David J. Kirby, Ph.D.

Analytical Chemist | Materials Characterization | STEM Educator

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Professional Summary

Analytical chemist with expertise in nanomaterials, imaging, chemical analysis, and materials characterization. Demonstrated success in mentoring and leading teams through clear, effective communication with a focus on consistency, precision, collaboration and creative problem-solving.

Education

Ph.D., Chemistry, The Pennsylvania State University, University Park, PA (2015)

Dissertation Title: Assembly of Nanowire Arrays: Exploring Interparticle Interactions, Particle Orientation, and Mixed Particle Arrays

B.S., Chemistry, Saint Francis University, Loretto, PA (2009)

Technical Skills

- *Microscopy & Imaging*: Optical microscopy (brightfield, darkfield, epifluorescence), confocal microscopy, SEM, TEM, AFM, ellipsometry.
- *Materials Preparation, Characterization, & Analytical Methods*: UV–Vis spectroscopy; FTIR spectroscopy, electrochemical analysis (cyclic voltammetry, linear sweep voltammetry); nanoparticle synthesis and surface modification.
- *Microfabrication & Cleanroom Techniques*: Contact and stepper photolithography; thin-film metal deposition and liftoff; wet chemical and reactive ion etching; Class 10 cleanroom practice.
- *Chromatography & Chemical Analysis*: HPLC, GC-MS.
- *Software & Data Analysis:* ImageJ, ImagePro Plus, Igor Pro, Gaussian, Adobe Photoshop/Illustrator, Microsoft Office 365, MarvinSketch, Filmora. Learning Management software including Moodle & Canvas

Research Experience

The Pennsylvania State University, University Park, PA
Graduate Researcher, Department of Chemistry, Laboratory of Christine Keating (2009-2015)

- Studied the assembly of nanowire arrays with a focus on controlling the organization through modification of interparticle and particle-surface interactions.
- Fabricated nanowires via a template electrodeposition process followed by a modified sol-gel silica coating and selective acid etching to control the asymmetric nature of particles.
- Characterized particles and assemblies using optical and electron microscopy techniques.
- Employed semiconductor manufacturing processes including, thin-film deposition, photolithography (contact and stepper), and etching to fabricate assembly substrates in a class 10 cleanroom environment.
- Analyzed images to evaluate the overall assembly quality and complete statistical comparisons between experimental conditions.

College of Wooster, Wooster, OH
Undergraduate Research Advisor, Department of Chemistry (2024-Present)

- Mentored students in the Sophomore Research and Senior Independent Study program
- Directed studies on the uptake, distribution of, and growth outcomes of hydroponic plants exposed to quantum dots and engineered metal (Au and Ag) nanoparticles with chitosan or polyethylene glycol coatings and fluorescent labels.
- Development of an electrochemical nitrate sensor and experimental methodology for use in hydroponic growth media using linear sweep voltammetry.
- Trained students to synthesize particles according to published procedure and characterize using UV-Visible spectroscopy, fluorimetry, dynamic light scattering, epi-fluorescence and confocal microscopy.
- Projects consistently awarded additional institutional funding based on their merit and proposed budget for further explorations.

Notre Dame College, South Euclid, OH
Undergraduate Research Advisor, Department of Chemistry (2016-2024)

- Coordinated a team of undergraduate researchers consisting of biology, chemistry, and pre-engineering students participating in for-credit research projects.
- Developed a collaborative program that utilized the unique skills of each student to study the growth outcomes of hydroponic plants exposed to nanomaterials including Au, Ag, and quantum dots.
- Trained students to synthesize and characterize particles according to published procedures and using UV-Visible Spectroscopy
- Expanded lab capabilities by obtaining scanning electron microscope training at the Swagelok Center for Surface Analysis and Characterization at Case Western Reserve University to supplement in-house characterization.

Saint Francis University, Loretto, PA
Undergraduate Researcher, Department of Chemistry, Laboratory of Rose Clark (2006-2009)

- Investigated mixed self-assembled monolayers (SAM) on evaporated gold electrodes and their effect on Cytochrome *c* electron transfer kinetics.
- Measured electron transfer rates using cyclic voltammetry
- Worked with collaborators at Penn State University to collect and interpret X-Ray photoelectron spectroscopy and grazing angle infrared spectroscopy data to characterize SAM distribution.

Applied Research & Industry Experience

Concurrent Technologies Corporation, Johnstown, PA, (2008-2009)
Intern, Analytical Services Department

- Worked with the analytical services team to characterize the corrosion and breakdown of metal and polymer materials and their coatings for government and private industry contracts.
- Performed accelerated weather testing according to ASTM standards using artificial seawater, elevated humidity, UV exposure, and de-icing solutions.
- Evaluated changes in material properties after environmental exposure and contributed data for reports on client projects.

Teaching Experience

The College of Wooster:

John Garber Drushal Distinguished Visiting Associate Professor of Chemistry (Fall 2024 - Present)

Notre Dame College:

Associate Professor of Chemistry & Marie Goetz Geier Distinguished Professor of STEM Education (Fall 2016 - Spring 2024)

Kent State University:

Lecturer Semiconductor Education & Research Program (Summer 2023 - Present)

The Pennsylvania State University–Behrend Campus:

Lecturer of Chemistry (Fall 2015 - Summer 2016)

The Pennsylvania State University–University Park Campus:

Teaching Assistantship & Lab Section Supervisor (2009 - 2015)

- Developed and taught lecture and laboratory courses across general chemistry, analytical chemistry, instrumental analysis, physical chemistry, inorganic chemistry and introductory physics.
- Designed and implemented laboratory curricula emphasizing experimental design, chemical analysis, data treatment, and scientific communication.
- Mentored students in research methods, independent projects, and technical skill development across chemistry and related STEM fields.
- Led and coordinated teaching teams, trained new instructors, supervised laboratory sections, and contributed to departmental assessment and curriculum efforts.

Selected Courses Taught

General Chemistry I & II and Labs, Analytical Chemistry & Lab, Instrumental Analysis Lab, Inorganic Chemistry Lab, Physical Chemistry and Lab, Semiconductor Manufacturing Processes, Cleanroom Technology, Molecular Science, Physics I & II and Labs, Earth Science (online)

Professional Service

Professional Organizations

- Conference Week Staff, PittCon Short Courses 2026

Institutional Governance & Committee Work – Notre Dame College

- Chair, Chemistry Department (Spring 2020 - Spring 2024)
- Assessment Coordinator, Chemistry Department (Spring 2019 - Spring 2024)
- Writer, Higher Learning Commission Reporting Team (2021 - 2023)
- Chair, Faculty Affairs & Development Committee (Fall 2018 - Spring 2019)
- Member, Faculty Affairs & Development Committee (Fall 2017 - Spring 2021)
- Member, Core Curriculum Committee Member (Fall 2021 - Spring 2024)
- Member, Faculty Senate Steering Committee Member (Fall 2018 - Spring 2019)

Program Leadership – Notre Dame College

- Coordinator, 3-2 Binary Engineering Program (Fall 2018 - Spring 2024)
- Coordinator, Choose Ohio First STEMM @NDC Program (Summer 2020 - Spring 2024)

Publications

- 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.
- 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.
- 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.
- 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.
- 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.
- Smith B. D.; Kirby, D. J.; Keating, C. D. "Vertical Arrays of Anisotropic Particles by Gravity-Driven Self-Assembly." *Small* **2011**, *7***,** 781-787.
- 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.; Semiconductor Manufacturing: the science of making the world's smallest devices and its future in Ohio, Wooster Science Café, Wooster, OH, February 3, 2026
- Kirby, D. J.; Making the World's Tiniest Devices using Chemistry – and How it's Happening in Ohio, ACS Cleveland Local Section, Cleveland, OH, February 19, 2025.
- 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 & Honors

- Notre Dame College Distinguished Faculty Award AY 2020-2021
- Marie Goetz Geier Distinguished Professor of STEM Education 2021
- Marie Goetz Geier Endowment awarded to fund electron microscopy training 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 & Volunteer Activities

- Evaluator, Equipment grant proposals, Society of Analytical Chemists of Pittsburgh and Spectroscopy Society of Pittsburgh (2024-Present)
- Summer camp director, Camp Living Waters (2013-2019)
- Summer camp counselor, Camp Living Waters (2005-2022)
- Student Volunteer, Rural Outreach Chemistry for Kids (R.O.C.K.), Saint Francis University (2005-2009)

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

Professional References

Christine Keating Ph.D. – Graduate Research Advisor, The Pennsylvania State University
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Sharon Balchak Ph.D. – Chair of Division of Math & Science, Notre Dame College
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David Orosz Ph.D. – Interim Provost/Dean of Faculty and Chemistry Chair, Notre Dame College
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