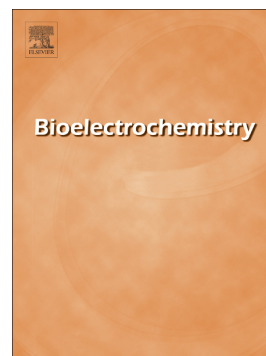


## Accepted Manuscript

Bioelectrical coupling in multicellular domains regulated by gap junctions: A conceptual approach

Javier Cervera, Alexis Pietak, Michael Levin, Salvador Mafe



PII: S1567-5394(18)30063-X  
DOI: doi:[10.1016/j.bioelechem.2018.04.013](https://doi.org/10.1016/j.bioelechem.2018.04.013)  
Reference: BIOJEC 7149  
To appear in: *Bioelectrochemistry*  
Received date: 6 February 2018  
Revised date: 13 April 2018  
Accepted date: 17 April 2018

Please cite this article as: Javier Cervera, Alexis Pietak, Michael Levin, Salvador Mafe , Bioelectrical coupling in multicellular domains regulated by gap junctions: A conceptual approach. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Biojec(2017), doi:[10.1016/j.bioelechem.2018.04.013](https://doi.org/10.1016/j.bioelechem.2018.04.013)

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

# Bioelectrical coupling in multicellular domains regulated by gap junctions: a conceptual approach

Javier Cervera,<sup>1</sup> Alexis Pietak,<sup>2</sup> Michael Levin,<sup>2,3,\*</sup> Salvador Mafe<sup>1,\*\*</sup>

<sup>1</sup>*Dept. de Termodinàmica, Facultat de Física, Universitat de València, E-46100 Burjassot, Spain*

<sup>2</sup>*Allen Discovery Center, Tufts University, Medford, Massachusetts 02155-4243, USA*

<sup>3</sup>*Biology Department, Tufts University, Medford, Massachusetts 02155-4243, USA*

## ABSTRACT

We review the basic concepts involved in bioelectrically-coupled multicellular domains, focusing on the role of membrane potentials ( $V_{\text{mem}}$ ). In the first model used, single-cell  $V_{\text{mem}}$  is modulated by two generic polarizing and depolarizing ion channels, while intercellular coupling is realized via voltage-gated gap junctions. Biochemical and bioelectrical signals are integrated via a feedback loop between  $V_{\text{mem}}$  and the transcription and translation of a protein forming an ion channel. The effective rate constants depend on the single-cell  $V_{\text{mem}}$  because these potentials modulate the local concentrations of signaling molecules and ions. This electrochemically-based idealization of the complex biophysical problem suggests that the spatio-temporal map of single-cell potentials can influence downstream patterning processes by means of the voltage-gated gap junction interconnectivity, much as in the case of electronic devices where the control of electric potentials and currents allows the local modulation of the circuitry to achieve full functionality. An alternative theoretical approach, the *BioElectrical Tissue Simulation Engine* (BETSE), is also presented. The BETSE modeling environment utilizes finite volume techniques to simulate bioelectric states from the perspective of ion concentrations and fluxes. This model has been successfully applied to make predictions and explain experimental observations.

Corresponding authors:

\**E-mail address:* michael.levin@tufts.edu (M. Levin)

\*\* *E-mail address:* smafe@uv.es (S. Mafe)

Download English Version:

<https://daneshyari.com/en/article/7704259>

Download Persian Version:

<https://daneshyari.com/article/7704259>

[Daneshyari.com](https://daneshyari.com)