

David J. Kirby Ph.D.

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Education:

The Pennsylvania State University, University Park, PA Ph.D. Department of Chemistry Dissertation Advisor: Dr. Christine Keating	2009-2015
Saint Francis University, Loretto, PA B.S. Chemistry Major and Physics Minor Research Advisor: Dr. Rose Clark	2005-2009

Teaching Experience

Associate Professor of Chemistry & Marie Goetz Geier Distinguished Professor of STEM Education – Notre Dame College (Fall 2016-Present)

- Developed materials, instructed, and assessed the classes and associated labs listed below. (~20 students/class)
 - General Chemistry I & II
 - Basic Physics I & II
 - College Physics I & II
 - Quantitative Analysis
 - Foundations of Physical Chemistry
 - Coordinating Seminar in Chemistry
 - Science for Living
 - Earth Science (online)
- Chemistry Department Chair (spring 2020 to present)
- Chemistry Department Assessment Coordinator (spring 2019 to present)
- Served on and chaired Faculty Affairs and Development Committee, a standing committee of the Notre Dame College Faculty Senate.
- Served on Core Curriculum Committee, a standing committee of the Notre Dame College Faculty Senate.
- Served on writing team for Higher Learning Commission assurance argument

Lecturer – Kent State University (Summer 2023 - Present)

- Developed materials, instructed, and assessed two summer courses (below) as part of the Semiconductor Education & Research Program sponsored by Intel
 - Introduction to Semiconductor Manufacturing
 - Cleanroom Technology & Semiconductor Processes

Lecturer of Chemistry – Penn State University – Behrend Campus (Fall 2015-Summer 2016)

- Lecturer for Quantitative Analysis course. Developed and presented materials relating to collection and statistical treatment of data from different chemical analysis. Managed course curriculum, laboratory, and assessment. (~15 students)

- Lecturer for General Chemistry course. Developed and presented course materials and assessments. Worked collaboratively with other instructors on course content. (~140 students)
- Lecturer for General Chemistry Lab. Worked collaboratively with other faculty to facilitate and assess a laboratory section (~25 students)
- Lecturer for Molecular Science course. Developed and presented materials relating to chemistry in the real world for a non-science audience. Managed course curriculum, and assessment. (~120 students)

Teaching Assistantships – Penn State University – University Park Campus (2009-2015)

- Mentor/co-mentor to Penn State Chemistry Research Experience for Undergraduates (REU) and National Nanotechnology Infrastructure Network (NNIN) summer students 2010 and 2013.
- Section Supervisor for General Chemistry Lab with responsibility for training teaching assistants, giving opening day and “how to write a lab report” lectures, development of additional laboratory experiments, and managing minor administrative issues during a class period.
- Teaching assistant for second semester General Chemistry lab with a materials chemistry focus. Responsibilities included, preparing a pre-lab lecture, managing two sections of 25-30 students for the lab period, and grading quizzes, weekly lab reports and a final exam.
- Teaching assistant for first semester General Chemistry lab. Responsibilities included, preparing a pre-lab lecture, managing two sections of 25-30 students for the lab period, grading quizzes, weekly lab reports, and a final exam.
- Teaching assistant for first semester General Chemistry lecture. Responsibilities included answering student questions about lecture, assisting students in develop an understanding of class materials during a supplementary one-hour session each week (3 sections, ~30 students per section), grading homework and quizzes, and proctoring exams.

Teaching Assistant/Peer Tutor – Saint Francis University (2007-2008)

- Undergraduate teaching assistant for General Chemistry lab. Assisted the laboratory instructor by answering student questions and monitoring the lab.
- Undergraduate teaching assistant for Human Chemistry lab (for health sciences majors). Assisted the laboratory instructor by answering student questions and monitoring the lab.
- Undergraduate teaching assistant for Organic Chemistry lab. Assisted the laboratory instructor by answering student questions and monitoring the lab.
- Peer Led Team Learning (PLTL) group leader for General Chemistry lecture. Guided a one hour per week group work session for general chemistry students during which course material was reinforced through additional and more complicated homework problems.

Professional Service

- Chair of Faculty Affairs & Development Committee (Fall 2018-Spring 2019)
- Faculty Affairs & Development Committee Member (Fall 2017-Current)
- Core Curriculum Committee Member (Fall 2021 – Current)
- Faculty Senate Steering Committee Member (Fall 2018-Spring 2019)
- Coordinator of 3-2 Binary Engineering Program (Fall 2018-Current)
- Coordinator of Choose Ohio First STEM @NDC Program (Summer 2020-Current)

Research Experience

Undergraduate Research Primary Investigator

Notre Dame College 2016 – Present

Actively coordinating a group of undergraduate students participating in required chemical research at Notre Dame College. This work seeks to explore the outcomes of plant growth when exposed to metal nanoparticles and quantum dots. Students synthesize following published procedures and characterize nanoparticles in house via UV-Visible spectroscopy. I have been trained to use scanning electron microscopes at the Swagelok Center for Surface Analysis and Characterization at Case Western Reserve University to supplement in-house characterization. Students have developed a hydroponic system to grow *brassica rapa var. komatsuna* and have observed the impacts of nanoparticle exposure on plant development. Students continue to work to develop analytical tools including titration and fluorescence microscopy to study the uptake and distribution of particles throughout the plant structures.

Graduate Research:

Penn State University 2009-2015

Explored highly particle dense assemblies of nano/micro-wires and the roles of inter-particle interactions and surface patterns to direct the location and orientation of the particles. Nanowires were generated by the templated electrodeposition method and were typically coated with a thin silica layer by a modified sol-gel process. Desired material segments were created using different metal salt solutions and acid etch steps. Particles were characterized using both scanning and transmission electron microscopy. Assembly was observed using optical reflectance and fluorescence microscopy, as well as confocal microscopy. Standard lithographic patterning techniques (contact and stepper projection) were used to generate surface structures (i.e. photoresist microwells) and liftoff of electron beam deposited evaporated metal films for gold platforms. Class 10 cleanroom procedures were followed for nanofabrication work. Surfaces were characterized by atomic force microscopy and ellipsometry. To supplement this work, I have become familiar with the following software platforms, NIH ImageJ, MediaCybernetics ImagePro Plus, Igor Pro, and Adobe Photoshop and Illustrator.

Internship:

Concurrent Technologies Corporation 2008-2009 (Manager: Leanne Debias)

This work explored corrosion of materials (metals and polymers) and their coatings following exposure to a variety of simulated environments. Samples were exposed to artificial seawater, elevated humidity, elevated UV, and deicing solution and their physical properties were tested according to ASTM standards.

Undergraduate Research:

Saint Francis University 2006-2009

Studied mixed self-assembled monolayer organization on evaporated gold electrodes and their effect on the electron transfer kinetics of Cytochrome *c*. The structure of the mixed self-assembled monolayer was probed by X-Ray photoelectron spectroscopy and grazing angle infrared spectroscopy. Electron transfer kinetics were examined using cyclic voltammetry.

Technical Skills

Instrumentation: Scanning electron microscopy (FEI Nova NanoSEM 630, ThermoFisher Apreo), transmission electron microscopy (JEOL JEM 1200 EXII), optical microscopy (inverted and upright, brightfield, darkfield, and epifluorescence), confocal microscopy (Leica TCS-SP5), UV/Visible spectroscopy, contact and stepper lithography, metal film evaporation, class 10 cleanroom, atomic force microscopy (Bruker Icon), ellipsometry, and cyclic voltammetry.

Software: Microsoft Office 365, Moodle, MarvinSketch, Wondershare Filmora, NIH ImageJ, MediaCybernetics ImagePro Plus, Igor Pro, and Adobe Photoshop and Illustrator.

Publications

- 1) Jahanmahin, O.; Kirby, D. J.; Smith, B. D.; Albright, C. A.; Gobert, Z. A.; Keating, C. D.; Fichthorn, K. A.; Assembly of Gold Nanowires on Gold Nanostripe Arrays: Simulation and Experiment, *J. Phys. Chem. C*, **2020**, *124*, 9559-9571.
- 2) Kirby, D. J.; Smith, B. D.; Keating, C. D. "Microwell Directed Self-Assembly of Vertical Nanowire Arrays." *Part. Part. Syst. Charact.* **2014**, *31*, 492-499.
- 3) Smith, B. D.; Kirby, D. J.; Boehm, S. J.; Keating, C. D. "Self-Assembled Binary Mixtures of Partially Etched Nanowires." *Part. Part. Syst. Charact.* **2015**, *32*, 347-354.
- 4) Smith, B. D.; Fichthorn, K. A.; Kirby, D. J.; Quimby, L. M.; Triplett, D. A.; González, P.; Hernández, D.; Keating, C. D. "Asymmetric van der Waals Forces Drive Orientation of Compositionally Anisotropic Nanocylinders within Smectic Arrays: Experiment and Simulation." *ACS Nano* **2014**, *8*, 657-670.
- 5) Smith B. D.; Kirby, D. J.; Ortiz Rivera, I.; Keating, C. D. "Self-Assembly of Segmented Anisotropic Particles: Tuning Compositional Anisotropy To Form Vertical or Horizontal Arrays." *ACS Nano* **2013**, *7*, 825-833.
- 6) Smith B. D.; Kirby, D. J.; Keating, C. D. "Vertical Arrays of Anisotropic Particles by Gravity-Driven Self-Assembly." *Small* **2011**, *7*, 781-787.
- 7) Yue, H.; Waldeck, D. H.; Schrock, K.; Kirby, D.; Knorr, K.; Switzer, Stephanie; Rosmus, J.; Clark, R. A. "Multiple Sites for Electron Tunneling between Cytochrome *c* and Mixed Self-Assembled Monolayers." *J. Phys. Chem. C* **2008**, *112* (7), 2514-2521.

Invited Lectures

- Kirby, D. J.; A Career Arc of an SFU Chemistry Graduate. Saint Francis University Senior Seminar Series, Saint Francis University, Loretto, PA, April 4, 2022.
- Kirby, D. J.; Smith, B. D.; Ortiz Rivera, I.; Quimby, L. M.; Keating, C. D. Assembly of Nanowire Arrays. Saint Francis University Senior Seminar Series, Saint Francis University, Loretto, PA, October 22, 2010.

Presentations

- Kirby, D. J.; Smith, B. D.; Keating, C. D. Location specific vertical assembly of nanowires via lithographic micro-features, American Chemical Society Colloid and Surface Science Symposium, Riverside, CA, June 25, 2013. (*oral presentation*)
- Kirby, D. J.; Smith, B. D.; Keating, C. D. Columnar Assembly of Two-Component Nanowires Using Microwells. Materials Research Society Self and Directed Assembly of Nanomaterials Workshop, Nashville, TN, September 29, 2011. (*oral presentation*)
- Kirby, D. J.; Smith, B. D.; Wustrow, A. E.; Fichthorn, K. A.; Keating, C. D.; Nanowire Interactions and Their Effect on Particle Dense Assemblies. The 247th National Meeting of the American Chemical Society, Dallas, TX, 2014. (*poster*)
- Kirby, D. J.; Smith, B. D.; Wustrow, A.; Keating, C. D. Nanowire Assembly Directed by Lithographic Microwells. The Pennsylvania State University Materials Day, University Park, PA, 2013. (*poster*)
- Kirby, D. J.; Smith, B. D.; Wustrow, A.; Keating, C. D. Nanowire Assembly Directed by Lithographic Microwells. The Pennsylvania State University Sponsors Days, University Park, PA, 2013. (*poster*)
- Kirby, D. J.; Smith, B. D.; Keating, C. D. Microwell Assisted Self-Assembly of Two-Component Nanowires to Specific Locations. The Pennsylvania State University Materials Day, University Park, PA, 2012. (*poster*)

- Kirby, D. J.; Basile, C.; Schrock, K. A.; Trout, C. J.; Clark, R. A. Examination of Multi-Component Self-Assembled Monolayers on the Electron Transfer Kinetics of Cytochrome *c*. The Pittsburgh Conference. Chicago, IL, 2009. (*poster*)
- Kirby, D. J.; Rosmus, J. J.; Clark, R. A. Understanding the surface of self-assembled monolayers on gold electrodes used for cytochrome *c* electrochemistry The Pittsburgh Conference. New Orleans, LA, 2008. (*poster*)
- Kirby, D. J.; Schrock, K. A.; Yue, H.; Clark, R. A.; Waldeck, D. Probing the Self-Assembled Monolayer Structure and the Electrodes Influence on Cytochrome *c* Electrochemistry. Duquesne Undergraduate Research Symposium. Pittsburgh, PA, 2007. (*poster*)
- Kirby, D. J.; Schrock, K. A.; Yue, H.; Clark, R. A.; Waldeck, D. Probing the Self-Assembled Monolayer Structure and the Electrodes Influence on Cytochrome *c* Electrochemistry. Saint Francis University Research Symposium Loretto, PA, 2007. (*poster*)
- Kirby, D. J.; Investigation of Cytochrome *c* Electron Transfer Kinetics and Formal Potential with Varying Composition of Self-Assembled Monolayers. Undergraduate Research at the Capitol Poster Session Harrisburg, PA, 2007. (*poster*)
- Kirby, D. J.; Schrock, K. A.; Clark, R. A. Effects of Changing Self-Assembled Monolayer Composition on Cytochrome *c* Electron Transfer Kinetics. Duquesne Undergraduate Research Symposium Pittsburgh, PA, 2006. (*poster*)
- Kirby, D. J.; Schrock, K. A.; Clark, R. A. Effects of Changing Self-Assembled Monolayer Composition on Cytochrome *c* Electron Transfer Kinetics. Saint Francis University Research Symposium Loretto, PA, 2006. (*poster*)
- Kirby, D. J.; Schrock, K. A.; Clark, R. A. Effects of Changing Self-Assembled Monolayer Composition on Cytochrome *c* Electron Transfer Kinetics. Saint Francis University Science Day Program Loretto, PA, 2006. (*poster*)

Awards and Honors

- Notre Dame College Distinguished Faculty Award AY 2020-2021
- Pennsylvania State University Chemistry Department Travel Award 2011, 2013 and 2014
- NSF Graduate Research Fellowship Program Honorable Mention 2011
- PSU Roberts Fellowship 2009-2010
- Society of Analytical Chemists of Pittsburgh College Chemistry Award 2009

Outreach and Volunteer Activities

- Summer camp director – organized and coordinated counselors and activities for a one-week camp for youth ages 12-18. (2013-2019)
- Summer camp counselor – helped lead activities and supervise campers (ages 10-18) for one week and two weekends each year from 2005-2022.
- Helped to organize and lead hands on science activities for K-12 students at local schools with the research group at Penn State and through the Rural Outreach Chemistry for Kids (R.O.C.K.) program at Saint Francis.

Professional Affiliations

- The American Chemical Society
- The American Chemical Society Colloid and Surface Science Division
- The American Chemical Society Cleveland Local Section
- Society of Analytical Chemists of Pittsburgh
- Spectroscopy Society of Pittsburgh

References Available Upon Request