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14. ABSTRACT
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**RPPR Final Report**  
as of 29-Aug-2022

Agency Code: 21XD

Proposal Number: 77068LSCF

**Agreement Number: W911NF-20-1-0199**

**INVESTIGATOR(S):**

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**Report Date:** 14-Sep-2022

Date Received: 09-Aug-2022

**Final Report** for Period Beginning 15-Jun-2020 and Ending 14-Jun-2022

**Title:** Support for the 2020 North American meeting of the International Society for Microbial Electrochemistry and Technology

**Begin Performance Period:** 15-Jun-2020

**End Performance Period:** 14-Jun-2022

**Report Term:** 0-Other

Submitted By: Moh El-Naggar

Email: mnaggar@usc.edu

Phone: (213) 740-2394

**Distribution Statement:** 1-Approved for public release; distribution is unlimited.

**STEM Degrees:**

**STEM Participants:**

**Major Goals:** Organization of the 2020\* North American Meeting of the International Society for Microbial Electrochemistry and Technology (\*postponed to 2021 due to COVID-19)

**Accomplishments:** NA-ISMET 2021 was co-organized by Moh El-Naggar from the University of Southern California (USC) and Orianna Bretschger from Aquacycl Inc. The meeting took place on November 17 – 19, 2021 at the Michelson Center for Convergent Biosciences of USC. We hosted a total number of 65 registered participants from across the United States and several international participants. Thanks to the generous support from the Office of Naval Research, Department of Energy, the Army Research Office, the Air Force Office of Scientific Research, the ISMET organization, and Gamry Instruments Inc., we were able to waive registration fees for all participants and reduce travel cost for several early-career researchers. The scientific program included 28 talks (16 from early-career researchers) and 24 posters that highlighted recent advances in microbial electrochemistry. The final program is appended to the uploaded version of this document, along with conference photos, and an ISMET Newsletter summary of the meeting's highlights.

**Training Opportunities:** Nothing to Report

**Results Dissemination:** Nothing to Report

**Honors and Awards:** Awards from the ONR-supported NA-ISMET meeting

Best Oral Presentations:

- Christine Lewis, Arizona State University School of Molecular Sciences and Biodesign Institute
- Grace Chong, University of Southern California

Best Poster Presentations:

- Biki Kundu, Rice University
- Alejandra Hernandez-Santana, University of Oklahoma

**Protocol Activity Status:**

**Technology Transfer:** Nothing to Report

**RPPR Final Report**  
as of 29-Aug-2022

**PARTICIPANTS:**

**Participant Type:** PD/PI

**Participant:** Moh El-Naggar

**Person Months Worked:** 1.00

Project Contribution:

National Academy Member: N

**Funding Support:**

**WEBSITES:**

**URL:** <https://naismet2021.usc.edu/>

Date Received: 09-Aug-2022

**Title:** NA-ISMET Meeting Website

**Description:** NA-ISMET Meeting Website

**Partners**

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I certify that the information in the report is complete and accurate:

Signature: Moh El-Naggar

Signature Date: 8/9/22 1:48PM

**PI Name:** Mohamed Y. El-Naggar

**Organization:** University of Southern California

**ONR Award Number:** N00014-20-1-2217

**Award Title:** Support for the 2020\* North American Meeting of the International Society for Microbial Electrochemistry and Technology

### **Scientific Objectives**

The International Society for Microbial Electrochemistry and Technology (ISMET) (founded in 2011) is the only international society dedicated to the full range of fundamental microbial electrochemical research and technology applications, and is the home organization for researchers from widely diverse backgrounds, including microbiologists, chemists, biophysicists, and engineers. The interdisciplinary nature of the field calls for a venue to bring together researchers from diverse background. To provide such a platform, ISMET promotes International and Regional meetings occurring every other year on alternating years.

The objective of the NA-ISMET 2021 (postponed from 2020 due to COVID-19) was to provide a welcoming space for an interdisciplinary group of researchers, primarily based in North America, to discuss their latest discoveries and innovative ideas on both basic science and applied technology in the field of microbial electrochemistry. After two years of limited travel and research interactions due to COVID-19, an in-person meeting was urgently needed to facilitate conversations and collaborations that help move the field forward.

### **Accomplishments**

NA-ISMET 2021 was co-organized by Moh El-Naggar from the University of Southern California (USC) and Orianna Bretschger from *Aquacycl Inc.* The meeting took place on November 17 – 19, 2021 at the Michelson Center for Convergent Biosciences of USC. We hosted a total number of 65 registered participants from across the United States and several international participants. Thanks to the generous support from the Office of Naval Research, Department of Energy, the Army Research Office, the Air Force Office of Scientific Research, the ISMET organization, and Gamry Instruments *Inc.*, **we were able to waive registration fees for all participants and reduce travel cost for several early-career researchers.** The scientific program included 28 talks (16 from early-career researchers) and 24 posters that highlighted recent advances in microbial electrochemistry. The final program is appended to this document, along with conference photos, and an ISMET Newsletter summary of the meeting's highlights.

### **Meeting Website**

<https://naismet2021.usc.edu/>

### **Awards**

#### **Best Oral Presentation:**

Christine Lewis, Arizona State University School of Molecular Sciences and Biodesign Institute  
Grace Chong, University of Southern California

#### **Best Poster Presentation:**

Biki Kundu, Rice University  
Alejandra Hernandez-Santana, University of Oklahoma

Excerpt from the ISMET Society Newsletter (Winter 2022 edition) summarizing events from the ONR-supported North American Meeting of ISMET, contributed by Dr Frauke Kracke, Staff Scientist at Stanford University and long-term ISMET member.



Did this really just happen? After months of isolation due to the global pandemic, about 70 ISMET members: students, professors, scientists, engineers, and electromicrobiology enthusiasts followed Moh's call to USC to spend three days together in LA. It seems that only the Californian sun didn't get the memo to show up.

It was the first in person meeting for many of us and we definitely made the most of it! Clearly, the ISMET community has not been sitting idle during global shutdowns. Did you know that *Shewanella* EET can power radical polymerization? Ever heard about swiss-cheese photocathodes for H<sub>2</sub> production? Or semiconductor quantum dots that facilitate photocatalytic N<sub>2</sub>-fixation in microbes?

The meeting was launched by asking the big questions, like "what is life?" - Carbon and energy of course! The participants shared inspiring visions, for example how "biology could revolutionize our energy economy over the next 80 years!" We discussed future questions around sustainability, and climate, the role of hydrogen and how the promisingly high, theoretical peak conversion efficiencies of MES warrants research efforts in that area. We heard about application focused advancements such as hydrogen-driven MES powered by intermittent, renewable energy, and breakthroughs in MEC design (turns out "we were trying to balance the wrong iron"). All the way to the inspiring journey of ISMET scientists pushing MFC wastewater treatment technology through the 'start-up valley of death' and turn it into a successful sustainability venture!

Surely, talks around the fundamentals of (extra)cellular electron transport processes could not be missing. We talked

about cell secreted redox shuttles and news on the electron sinks and outs in our favorite *Shewanella*, including introduced rhodopsin for photoexcitement! We marveled over cool pictures that enable the visualization of specific layers in biofilms composed of *Geobacter* mutants. Further, we got introduced to cool techniques like electrochemical NAD/NADH determination, and optics for single molecule imaging that are capable of visualizing single redox proteins. After the bionic leaf, microbial biotechnology introduced us to artificial root nodules for N<sub>2</sub>-fixation. We learned about the role of iron-dependent EET in enterococcal pathogenesis, microbial electrochemical photosynthesis, how to use an anode to increase the rate and yield in lactic acid bacteria fermentation, and how to successfully catch your electroactive-bacteria-pokémon!

The conference organization team did a fantastic job to pull off this event during uncertain times and with all the additional safety regulations in place. Several participants that were not able to join us in person and could be accommodated by virtual presentations for the audience at USC. We had such a great time enjoying breakfast together on campus and lunches under palm trees. The final, surprise dinner under illuminated fig trees including margaritas was a perfect setting for a special night together after such long time apart! We want to congratulate Grace Chong and Biki Kundu for winning awards for best oral and poster presentations, as well as thank the organization team one more time – Moh El-Naggar, Christina Tasulis Williams, Bingran Cheng, and everyone else involved, thank you for making this meeting happen!

We can't wait to repeat this with the global ISMET community in Greece in 2022!

Photographs from the ONR-supported NA-ISMET meeting highlighting talks, poster session, and conference dinner

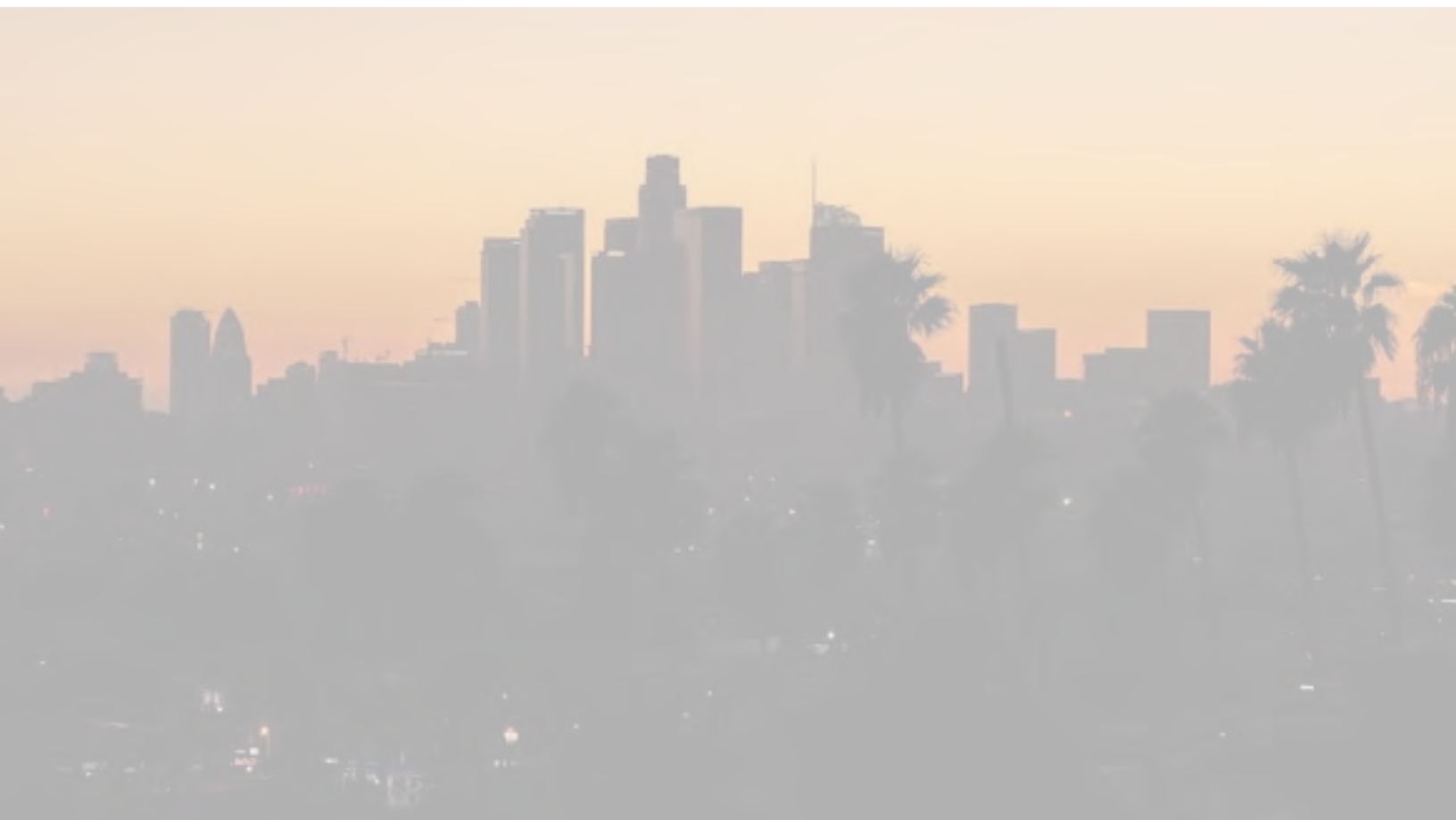




# 2021 NA-ISMET

North American Meeting of The International Society for Microbial Electrochemistry and Technology

**NOV. 17-19, 2021**  
**LOS ANGELES CA**



## PARTNERS & SPONSORS



## **Welcome to NA-ISMET 2021**

The 2021 North American Meeting of the International Society for Microbial Electrochemistry and Technology is hosted by the University of Southern California during November 17th - 19th, 2021. NA-ISMET 2021 is supported by the Office of Naval Research, Department of Energy, the Army Research Office, the Air Force Office of Scientific Research, Gamry Instruments Inc. and the International Society for Microbial Electrochemistry and Technology.

### **Local organizing committee:**

Moh El-Naggar  
Orianna Bretschger  
Christina Tasulis Williams  
Bingran Cheng  
Karla Abuyen  
Grace Chong  
Joshua Atkinson  
Christina Cole

### **Conference Overview**

The NA-ISMET 2021 meeting will be held in the Michelson Center for Convergent Bioscience (MCB building, also known as Michelson Hall) at USC University Park Campus. Talks will take place in MCB conference room 101. Both poster sessions will be held on the building patio, where will be purposed as the dining area for coffee breaks and meals (weather permitting, unless indicated otherwise).

The meeting will begin with a late afternoon keynote address followed by a selection of mixed-topic talks and a poster session on Wednesday November 17th. On Thursday, invited and contributed talks will highlight recent advances in microbial electrochemistry before a poster session and dinner. Following the morning talks on Friday, November 19th, you will have the opportunity for a tour of the laboratory/USC campus or explore Los Angeles before departure.

## Invited Speakers



### **Arpita Bose**

Associate Professor  
Department of Biology  
Washington University in St. Louis



### **Jörg Stefan Deutzmann**

Research Professor  
Civil and Environmental Engineering  
Stanford University



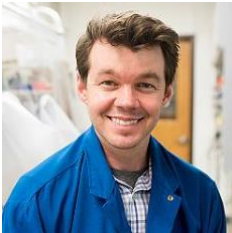
### **Michaela TerAvest**

Assistant Professor  
Biochemistry and Molecular Biology  
Michigan State University



### **Zhiyong (Jason) Ren**

Professor  
Civil and Environmental Engineering  
Princeton University



### **Benjamin (Keith) Keitz**

Assistant Professor  
McKetta Department of Chemical Engineering  
University of Texas at Austin



### **Kimberly Kline**

Associate Professor  
Singapore Centre for Environmental Life Sciences Engineering  
Nanyang Technological University Singapore

# Conference Schedule\*

\*subject to change

Wednesday, November 17

- 2:00-4:00            **Registration**  
Important note to poster presenters: please bring your poster to the Michelson Hall during registration. You can put it up on the numbered spot (corresponding to the poster number) on the poster boards. Posters can stay up throughout the conference. Poster with odd numbers will be presented on Wednesday, and even numbers on Thursday.
- 4:00-4:10            **Welcome -- Moh El-Naggar**
- 4:10-4:40            **Invited Talk #1 -- Arpita Bose (Zoom)**  
Washington University in St. Louis  
*Exploring the electric side of photosynthesis*
- 4:40-5:00            **Matthew Lew**  
Washington University in St. Louis  
*Single-molecule imaging of the electron transfer pathways within single electroactive bacteria*
- 5:00-5:20            **Christine Lewis**  
Arizona State University  
*Electrochemically driven photosynthetic electron transport in cyanobacteria lacking photosystem II*
- 5:20-5:40            **Bruce Logan**  
The Pennsylvania State University  
*Novel microbial electrolysis cell design with asymmetric feed to manage the ion transport across the membrane*
- 5:40-7:00            **Poster Session I**  
Odd-numbered posters
- 7:00                    **Dinner**

Thursday November 18

- 8:00-9:00        **Breakfast**
- 9:00-9:30        **Invited Talk #2 -- Jöerg Stefan Deutzmann**  
Stanford University  
*Activity and Limitations of Microbes in Microbial Electrosynthesis Using Intermittent Electricity*
- 9:30-9:50        **Frauke Kracke**  
Stanford University  
*Microbial physiology under H<sub>2</sub>-driven electrosynthesis conditions*
- 9:50-10:10      **Sara Tejedor Sanz**  
Rice University  
*Bioenergetic and biotechnological implications of extracellular electron transfer in lactic acid bacteria*
- 10:10-10:30     **Buz Barstow**  
Cornell University  
*Genetics of, and thermodynamic constraints on electromicrobial production*
- 10:30-11:00     **Coffee Break**
- 11:00-11:20     **Daniel Bond**  
University of Minnesota  
*Visualizing redox gradient within Geobacter electrode biofilms*
- 11:20-11:40     **Grace W Chong**  
University of Southern California  
*Single molecule tracking of bacterial cell surface cytochromes reveals dynamics that impact long-distance electron transport*
- 11:40-12:00     **Justus Nwachukwu**  
Arizona State University  
*CATCH Protein Nanowires: Second Generation Assembly of Small Tetraheme Cytochrome from Shewanella oneidensis*
- 12:00-1:20      **Lunch**
- 1:20-1:50        **Invited Talk #3 – Michaela TerAvest (Zoom)**  
Michigan State University  
*Inward electron transfer in Shewanella oneidensis*

- 1:50-2:10      **Lev Tsypin**  
California Institute of Technology  
*Nitrate reduction stimulates and is stimulated by phenazine-1-carboxylic acid oxidation via NarZ in Citrobacter portucalensis MBL*
- 2:10-2:30      **Olja Simoska**  
University of Utah  
*Understanding the properties and mechanism of phenazines that promote mediated electron transfer in Escherichia coli*
- 2:30-2:50      **Fernanda Jimenez Otero**  
George Mason University  
*Effect of exogenous perturbations on electron-shuttle facilitated long-range electron transfer*
- 2:50-3:20      **Coffee Break**
- 3:20-3:50      **Invited Talk #4 – Zhiyong (Jason) Ren (Zoom)**  
Princeton University  
*The potential and niche applications of hybrid microbial electrolysis*
- 3:50-4:10      **Brian J. Eddie**  
US Naval Research Laboratory  
*Bridging the language barrier between biology and electronics with protonics*
- 4:10-4:30      **Xun Guan**  
University of California, Los Angeles  
*A microbial-material hybrid system for photocatalytic nitrogen fixation with high quantum efficiency*
- 4:30-4:50      **Orianna Bretschger**  
Aquacycl  
*BioElectrochemical Treatment Technology (BETT) – the new practical approach for wastewater management and resource recovery*
- 4:50-5:10      **Rodrigo Jose Jimenez Sandoval**  
King Abdullah University of Science and Technology  
*Synthesis of size-controlled nanoclusters and nanoparticles by Geobacter sulfurreducens and their catalytic application in the oxygen evolution reaction*
- 5:10-5:30      **Joshua Atkinson**  
University of Southern California  
*Real-time bioelectronic sensing of environmental contaminants*

5:30-6:50      **Poster Session II**  
Even numbered posters

7:00            **Dinner**  
*Location: Moreton Fig Patio*

Friday November 19

8:00-8:30      **Breakfast**

8:30-9:00      **Invited Talk #5 – Keith Keitz**  
University of Texas at Austin  
*Expanding whole cell catalysis using extracellular electron transfer*

9:00-9:20      **Xu Zhang**  
Rice University  
*Multichannel bioelectronic sensing using engineered Escherichia coli*

9:20-9:40      **Chong Liu**  
University of California, Los Angeles  
*Materials design for local microenvironment for bioelectrochemical CO<sub>2</sub> and N<sub>2</sub> fixation*

9:40-10:00     **Coffee Break**

10:00-10:30    **Invited Talk #6 – Kimberly Kline**  
Nanyang Technological University  
*A role for Extracellular Electron Transfer in Enterococcal Pathogenesis*

10:30-10:50    **Namita Shroff**  
University of Southern California  
*Extracellular electron transport mechanisms within the human gut microbiome*

10:50-11:10    **Tingting Yang**  
University of Southern California  
*Direct measurements of long-distance electron transport in freshwater cable bacteria*

11:10-11:30    **Cheng Li**  
Oregon State University  
*Culturing cable bacteria filaments*

11:30-12:00    **Awards and Closing Remark**

12:00           **Lunch**

## Poster Presentations

#	Presenter	Title
1	Karla Abuyen	Electrochemical studies of a heterologously expressed iron oxidase, <i>Cyc2</i> , in <i>Shewanella oneidensis</i>
2	Joshua Atkinson	Controlling the conductivity of light-patterned biofilms
3	Gahyun Baek	Comparing improvements using microbial electrolysis cell electrodes in anaerobic digestion with those due to increased surface area
4	Marko Chavez	Synthesis of palladium nanoparticles by electrode-respiring <i>Geobacter sulfurreducens</i> biofilms
5	Sol Choi	Crossing the <i>Geobacter</i> periplasm doesn't need to be complicated
6	Christina M Cole	Spin filtering in bacterial periplasmic electron carriers
7	Fangyuan Dong	An engineered, non-diazotrophic cyanobacterium and its application in bioelectrochemical nitrogen fixation
8	Alejandra Hernandez-Santana	Using mutant strains to test for direct electron uptake: a way to account for the electrons transferred through molecular hydrogen
9	Ethan Howley	Modeling cyclic voltammetry in <i>G. sulfurreducens</i>
10	Shuo Huang	Post-translational flavinylation is associated with diverse extracytosolic redox functionalities throughout bacterial life
11	Abhiney Jain	Leveraging native Mtr systems in model organisms to characterize novel extracellular electron transfer components

- 12 Yamini Jangir Degrading chitin to breathing rocks – living in deep-sea sediments
- 13 Biki Kundu Elucidating the impact of altered carbon fluxes on extracellular electron transfer in *Escherichia coli*
- 14 Leila Mahrokh Investigations of extracellular electron transfer by a magnetotactic bacterium
- 15 Anna Mangus Cryogenic electron tomography and 3D reconstructions of the intracellular/extracellular nanowire interface of *Geobacter sulfurreducens*
- 16 Ruggero Rossi Long-term, pilot-scale (850 L) test results for a single air-cathode microbial fuel cell producing electricity while treating wastewater
- 17 Joshua Sackett Uncovering the genetic basis of oxidative extracellular electron transfer mechanisms in marine sediment bacterial consortia
- 18 Ruth Starwalt-Lee Electrolocation? Investigating redox-mediated taxis in *Shewanella oneidensis*
- 19 Joe Tolar Quinones and flavins have distinct, but complementary roles in extracellular electron transfer in *Lactiplantibacillus plantarum*
- 20 Leah Trutschel Determining genes involved in extracellular electron uptake in *Shewanella oneidensis* MR-1
- 21 Luguang Wang (presented by Cheng Li) Bioelectrosynthesis of Single Cell Protein by Coupling Fast-growing *Methanococcus Maripaludis* with Microbial Electrolysis cells
- 22 Hang Yu Electrochemical properties of anaerobic methanotrophic consortia
- 23 Fengjie Zhao Light-induced patterning of electroactive bacterial biofilms