MITK'EL B. SANTIAGO BERRÍOS, PH.D

Urb. La Hacienda, 33 Medialuna St., Caguas, PR 00725|Tel. 787-477-0907|email: mitkel.santiago@upr.edu

OVERVIEW

Over 10 years of research project experience utilizing diverse instrumentation and equipment, some last generation and highly sophisticated, achieving important discoveries for the scientific community including the development of sustainable and green energy applications, resulting in two patents and multiple papers.

- Expertise in procedures and analytical techniques including UV-VIS, FT-IR, SEM, XRD, Electrochemistry, and Synchrotron Spectroscopy techniques, among others to support numerous research projects.
- Completed the prestigious Provost Academic Diversity Postdoctoral Fellowship from Cornell University.
- Opinion leader offering insight in curricular changes and other operational and academic initiatives.
- Developed numerous papers, reports and scientific proposals resulting in grant approvals.

EXPERIENCE

Department of Chemistry, University of Puerto Rico, Humacao Campus

Assistant Professor, Chemistry ***Aug. 2022 – present***

Engaged in simultaneous assignments managing multiple research initiatives and leading several collaboration groups, applying for grants, and teaching undergraduate chemistry courses.

- Maintaining collaboration partnerships between Cornell University, Brookhaven National Laboratories, the National Renewable Energy Laboratory (NREL), Universidad Ana G. Méndez and within the University of Puerto Rico.
- Draft proposals with several federal sponsors such the National Science Foundation, Department of Energy and National Institute of Health (via PR-INBRE).

Division of Science and Technology, Universidad Ana G Méndez, Cupey Campus

Associate Professor, Chemistry ***Aug. 2016 – July 2022***

Engaged in simultaneous assignments directing and managing multiple research initiatives and leading several collaboration groups, applying for grants, and delivering courses, mentoring up to 30 undergraduate research students. Coordinator of the Chemistry Program and leader of a research group on materials for renewable energy technologies.

- Manage alliances with Cornell University (CU), Brookhaven National Lab NSLS II and the University of Puerto Rico (UPR), to propel collaborative agreements for student research initiatives.
    - Drafted a proposal jointly with CU and UPR colleagues, attaining a $2.4M grant from the National Sciences Foundation, to develop an interdisciplinary team to develop mechanisms using

electrochemistry and synchrotron (particle accelerator) techniques, evaluate and improve processes.
    - 80%+ of undergraduate students' complete degrees with a published paper.
    - 70% of students continue graduate studies.
- Source and procure advanced laboratory equipment and instrumentation including an X-ray diffractor (calibrated, conditioned, and updated operating system), potentiostat, and U/V and IR spectrophotometer, DLS, and fluorimeter, among others.
- Draft proposals, patents, and scientific papers in different journals.
- Developed laboratory safety protocols during the COVID-19 emergency.
- Obtained excellent audit results from the National Science Foundation.
- Appointed to several committees such as the Graduate Thesis Evaluation, Administrative Council, Academic Board and Academic Senate, with comprehensive responsibilities including the evaluation of courses and syllabi, compliance with institutional policies and other initiatives to improve academic excellence.
- Active member of a US Department of Education project mentoring first year students to adjust to college life and acquiring laboratory skills during the process. Grew retention rate to 74%.

School of Natural Sciences and Technology, Universidad Ana G Méndez, Cupey Campus

Assistant Professor, Chemistry ***Aug. 2011 – June 2016***

Delivered and improved, with interactive workshops, chemistry courses (inorganic/organic/general) for undergraduate students, teaching chemical reactions and mechanisms, training on equipment use and processes: volumetric analysis; FT-IR, NMR analysis; UV/VIS spectroscopy; diffuse reflectance spectroscopy; cyclic voltammetry and X-ray Diffraction.

- Identified federal funding for the research laboratory with last generation equipment for synchrotron analysis and experiments with different intensity light sources.
- Attained two patents (product and process) for oxidation resistant lead selenide.
- Prepared proposals to perform experiments in state-of-the-art laboratories such as the Brookhaven National Lab NSLS II, Center for Functional Nanomaterials, at the Cornell High Energy Synchrotron Source involving and mentoring undergraduate students in the process.

Cornell University, Ithaca, NY

Postdoctoral Fellow – Inorganic/Materials Chemist ***July 2007 – Aug. 2009***

Performed research on an instrument that measured electrical resistance and supported six other campus initiatives researching the characterization of quantum dots, polymers, and single molecule conductance.

- Materials characterizations included: X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), and several electrochemistry techniques.
- Organized monthly conferences between Cornell's scientists to strengthen institutional cross collaboration.
- Participated in training at Columbia University and MIT.

EDUCATION

University of Puerto Rico, Río Piedras Campus – *Ph.D. in Inorganic Chemistry* **2007**

- ✓ Research resulted in four peer-reviewed publications and two fellowships.
- ✓ Outreach Leader for fuel cell short workshops sponsored for high school teachers and students.
- ✓ Active member organizing the first graduate meeting centered in networking and collaboration with peer students.
- ✓ Dr. Jorge L. Colón, Research Advisor; several publications on topics including:
    - Direct Intercalation of Bis-2,2′,2″, 6-terpyridylcobalt (III) into Zirconium Phosphate Layers for Biosensing Applications.
    - Effect of enzyme and cofactor immobilization on the response of ethanol oxidation in zirconium phosphate modified biosensors.
    - Layered Inorganic Materials as Redox Agents: Ferrocenium-Intercalated Zirconium Phosphate.
    - NADH Electrooxidation using Bis (1,10-phenanthroline-5,6-dione) (2,2′-bipyridine) ruthenium (II)-exchanged Zirconium Phosphate Modified Carbon Paste Electrodes.

University of Puerto Rico, Río Piedras Campus – *Bachelor of Sciences, Major in Chemistry* **2000**

Trainings / Seminars: Hazard Communication and Occupational Exposure to Hazardous Chemicals in Laboratories; Synchrotron Techniques, Mentoring Undergraduate Students from the National Science Foundation.

AWARDS AND ACKNOWLEDGEMENTS

- **Provost Academic Diversity Postdoctoral Fellowship** **July 2007**
  This prestigious fellowship is awarded to students pursuing postdoctoral experience at Cornell University. The fellowship allowed me to have expertise on nanotechnology, molecular electronics and inorganic chemistry and electrochemistry synthesis and characterization.

- **NIH-RISE graduate fellowship** **August 2006**
  This fellowship is awarded to graduate students at Universidad de Puerto Rico, whose research has biomedical applications. My research based on ethanol and lactate biosensors was the result of this fellowship.

- **PR-AGEP graduate fellowship** **August 2004**
  This fellowship is awarded to graduate students at Universidad of Puerto Rico during their first year of studies. Ethical and teacher assistantship during this first year are part of the graduate school training.

PATENTS AND PUBLICATIONS

- **Santiago-Berríos, M. B.** and Rodríguez, W. Patent "Synthesis and Characterization of lead selenide capped with a benzoate ligand"; US9505618B2, 2015.

- **Santiago-Berríos, M. B.** and Rodríguez, W. Patent "Lead Selenide capped with a benzoate ligand"; US10128390, 2018.

- "Ex Situ and In Situ Analyses of the Mechanism of Electrocatalytic Hydrogen Peroxide Production by $Co_xZn_{1-x}O$ ($0 < x < 0.018$) Materials in Alkaline Media" Joselyn Del Pilar Albadalejo, Suheily Alonso-Sevilla, Nicohl I. Cintrón, Xinran Feng, Ángel D. García, Dinorah D. Martínez-Torres, Astrid M. Rodríguez, Natalia I. Román-Montalvo, José I. Torres, Yao Yang, Armando Peña-Duarte, Rahul Singhal, Louise M. Debefve, Christopher J. Pollock, Carlos R. Cabrera, Héctor D. Abruña, and **Mitk'El Benedikt Santiago-Berríos** ACS Applied Energy Materials **2022**, 5, 6, 6597-6605.
- "Iron Quantum Dots Electro-Assembling on Vulcan XC-72R: Hydrogen Peroxide Generation for Space Applications" Armando Peña-Duarte, Santosh H Vijapur, Timothy D Hall, Kathleen L Hayes, Eduardo Larios-Rodríguez, Joselyn Del Pilar-Albaladejo, **Mitk'El B Santiago**, Stephen Snyder, Jennings Taylor, Carlos R Cabrera ACS Applied Materials & Interfaces **2021**, 13, 25, 29585–29601.
- "Non-Precious Metal-Based Electrocatalytic Cathode Materials for Alkaline Membrane Fuel Cells (AMFC)" Joselyn Del-Pilar, **Mitk'El Santiago**, Carlos R Cabrera ECS Transactions **2019**, 92, 661.
- " Effect of the ligand in the crystal structure of zinc oxide: an x-ray powder diffraction, x-ray absorption near-edge structure, and an extended x-ray absorption fine structure study" María de los A. Cepeda-Pérez, Cristina M. Reyes-Marte, Valerie Ann Carrasquillo, William A. Muñiz, Edgar J. Trujillo, Rahul Singhal, Harry Rivera, **Mitk'El B. Santiago-Berríos** MRS Communications **2016**, 6, 93-97.
- "Synthesis, characterization and electrochemical characterization of lead selenide sub-micron particles capped with a benzoate ligand and prepared at different temperatures" Weyshla A. Rodríguez-Rodríguez, Jadiel Colón, Roger Guzmán, Harry Rivera and **Mitk'El B. Santiago-Berríos** Mater. Res. Express **2014,** 1**,** 35906.
- "Direct Intercalation of Bis-2,2',2", 6-terpyridylcobalt(III) into Zirconium Phosphate Layers for Biosensing Applications" **Mitk'El B. Santiago-Berríos**, Chasterie Declet-Flores, Amanda David, Solmarie Borrero, Meredith M. Vélez, Agustín Díaz-Díaz, Ana R. Guadalupe, Jorge L. Colón, Langmuir **2012**, 28, 4447-4452.
- "Single-Molecule Conductance of Pyridine-Terminated Dithienylethene Switch Molecules" Eugenia S. Tam, Joshua J. Parks, William W. Shum, Yu-Wu Zhong, **Mitk'El B. Santiago-Berríos**, Xiao Zheng, Weitao Yang, Garnet K. –L Chan, Héctor D. Abruña and Daniel C. Ralph, ACS Nano **2011**, 5, 5115-5123.
- "Synthesis and Characterization of $(smif)_2M^n$ ($n = 0$, M = V, Cr, Mn, Fe, Co, Ni, Ru; $n = +1$, M = Cr, Mn, Co, Rh, Ir; smif = 1,3-di-(2-pyridyl)-2-azaallyl)" Brenda A. Frazier†, Erika R. Bartholomew, Peter T. Wolczanski, Serena DeBeer, **Mitk'El Santiago-Berrios**, Hector D. Abruña, Emil B. Lobkovsky, Suzanne C. Bart, Susanne Mossin, Karsten Meyer, and Thomas R. Cundari, Inorganic Chemistry **2011**, 50, 12414-12436.
- "Mechanisms of Quenching of Alexa Fluorophores by Natural Amino Acids" Huimin Chen, Syed S. Ahsan, **Mitk'El B. Santiago**, Héctor D. Abruña and Watt W. Webb, Journal of the American Chemical Society, **2010**, 132, 7244-7245.

- "Effect of enzyme and cofactor immobilization on the response of ethanol oxidation in zirconium phosphate modified biosensors" **Mitk'El B. Santiago**, Gabriel A. Daniel, Amanda David, Ana R. Guadalupe and Jorge L. Colón, Electroanalysis, **2010**, 22, 1097-1105.
- "Semi-Perfluoroalkyl Polyfluorenes for Orthogonal Processing in Fluorous Solvents" Jin-Kyun Lee, Hon Hang Fong, Alexander A. Zakhidov, Georgia E. McCluskey, Priscilla G. Taylor, **Mitk'El B. Santiago-Berríos**, Andrew B. Holmes, Héctor D. Abruña, George G. Malliaras, and Christopher k. Ober, Macromolecules, **2010**, *43*, 1195-1198.
- **"**PbSe Nanocrystal Excitonic Solar Cells" Joshua J. Choi, Yee-Fun Lim, **Mitk'El B. Santiago-Berrios**, Matthew Oh, Byung-Ryool Hyun, Liangfeng Sun, Adam C. Bartnik, Augusta Goedhart, George G. Malliaras, Héctor D. Abruña, Frank W. Wise, Tobias Hanrath, Nano Letters, **2009**, *9*, 3749-3755.
- "Layered Inorganic Materials as Redox Agents: Ferrocenium-Intercalated Zirconium Phosphate" **Mitk'El B. Santiago**, Chasterie Declet-Flores, Agustín Díaz, Meredith M. Vélez, Myrna Zoé Bosques,Yannis Sanakis, Jorge L. Colón, Langmuir, **2007**, *23*, 7810-7817.
- "NADH Electrooxidation using Bis(1,10-phenanthroline-5,6-dione)(2,2'-bipyridine)ruthenium(II)-exchanged Zirconium Phosphate Modified Carbon Paste Electrodes" **Mitk'El B. Santiago**, Meredith M. Vélez, Solmarie Borrero, Agustín Díaz, Cristina Hofmann, Ana R. Guadalupe, Jorge L. Colón, Electroanalysis, **2006**, *18*, 559-572.

RELEVANT GRANTS

NSF 1827622 09/01/2018-08/31/2024

NSF-PREM: Center for Interfacial Electrochemistry of Energy Materials (CiE2M)

The University of Puerto Rico, Rio Piedras Campus (UPRRP), Universidad Metropolitana (UMET) and Universidad del Turabo (UT), all located in Puerto Rico and Hispanic Serving Institutions (HSI), and the Cornell High Energy Synchrotron Source (CHESS) have teamed up in this educational and innovative collaborative materials research effort to bring together and develop a diverse and talented scientific interdisciplinary community with expertise in operando synchrotron X-ray techniques to enhance energy storage and conversion devices. In this collaborative effort, graduate and undergraduate students will perform research at their home institutions and at CHESS, to study the electrochemical processes associated with energy conversion and storage technologies. This Partnership in Research and Education for Materials (PREM) project will impact participating students' education by offering new tailored courses in their curriculum, and by developing workshops and making training opportunities available to them in strong collaboration with CHESS. The results of this research and educational partnership among UPR-UMET-UT-CHESS will be disseminated in publications in peer-reviewed journals and conference presentations. Workshops and synchrotron hands-on activities will also be developed for K-12 students to motivate their interest in energy-based technologies and as well as the use of high-energy X-ray synchrotron techniques through close interactions and collaborations with CHESS.

Role: Co-PI and IRG leader (Subaward to Universidad Ana G. Méndez (UAGM))

US Department of Education P120A130108 08/01/2013-07/30/2016

MSEIP at UMET: A Comprehensive Initiative to Integrate Research throughout STEM Undergraduate Education

This proposal helps science undergraduate students to adjust to college life and to acquire certain skills to become scientists. Our strategy includes hands-on activities and research during their first and second year.

Role: Member of the Faculty Leaders Team

NSF EPS-1002410 10/01/2011-09/30/2015

Using Quantum Dots for the Design of New Light Harvesting Assemblies

This study includes the use of quantum dots functionalized with aromatic ligands for solar energy harvesting applications. The use of aromatic ligands provides robustness and prevents the oxidation of quantum dots.

Role: Principal Investigator (of subaward to UAGM)

NSF EPS-1002410

Institute for Functional Nanomaterials: 2015 Exploratory Research Projects

Nanomaterias for solar energy harvesting applications

In this project we will systematically use a series of nanoparticles and nanorods for solar energy harvesting applications to improve a testbed design by the IRG4 of the original proposal using lead selenide quantum dots.

Role: **Principal Investigator (of subaward to UAGM)**

NSF CHE 1262826 10/01/2013-09/30/2016

PR REU at UMET: Research training in cross-disciplinary chemical sciences

This study uses functionalized zinc oxide materials for solar energy harvesting applications. By functionalizing the material, it results in a profound effect in the crystal structure, and therefore affects the electronic properties of the material.

Role: REU Mentor

MEMBERSHIPS

- Materials Research Society
- International Society of Electrochemistry
- Society for Advancement of Chicanos and Native Americans in Science (SACNAS)
- American Chemical Society (ACS) (2021 Chair, Puerto Rico Section)