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Guest Editorial

Methodology of Research and Applications of Electric Fields

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Bioelectricity is central to the physiology and pathology of wound healing, nervous system function, immune responses, cardiac and skeletal muscle function, and cancers. Recent technological advances in engineering, physics, chemistry, and computer science have spawned wide-ranging electric field-based methodologies with biological and biomedical applications, which continue to emerge. This special issue focuses on bioelectricity-based methodological innovations and applications, and is intended as a springboard for interdisciplinary innovations and ideas that will be reported in future issues of *Bioelectricity*.

This special issue features a topical ''My Experiments in Bioelectricity (MEB)'' perspective by Colin McCaig from the University of Aberdeen in Scotland, which recounts his scientific research journey in bioelectricity of >45 years, includes crossing paths with many other pioneers in the field, and outlines future perspectives and current collaborations in the development of novel electrical therapeutic devices.

Two excellent comprehensive reviews highlight technological advances for electrical neurostimulation and their potential for biomedical applications. Specifically, Jarno Tanskanen and colleagues from Tampere University in Finland review technologies focused on closed loop stimulation of neural systems and Stephanie Iwasa and colleagues from the University of Toronto in Canada outline advances in neurostimulation for regenerative medicine with techniques incorporating stem cells.

Other contributions in this issue are exciting original research articles, including a simplistic theoretical exploration of using Brownian particle motion to account for bioelectricity emissions of DNA (Richard Oates from Rhodium Scientific in Texas), a study that uses quadrupoles incorporating bipolar cancellation as a novel way to achieve remote focused electrostimulation (Shu Xiao and colleagues from the Old Dominion University in Virginia), development of thermochromic tissue phantoms to allow rapid characterization of thermal effects associated with pulsed electric field treatments and highlight the effective use of active cooling to reduce such thermal effects (Michael Sano and Matthew DeWitt from the University of North Carolina), tissue engineering chamber development for wireless electrical stimulation of cardiac tissues *in vivo* (Damián Hernández and colleagues from the St Vincent's Institute of Medical Research in Australia), and finally microfluidic device development to optimize electrical stimulation for guiding human cell migration safely (Zhiqiang Zhao and colleagues from the University of California at Davis).

The special issue is rounded out by contributions from the editorial team, including a book review, bioelectricity-related meetings from around the world and *Bioelectricity Buzz*, a selection of recent articles that will interest *Bioelectricity* readers. Some additional articles submitted to this special issue will be included in a special section in the March 2021 issue on acceptance.

Bioelectricity has a wide-reaching relevance and this special issue emphasizes that. Articles come from contributing authors across the globe and highlight the rapid advances in bioelectricity-based research methods and application development. Novel electrode designs, microfluidic device development, wireless electrical stimulation, and other emerging technologies will enable exciting bioelectricity-related research and clinical applications.

Although interdisciplinarity is increasing across all research arenas, this issue demonstrates clearly that innovations in the field of bioelectricity inherently integrate techniques and technologies drawn from medicine, computer science, physics, biology, chemistry, materials science, and genetics (and others). We are excited about the renaissance in bioelectricity research and we look forward to publishing many more breakthroughs in the future.

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