

## Jacob Michael Strain

**Objective: A tenure-track professor position at a PhD granting institution.**

### University of Texas at Austin

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### Education

#### 2015-2020

**Ph.D. Electroanalytical Chemistry, University of Louisville, Louisville, KY, USA**

#### Dissertation Title:

Electrochemical Reduction of Carbon Dioxide and Carbon Monoxide to Produce Green Fuels and Chemicals. Defended on April 21<sup>st</sup>, 2020

Conn Center for Renewable Energy, Department of Chemistry

Supervisors: Dr. Joshua M. Spurgeon and Prof. Francis P. Zamborini

**Extracurricular:** Chemistry Graduate Student Association (CGSA) Secretary 2016-2017

#### Awards:

(1) First Place Graduate Student Oral Talk in Analytical/Physical Chemistry Division. Kentucky Academy of Sciences Annual Meeting (KAS) 2016.

(2) Second Place at the 2019 Student Research Exposition Speed Engineering.

(3) GNAS Scholarship Research Funds (\$250).

#### 2007-2012

**B.S. Investigative Biotechnology, Minor in Chemistry Western Kentucky University,**

Bowling Green, KY, USA

#### Extracurricular:

(1) Association for Undergraduate Geneticists (AUG), Treasurer (2008-2010)

(2) American Chemical Society (ACS) Student Affiliates (2008-2010)

(3) Chemistry Club (2008-2010)

**Awards:** (1) JW Potter Scholarship Recipient, Full 4-Year Tuition Scholarship

### Work Experience

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<b>Nov 2020- Present</b>	<b>Postdoctoral Fellow</b> , University of Texas at Austin, Department of Chemistry, Austin, TX, USA <i>Supervisors:</i> Dr. Michael J. Rose and Dr. Sean T. Roberts. <i>Description:</i> Electrochemical and spectroscopic analysis of functionalized Si substrates. Exploring singlet fission at hybrid interfaces. <i>Key Techniques:</i> Silicon wafer chemistry, electrochemistry, time-resolved spectroscopy, and materials characterization.
<b>Jan 2015- June 2020</b>	<b>PhD student</b> , University of Louisville, Department of Chemistry, Louisville, KY, USA <i>Supervisors:</i> Dr. Joshua M. Spurgeon and Prof. Francis P. Zamborini.

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	<p><i>Description:</i> Experimental inorganic and organic electroanalytical chemistry PhD requiring multidisciplinary approaches. Developed skills in catalyst synthesis, (photo)electrochemical characterization, electrode fabrication, and cell reactor design.</p> <p><i>Key Techniques:</i> Potentiostat use, NMR, gas chromatography, silicon electrode design, SEM, XRD, CNC milling, and Solidworks.</p> <p><i>Key Achievements:</i> Nine published works with one patent pending. Second place for poster in 2019 Student Research Exposition Speed Engineering.</p>
<b>Teaching</b>	<p><b>Graduate Teaching Assistant</b>, University of Louisville, Louisville, KY</p> <p><i>Supervisors:</i> Prof. Richard Baldwin and Dr. Natali Richter</p> <p><i>Description:</i> Undergraduate analytical and organic labs including honors analytical labs. Approximately 460 students over the course of five years. In fall of 2019 acting as head TA for a lab class that coordinates 21 TA's for 83 lab sections. As part of the appointment are various proctoring and exam grading responsibilities throughout the semesters.</p>
<b>Jan 2014- April 2017</b>	<p><b>Research Technician/Graduate Student</b>, Western Kentucky University, Department of Chemistry, Bowling Green, KY and University of Louisville, Department of Chemistry, Louisville, KY</p> <p><i>Supervisors:</i> Dr. Hemali Rathnayake, Dr. Jinjun Liu, and Dr. Moon-soo Kim</p> <p><i>Description:</i> Performed molecular cloning in support to the fabrication of pathogen detection devices with high-throughput capabilities for Dr. Kim. The work conducted in Dr. Rathnayake's lab which continued while starting the program at University of Louisville in 2015 which expanded to Dr. Liu's lab gaining experience conducting ultrafast transient absorption spectroscopy studying the photophysical dynamics of the products and devices that were generated in Dr. Rathnayake's lab.</p> <p><i>Key Techniques:</i> Schlenk line synthesis, polymer synthesis, NMR characterization, FTIR, UV/VIS, fluorescence, AFM, SEM, TEM, XRD, TGA, DSC, single-crystal X-ray diffraction, glove box use, organic photovoltaic device fabrication and characterization, ultrafast transient absorption spectroscopy, Glotaran, multivariate regression analysis, Gaussian, molecular cloning, biochemical techniques, protein engineering, and electrochemical analysis.</p> <p><i>Key Achievements:</i> 2 publications, 1 poster, and 4 oral talks with one talk receiving an award for first place in the Graduate Student Analytical/Physical Division.</p>
<b>Mentoring</b>	<p><b>WKU</b>, 1 Postdoc, 4 Master's Students, 4 undergraduate students, 1 High School Student conducting training in organic synthesis, NMR characterization, UV/VIS, FTIR, device fabrication and characterization, molecular cloning, microbiology and biochemical techniques. 2 other PhD students were trained in organic photovoltaic device fabrication at Dr. Rathnayake's new lab at University of North Carolina Greensboro.</p>
<b>2013- March 2014</b>	<p><b>Team Leader</b>, Institute for Environmental Health (IEH), Scottsville, KY</p> <p><i>Supervisors:</i> Andy Buschow and Deidra McClendon</p> <p><i>Description:</i> Participated in the building of a brand-new lab outfitting the building and group of lab technicians to reach accreditation status to conduct food safety testing encompassing PCR pathogen screening and microbial count tracking. Responsibilities as Team Leader included leading daily shifts of 6-8 technicians, conducting training and assurance of accreditation status with official authorities while maintaining positive reputation with the client.</p>

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	<p><i>Key Techniques:</i> Biological Hazard Safety Level 2, PCR, microbial pour plating, testing quality assurance methods, LIMS, and sample tracking and integrity.</p>
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<b>2007-2011</b>	<p><b>Undergraduate Research Assistant</b>, Western Kentucky University, Departments of Chemistry, Biology, and Mathematics, Bowling Green, KY  <i>Supervisors:</i> Prof. Shivendra Sahi, Prof. Chad Snyder, Prof. Kinchel Doerner, Prof. Di Wu, Mr. John Sorrell, Prof. Nancy Rice  <i>Description:</i> For Dr. Sahi: maintained <i>Medicago sativa</i> tissue cultures for the use of genetic transformation with <i>Agrobacterium tumefaciens</i>. For Dr. Snyder: Synthesized bulky polypyrrole complexes by organometallic synthesis and characterized with IR, NMR and mass spectrometry. For Dr. Doerner: Developed an enzyme assay on a 4-vinylphenol reductase from <i>Lactobacillus</i> sp. pep8 using UV/VIS spectroscopy. For Dr. Wu: Refined the molecular structures of proteins through establishing curvature profiles to construct precise models by improving the interatomic distance data using MATLAB and Perl programming. For Mr. Sorrel: Maintained core lab instruments to facilitate expedient use for researchers. Organized incoming inventory to be stored properly for facility users. Ensured a clean lab environment to maintain safety standards required for the facility. Assisted affiliated research groups when an extra pair of hands was required. For Dr. Rice: Characterizing the promoter for the gene eNOS in <i>Rattus norvegicus</i> myofibroblasts using promoter-bashing techniques with genetic expression analysis using luciferase gene reporter assays.  <i>Key Techniques:</i> Molecular cloning, PCR, DNA sequencing, plant culturing, microbial culturing, anaerobic microbiology, mammalian cell culturing, UV/Vis, protein characterization, Schlenk line synthesis, organometallic synthesis, NMR, FTIR, MATLAB, and Perl.  <i>Key Achievements:</i> Several poster presentations and one talk.</p>
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<b>Teaching</b>	<p><b>Undergraduate Teaching Assistant and Tutor</b>, Western Kentucky University, Department of Chemistry, Bowling Green, KY  <i>Supervisors:</i> Ms. Amanda Brooks, Prof. Chad Snyder, Prof. Darwin Dahl  <i>Description:</i> Taught several undergraduate analytical, general, and organic labs encompassing approximately 175 students. Also participated in the organization and implementation of Super Saturday classes involving the assistance of children with educational chemistry activities.</p>
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### Record of Peer Reviews

1. *Journal of CO<sub>2</sub> Utilization* (1)
2. *Communications Chemistry* (1)
3. *Chemical Engineering Journal* (1)
4. *Journal of Materials Chemistry A* (1)

**Publications, total citations = 78; h-index=4; i10-index=3 (current as of 01/30/2021)**

1. **Methods for the reduction of carbon dioxide.** Steve P. Cronin, Craig A. Grapperhaus, Robert M. Buchanon, Jacob M. Strain, Joshua M. Spurgeon. USA. Patent Pending #US20200277248A1, **2020.**

2. **Pulsed electrochemical carbon monoxide reduction on thick oxide-derived copper.** Jacob M. Strain, Saumya Gulati, Sahar Pishgar, Joshua M. Spurgeon. *ChemSusChem* **2020**, 13, 11, 3028-3033.
3. **Exploiting Metal-Ligand Cooperativity to Sequester, Activate, and Reduce Atmospheric Carbon Dioxide with a Neutral Zinc Complex.** Steve P. Cronin, Jacob M. Strain, Mark S. Mashuta, Joshua M. Spurgeon, Robert M. Buchanan and Craig A. Grapperhaus. *Inorganic Chemistry* **2020**, 59, 7, 4835-4841.
4. **Assessing contaminants from ion-exchange membranes in the evaluation of aqueous electrochemical carbon dioxide reduction.** Jacob M. Strain, Joshua M. Spurgeon. *Journal of CO<sub>2</sub> Utilization* **2020**, 35, e298-e302.
5. **Investigation of the photocorrosion of n-GaP photoanodes in acid with in-situ UV-Vis spectroscopy.** Sahar Pishgar, Jacob Strain, Saumya Gulati, Gamini Sumanasekera, Gautam Gupta, Joshua Spurgeon. *Journal of Materials Chemistry A* **2019**, 7, 25377-25388.
6. **Synthesis, Characterization, and HER Activity of Pendant Diamine Derivatives of NiATSM.** Caleb A. Calvary, Oleksandr Hietsoi, Jacob M. Strain, Mark S. Mashuta, Joshua M. Spurgeon, Robert M. Buchanan, Craig Alan Grapperhaus. *European Journal of Inorganic Chemistry* **2019**, 33.
7. **Effect of Stacking Interactions on the Translation of Structurally Related Bis-thiosemicarbazone Ni(II) HER Catalysts to Modified Electrode Surfaces** Nicholas Vishnosky, Alexander Gupta, Rahul Jain, Jacob Strain, Joshua Spurgeon, Yaroslav Losovyj, Mark Mashuta, Robert Buchanan, Gautam Gupta, Craig Grapperhaus, *Inorganic Chemistry* **2019**, 58, 18.
8. **Photocatalytic hydrogen evolution on Si photocathodes modified with bis(thiosemicarbazonato)nickel(II)/Nafion.** Saumya Gulati, Oleksandr Hietsoi, Caleb A. Calvary, Jacob M. Strain, Sahar Pishgar, Henry C. Brun, Craig A. Grapperhaus, Robert M. Buchanan, Joshua M. Spurgeon. *Chemical Communications* **2019**, 55, 9440-9443.
9. **Precise control in photovoltaic response of Poly(3-hexylthiophene): Fullerene solar cells via accelerated-solvent vapor annealing.** Soundaram J. Ananthakrishnan, Swapnil Sahare, Jacob Strain, Manda Venkataramana, Muhammad Jahan, Hemali Rathnayake. *Science Advances Today* **2018**, 4, 25279.
10. **Heterogeneously catalyzed two-step cascade electrochemical reduction of CO<sub>2</sub> to ethanol.** Nolan Theaker, Jacob M. Strain, Bijandra Kumar, Joseph P. Brian, Sudesh Kumari, Joshua M. Spurgeon. *Electrochimica Acta* **2018**, 274, 1-8.
11. **Photoelectrochemical Reduction of CO<sub>2</sub> to HCOOH on Silicon Photocathodes with Reduced SnO<sub>2</sub> Porous Nanowire Catalysts.** K. Ramachandra Rao, Sahar Pishgar, Jacob M. Strain, Bijandra Kumar, Veerendra Atla, Sudesh Kumari, Joshua Spurgeon. *Journal of Materials Chemistry A* **2018**, 6, 1736-1742.
12. **A Novel Donor–Donor Polymeric Dyad of Poly(3-Hexylthiophene-Block-Oligo(Anthracene-9,10-Diyl): Synthesis, Solid-State Packing, and Electronic Properties** Soundaram J. Ananthakrishnan, Jacob Strain, Niharika Neerudu Sreeramulu, Abu Mitul, Louis E. McNamara, Anastasiia Iefanova, Nathan I. Hammer, Qiquan Qiao, Hemali Rathnayake. *Journal of Polymer Science Part A: Polymer Chemistry* **2016**, 54, 3032-3045.
13. **Synthesis, Characterization, and Structure of Some New Substituted 5, 6-Fused Pyridazines.** Chad A. Snyder, Nathan C. Tice, Phenahas G. Sriramula, James L. Neathery, Justin K. Mobley, Chad L. Phillips, Andrew Z. Preston, Jacob M. Strain, Eric S. Vanover, Michael P. Starling, Nilesh V. Sahi. *Synthetic Communications* 2011, 41, 9.

#### Presentations (Oral)

1. **The electroreduction of CO<sub>2</sub> to value-added products using a molecular catalyst system** Jacob Strain, Steve Cronin, Joshua Spurgeon, Robert Buchanan, Craig Grapperhaus.

- GNAS Scholarship Symposium February 2020.
- 2. Ultrafast Transient Absorption Spectroscopy Investigation of Photoinduced Dynamics in Poly(3-hexylthiophene)-block-oligo(anthracene-9,10-diyl)**  
Jacob Strain, Hemali Rathnayake, Jinjun Liu.  
International Symposium of Molecular Spectroscopy 2017.  
[http://isms.illinois.edu/2017/schedule/abstract\\_files/2763.pdf](http://isms.illinois.edu/2017/schedule/abstract_files/2763.pdf)
  - 3. Ultrafast Transient Absorption Spectroscopy Investigation of Photoinduced Dynamics in Novel Donor-Acceptor Core-Shell Nanostructures for Organic Photovoltaics**  
Jacob Strain, Thulitha M. Abeywickrama, Hemali Rathnayake, Jinjun Liu; Three Talks Given (2017) American Chemical Society Annual Meeting San Francisco.  
<https://ep70.eventpilot.us/web/page.php?page=IntHtml&project=ACS17SPRING&id=2623576>  
(2016) Kentucky Academy of Sciences 2016 Annual Meeting.  
**Award:** First Place Graduate Student Oral Talk in Analytical/Physical Chemistry Division.  
(2016) International Symposium of Molecular Spectroscopy.  
<http://adsabs.harvard.edu/abs/2016isms.confEFD08S>
  - 4. Study of 4-vinylphenol reductase**  
2009 KY-TN American Society of Microbiology Branch Meeting, Knoxville, TN.  
Jacob Strain and Dr. Kinchel Doerner.

#### Presentations (Posters)

- 1. Pulsed Electrochemical Carbon Monoxide Reduction on Oxide-Derived Copper Catalyst**  
January 2020 Gordon Research Conference: Electrochemistry, Ventura, CA  
Jacob M. Strain, Saumya Gulati, Sahar Pishgar, Joshua Spurgeon
- 2. Electrochemical Reduction of CO<sub>2</sub> and CO to Produce Fuels and Chemicals**  
August 30, 2019 Student Research Exposition Speed Engineering, Louisville, KY  
Jacob M. Strain and Joshua M. Spurgeon  
**Award:** Second Place \$150 prize
- 3. Anthracene and Thiophene Based Polymeric Derivatives for Organic Photovoltaics**  
2014 SERMACS, Nashville, TN  
Jacob M. Strain, Hemali Rathnayake
- 4. Study of 4-vinylphenol reductase in *Lactobacillus* sp. pep-8**  
2010 40<sup>th</sup> Annual WKU Student Research Conference Poster Session, Bowling Green, KY  
Jacob Strain and Dr. Kinchel Doerner
- 5. Characterization of the promoter for NOSIII in *Rattus norvegicus* myofibroblasts**  
2010 Kentucky Academy of Sciences Annual Meeting, WKU, Bowling Green, KY  
Jacob Strain and Dr. Nancy Rice.
- 6. Synthesis and characterization of bulky disubstituted rhenium n5-1,3-diphenylacetylcyclopenta[c]pyridazine**  
Jacob Strain and Dr. Chad Snyder. Given at Four Conferences:  
(2010) 239<sup>th</sup> American Chemical Society (ACS) National Meeting, San Francisco, CA.  
(2009) Kentucky Academy of Sciences Annual Meeting, Northern Kentucky University, Highland Heights, KY.  
(2009) 237<sup>th</sup> ACS National Meeting, Salt Lake City, UT.  
(2009) 39<sup>th</sup> Annual WKU Student Research Conference, Bowling Green, KY.

#### Published Abstracts

- 1. Ultrafast transient absorption spectroscopy investigation of excited state dynamics of methyl ammonium lead bromide perovskite nanostructures**  
Hamzeh Telfah, Jinjun Liu, Abdeljaqer Jamhawi, Jacob Strain, Meghan Teunis, Rajesh Sardar. (2017) 253<sup>rd</sup> American Chemical Society Annual Meeting, San Francisco, CA.
- 2. Small molecular donor-acceptor dyads as additives for organic photovoltaics**  
Danielle Chavis, Jacob Strain, Hemali Rathnayake.  
(2015) 249<sup>th</sup> American Chemical Society Annual Meeting, Denver, CO.