

Open camera or QR reader and
scan code to access this article
and other resources online.



A Multi-Faceted Issue to Complete Volume 6

Michael Levin, PhD¹ and Mustafa B.A. Djamgoz, PhD²

Dear Bioelectricity Community,

A multi-faceted issue to complete volume 6

It is with great pleasure that we complete volume 6 of *Bioelectricity*. The field continues to blossom, and one can bet that there is some kind of “bioelectricity” in every walk of life. Some of these are represented in this issue, topics ranging from sustainable/renewable energy to immunology and an application of machine learning.

In addition, a few recent studies published elsewhere are worthy of note. Overall, these involve roles for bioelectricity in the scales of cellular properties, morphogenesis, and inter-animal behavior. Liang et al.¹ provide evidence that the ion channel Anoctamin coordinates morphogenesis in the urochordate notochord. Operating across several scales of organization, it works in concert with the Na⁺/Ca²⁺ exchanger and the endoplasmic reticulum residing SERCA, RyR, and IP3R proteins to establish Ca²⁺ signaling molecular modules that regulate notochord morphogenesis and Ca²⁺ dynamics appropriate to specific stages of *Ciona intestinalis* (an early chordate) development. To complement the use of bioelectric hardware by living tissues, Barnana et al. review biodielectrics—piezo, pyro, and ferroelectricity in biological and bio-inspired materials.² Song et al. show that electrically-stimulated conductive gels enhanced human mesenchymal stem cell viability and attachment.³ A remarkable study⁴ showed that African weakly electric fish *Gnathonemus petersii* use each other's electric field sense to extend electrolocation range, effectively seeing and discriminating objects “through each other's eyes” (except it's an electric sense and not vision). It has been suggested by one of us (M.L.) that bioelectricity serves as a kind of cognitive glue—binding cells and other components into coherent large-scale systems at the level of single bodies,⁵ and even inter-embryo communication;⁶ this finding shows that evolution reused the same trick at a larger scale among individuals in a behavioral setting. When it comes to bioelectricity, as above, so below.

Looking forward to the future, there is a major bioelectricity meeting coming up at Oxford University in April 2025. This

conference is entitled The Bioelectricity Cluster organized by Rosalia Moreddu, Malavika Nair and Massimo Mariello.⁷ The proceedings will be complemented by a Special Issue of *Bioelectricity* planned for the June 2025 issue. A call for papers will be issued on line very soon. Our close relationship with the International Society for Electroporation-Based Technologies and Treatments continues to grow. A further Special Issue on Recent Developments in Electroporation is planned for December 2025.

Altogether an exciting time for our field indeed. We wish you well for the New Year and look forward to many more fruitful interactions.

References

1. Liang Z, Dondorp DC, Chatzigeorgiou M. The ion channel Anoctamin 10/TMEM16K coordinates organ morphogenesis across scales in the urochordate notochord. *PLoS Biol* 2024; 22(8):e3002762; doi: 10.1371/journal.pbio.3002762
2. Barnana HD, Tofail SAM, Roy K, et al. Biodielectrics: Old wine in a new bottle? *Front Bioeng Biotechnol* 2024;12: 1458668; doi: 10.3389/fbioe.2024.1458668
3. Song S, McConnell KW, Shan D, et al. Conductive gradient hydrogels allow spatial control of adult stem cell fate. *J Mater Chem B* 2024;12(7):1854–1863; doi: 10.1039/d3tb02269b
4. Pedraja F, Sawtell NB. Collective sensing in electric fish. *Nature* 2024;628(8006):139–144; doi: 10.1038/s41586-024-07157-x
5. Levin M. Bioelectric networks: the cognitive glue enabling evolutionary scaling from physiology to mind. *Anim Cogn* 2023;26(6):1865–1891; doi: 10.1007/s10071-023-01780-3
6. Tung A, Sperry M, Clawson W, et al. Embryos Assist Each Other's Morphogenesis: calcium and ATP signaling mechanisms in collective resistance to teratogens. In review 2023.
7. <https://sites.google.com/view/bioelectricitycluster/speakers?authuser=0>

—Michael Levin, PhD and Mustafa B.A. Djamgoz, PhD

¹Tufts University, Medford, Massachusetts, USA.

²Imperial College London, London, United Kingdom.