious effects of exercise impractical, it is also worth noting that there is a growing rationale by which exercise science is a novel approach to therapeutic discovery within biomedicine. Indeed, both the McGinnis and the Miller reviews included in this issue of *Conditioning Medicine* attend to the fact that, independent of population-wide adherence rates, exercise is a sustainable, cost-effective, and pragmatic means of uncovering potent mechanisms of cellular preconditioning.

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