

# Electrical Cell Biology Workshop

28/29 March 2019

University of Warwick, Coventry, UK



**Bio Electrical Engineering  
Innovation Hub at Warwick**

The theoretical and experimental inquiry within biological sciences has never fully embraced an electrical viewpoint. While important studies of bioelectrical processes have and are being conducted, such as the Nobel-winning chemiosmotic mechanism of energy generation on membranes and the chemical basis of neuronal electrical processes, these are commonly considered as confined processes not relating to other cellular functions or being specific to certain cell types only (e.g. neurons). Fragmented individual studies on a diverse range of biological systems, conducted over the last decade, however, show that electrical forces and electrochemical gradients are fundamental in maintaining all kinds of cellular functions and organising them across space/time.

**We are at an exciting nexus, to develop a new theoretical and experimental framework that links electrical forces to the cell biological mechanisms that generate, sense, and use them.** The goal of this international workshop is to facilitate this process through interdisciplinary scientific exchange.

## SPONSORED BY:



UK Research  
and Innovation



**EPSRC**

Engineering and Physical Sciences  
Research Council

## FINAL PROGRAMME

All sessions: 25 min talks + 5min for questions and changeover between talks

### 28 March 2018:

9:30 – 10:20 Registration  
10:20 – 10:30 Introduction and workshop motivation (O. Soyer)

#### 10:30 – 12:00      **Session 1: Electrochemistry meets biology**

**Shelley Minteer (U of Utah):** *'Mechanisms of Extracellular Electron Transfer: From Methods of Evaluation to Materials for Promotion'*

**Pat Unwin (U of Warwick):** *'Lab-on-a-Tip: Multifunctional Nanoscale Electrochemical Probes for Single Cell Measurements'*

**Andrew Marsh (U of Warwick):** *'Bacterial adhesion and molecular interactions'*

12:00 – 13:30      Lunch

#### 13:30 – 15:00      **Session 2: Mammalian cell bioelectricity**

**Mustafa Djamgoz (Imperial College London):** *'Bioelectricity of cancer'*

**Sonia Antoranz Contera (U of Oxford):** *'Electromechanical coupling in neurons, collagen and the extracellular matrix'*

**Roland Knorr (Max Planck Institute):** *'Membranes in electric fields'*

15:00 – 15:30      Coffee

#### 15:30 – 17:00      **Session 3: Bacterial electrical signaling**

**Minsu Kim (Emory University):** *'Tight regulation of electrically-charged substrate transport'*

**Arthur Prindle (Northwestern University):** *'Emergent metabolic dynamics in microbial communities'*

**Munehiro Asally (U of Warwick):** *'Electrically induced bacterial membrane potential dynamics'*

17:00 – 18:00      Coffee and Open discussion

18:00 – 19:00      Poster Session and Drinks

19:00 – Late      Dinner

**29 March 2019:**

**9:30 – 11:00      Session 4: Electro-biophysics and bioengineering**

**Robert Bradley (Imperial College London):** *'Engineering electroactivity for signalling, energy, and electrosynthesis'*

**Dr Paulo Rocha (U of Bath):** *'Detecting minuscule electrical activity of cell populations'*

**Teuta Pilizota (U of Edinburgh):** *'Single-cell bacterial electrophysiology'*

**11:00 – 11:30      Coffee**

**11:30 – 13:00      Session 5: Metabolism as an electron-flow system**

**Orkun Soyer (U of Warwick):** *'Understanding metabolism as an electrical process'*

**Matthias Heinemann (U of Groningen):** *'An upper limit on Gibbs energy dissipation governs cellular metabolism'*

**Joff Silberg (Rice University):** *'Using synthetic protein electron carriers to control bacterial metabolism'*

**13:00 – 14:00      Lunch**

**14:00 – 15:30      Session 6: Plant bioelectricity**

**Murray Grant (U of Warwick):** *'Do variation potentials underpin systemic plant immunity'*

**George Bassel (U of Birmingham):** *'Information processing and distributed computing in plant organs'*

**Giovanni Sena (Imperial College London):** *'Feel the force: root electrotopism in Arabidopsis'*

**15:30 – 17:00      Coffee/Cake and Open discussion**