



Virginia Commonwealth University  
VCU Scholars Compass

---

Biology and Medicine Through Mathematics  
Conference

---

## On the Optimization of Biological Field Effect Transistors

Ryan M. Evans

*National Institute of Standards and Technology, ryan.evans@nist.gov*

Arvind Balijepalli

*National Institute of Standards and Technology, arvind.balijepalli@nist.gov*

Anthony Kearsley

*National Institute of Standards and Technology, anthony.kearsley@nist.gov*

Follow this and additional works at: <https://scholarscompass.vcu.edu/bamm>

 Part of the [Life Sciences Commons](#), [Medicine and Health Sciences Commons](#), and the [Physical Sciences and Mathematics Commons](#)

---

<https://scholarscompass.vcu.edu/bamm/2020/talk/43>

This Event is brought to you for free and open access by the Dept. of Mathematics and Applied Mathematics at VCU Scholars Compass. It has been accepted for inclusion in Biology and Medicine Through Mathematics Conference by an authorized administrator of VCU Scholars Compass. For more information, please contact [libcompass@vcu.edu](mailto:libcompass@vcu.edu).

# On the Optimization of Biological Field Effect Transistors

Ryan M. Evans<sup>1,\*</sup>, Arvind Balijepalli<sup>2</sup>, Anthony Kearsley<sup>1</sup>

<sup>1</sup> *Applied and Computational Mathematics Division*

<sup>2</sup> *Microsystems and Nanotechnology Division*

*National Institute of Standards and Technology*

*100 Bureau Drive*

*Gaithersburg*

*MD 20899*

\*ryan.evans@nist.gov

## Abstract

Biological field effect transistors (Bio-FET) are low-cost, portable, and accurate detection tools that offer a path to personalized healthcare through tailored care to individuals or specific subsets of a population. One promising strategy for optimal design of (Bio-FET) seeks design variables that maximize a Bio-FET's signal which, concurrently, leads to signal distortion. A new mathematical formulation of this important problem is presented which employs a nonlinear integrodifferential equation and imposes constraints to simultaneously optimize two competing objectives. These two conflicting objectives can be reconciled through an optimal control formalism developed by Jacques-Louis Lions.