Jacob Daniel Aubrey

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EDUCATION

Doctor of Philosophy in Chemistry, Rensselaer Polytechnic Institute (RPI), Troy, New York (NY)
Aug. 2023 – Present
GPA: 3.94

Bachelor of Science in Chemistry, ACS Certified, summa cum laude, State University of New York (SUNY) at Oneonta, Oneonta, NY
May 2023
GPA: 3.91

Associate of Science in Engineering, summa cum laude, SUNY Adirondack, Queensbury, NY
May 2021
GPA: 3.88

RESEARCH EXPERIENCE

Graduate Research Assistant and NIGMS T32 Training Program Fellow, RPI | *Feb. 2024 – Present*
Principal Investigator (PI): Peter J. Bonitatibus Jr., Ph.D.; Co-PI: Ge Wang, Ph.D.
Project: *Photon Counting CT (PCCT) Protocol Optimization and Contrast Agent Development*

Ongoing:

- Optimizing PCCT protocols for calcified plaque imaging in phantoms using a novel tantalum-oxide nanoparticle (TaO_x NP) contrast agent

Completed:

- Evaluated how PCCT energy thresholds near a given material's K-edge affect material decomposition (MD) to better inform material-specific binning scheme design (manuscript in prep)
- Identified critical, material-dependent effects of X-ray pre-filtration on PCCT MD (https://doi.org/10.1088/1361-6560/ae98dc)
- Demonstrated superior performance of TaO_x NP contrast as compared to iodinated contrast in the presence of X-ray pre-filtration-mediated metal artifact reduction at PCCT (https://doi.org/10.1088/1361-6560/ae0be9)
- Characterized the surface bonding and coating architecture of the novel TaO_x NP contrast agent using solution phase ^{1}H, ^{13}C, and ^{29}Si NMR, $^{1}H/^{13}C$ HMBC NMR, and ^{1}H CPMG NMR (https://doi.org/10.20935/AcadNano7737)

Visiting Researcher, RPI | *Jun. 2023 – Aug. 2023*
Advisor: K. V. Lakshmi, Ph.D.
Project: *Computational Analysis of Photosystem I Phylloquinone A_{1A}*

- Modeled photosystem I (PSI) phylloquinone A_{1A} using DFT
- Altered the number of PSI proteins in the model to analyze protein matrix effects
- Compared computational EPR results to empirical EPR results in the literature to determine model accuracy

Undergraduate Researcher, SUNY Oneonta | *Aug. 2022 – May 2023*
Advisor: Maurice Odago, Ph.D.
Project: *Molecular Luminescent Sensors for Anion Detection and Quantification*

- Synthesized compounds engineered for anion binding and detection
- Characterized compounds with NMR, IR, UV-Vis, and Fluorescence spectroscopy
- Analyzed anion binding of compounds via UV-Vis tetrabutylammonium-anion titrations

Undergraduate Researcher in the International Genetically Engineered Machine (iGEM) program, SUNY Oneonta | *Jun. 2022 – Oct. 2022*
Advisors: Jill Fielhaber, Ph.D.; Kelly Gallagher, Ph.D.; William Vining, Ph.D.
Project 1: *Development of a Cyanophage DNA Delivery Vehicle for Efficient Genetic Engineering of Cyanobacteria*

- Researched Cyanobacteria and cyanophages through literature and expert interviews
- Performed gene alignments to determine the putative capsid genes of the cyanophage S-TIP37
- Used *Golden Gate Assembly* to begin construction of an S-TIP37 phagemid
- Organized work on an open-source wiki (https://2022.igem.wiki/suny-oneonta/)
- Presented work in Paris, October 23 – 30, at the 2022 iGEM Grand Jamboree
- Received a silver medal at the iGEM Grand Jamboree for the team's accomplishments

Project 2: *International Interlab Protein Expression Study*

- Participated in an international interlaboratory study to determine the reproducibility of fluorescent protein expression in different test cell line strains
- Expressed various fluorescent proteins in different test cell lines
- Used a fluorescence spectrometer to determine protein expression and a microplate reader to determine cell growth
- Reported findings on an open-source wiki (https://2022.igem.wiki/suny-oneonta/)

PUBLICATIONS

Aubrey, J. D.; Perkinson, E.; Wang, G.; Bonitatibus, P. J., Jr. Material-dependent effects of X-ray pre-filtration on material decomposition in photon-counting CT. *Phys. Med. Biol.* **2026**. https://doi.org/10.1088/1361-6560/ae98dc.

Aubrey, J. D.; Perkinson, E. P.; Wang, G.; Bonitatibus, P. J., Jr. Metal artifact reduction and contrast agent performance as a function of source spectral shape. *Phys. Med. Biol.* **2025**, *70*(20), 205005. https://doi.org/10.1088/1361-6560/ae0be9.

Aubrey, J. D.; Gibson, J.; Leman, J. T.; Yeh, B. M.; Bonitatibus, P. J., Jr. Insights into nanoparticle surface bonding and coating architecture via multinuclear NMR. *Acad. Nano: Sci. Mat. Tech.* **2025**, *2*(2). https://doi.org/10.20935/AcadNano7737. PMCID: PMC12199202.

ORAL PRESENTATIONS

Aubrey, J. D.; Perkinson, E. P.; Wang, G.; Bonitatibus, P. J., Jr. Tantalum oxide nanoparticle contrast is better preserved than iodinated contrast under spectral shaping for metal artifact

reduction in photon-counting CT. 5th Annual NY Capital Region Society for Applied Spectroscopy Symposium; RPI, Troy, NY; May **2026**. (best oral presentation award)

Bonitatibus, P. J., Jr.; **Aubrey, J. D.**; Gibson, J.; Leman, J. T. Insights into tantalum oxide nanoparticle surface bonding and siloxane coating architecture via multinuclear NMR. ACS Northeast Regional Discussion; Worcester State University, Worcester, MA; November **2025**.

Bonitatibus, P. J., Jr.; **Aubrey, J. D.**; Leman, J. T.; Gibson, J.; Dobrovolskaia, M. Nanotoxicology, long-term biodistribution/excretion, and current status of scaled-up synthesis/characterization of a potentially translatable tantalum oxide agent. Materials Research Society Fall Meeting & Exhibit; Boston, MA; December **2024**; ID SB06.04.03.

POSTER PRESENTATIONS

Aubrey, J. D.; Perkinson, E. P.; Wang, G.; Bonitatibus, P. J., Jr. Metal artifact reduction and contrast agent performance as a function of source spectral shape. Annual NIGMS and NIA T32 Training Program Retreat; RPI, Troy, NY; April **2026**.

Aubrey, J. D.; Perkinson, E. P.; Wang, G.; Bonitatibus, P. J., Jr. Metal artifact reduction and contrast agent performance as a function of source spectral shape. Annual Chemistry and Chemical Biology Graduate Research Symposium; RPI, Troy, NY; December **2025**.

Aubrey, J. D.; Gibson, J.; Leman, J. T.; Yeh, B. M.; Bonitatibus, P. J., Jr. Insights into nanoparticle surface bonding and coating architecture via multinuclear NMR. 76th Southeastern and 81st Southwest Joint Regional Meeting of the American Chemical Society (SERMACS/SWRM); Orlando, FL; October **2025**; Poster 649.

Aubrey, J. D.; Gibson, J.; Leman, J. T.; Yeh, B. M.; Bonitatibus, P. J., Jr. Insights into nanoparticle surface bonding and coating architecture via multinuclear NMR. 49th National Organic Chemistry Symposium; RPI, Troy, NY; June **2025**; Poster M34. (best poster award)

Aubrey, J. D.; Perkinson, E. P.; Wang, G.; Bonitatibus, P. J., Jr. Metal artifact reduction and contrast agent performance as a function of source spectral shape. 4th Annual NY Capital Region Society for Applied Spectroscopy Symposium; RPI, Troy, NY; June **2025**.

Perkinson, E. P.; **Aubrey, J. D.**; Bonitatibus, P. J., Jr. Energy bin selection for photon-counting CT of iodine and tantalum diagnostic imaging agents. HVCC Honors College Service Project Showcase; Troy, NY; April **2025**.

Aubrey, J. D.; Gibson, J.; Leman, J. T.; Yeh, B. M.; Bonitatibus, P. J., Jr. Insights into nanoparticle surface bonding and coating architecture by multinuclear solution-phase NMR spectroscopy. RPI NIA-NIGMS Annual Retreat; RPI, Troy, NY; April **2025**.

Perkinson, E. P.; **Aubrey, J. D.**; Bonitatibus, P. J., Jr. Energy bin selection for photon-counting CT of iodine and tantalum diagnostic imaging agents. Northeast Regional Honors Council Conference; Harrisburg, PA; March **2025**.

Perkinson, E. P.; **Aubrey, J. D.**; Bonitatibus, P. J., Jr. Energy bin optimization for photon-counting CT of iodine, barium, and tantalum contrast agents. Chemistry Summer Undergraduate Research Program (SURP) Poster Session; RPI, Troy, NY; July **2024**.

Schlogl, M. E.; Narayana, B.; Landry, P. J.; **Aubrey, J. D.**; Lakshmi, K. V. Electrochemical and quantum mechanical studies of structure-function relationships of quinone cofactors. 16th Annual ENY ACS Undergraduate Research Symposium; Siena College, Loudonville, NY; April **2024**.

Reyes, J.; Alvarenga, J.; **Aubrey, J. D.**; Buchanan, L.; Yashinski, D.; Gallagher, K.; Fielhaber, J. Cyanospectre: first stage in a toolkit for cyanobacterial engineering. American Chemical Society National Meeting Symposium; New Orleans, LA; March **2024**.

Reyes, J.; Alvarenga, J.; **Aubrey, J. D.**; Buchanan, L.; Yashinski, D.; Gallagher, K.; Fielhaber, J. Cyanospectre: First stage in a toolkit for cyanobacterial engineering. iGEM Grand Jamboree; Paris Convention Center, Paris, France; October **2022**.

RESEARCH SKILLS

PCCT and Quantitative Image Analysis

- PCCT imaging using a MARS v5 system, including scan protocol development and optimization, image acquisition, reconstruction, material decomposition, and virtual monoenergetic image (VMI) generation
- Quantitative image analysis, including region-of-interest and voxel-level analysis, material identification and quantification, sensitivity and specificity, RMSE, contrast-to-pooled-noise ratio, AUROC, linear regression, fast Fourier transform, and 2D/3D visualization
- Design, testing, and validation of custom Python-based tools for PCCT data analysis, including DICOM processing, ROI registration and analysis, basis-vector calibration, basis-map analysis, VMI generation, flatfield/projection analysis and pixel masking, structured data export, and workflow automation
- Image processing and analysis using MARS Vision, MARS FastMD, ImageJ, and custom Python-based software
- Custom phantom design and fabrication using CAD software and 3D printing (extrusion and resin)

Synthetic and Analytical Chemistry

- Coordination compound, small-molecule organic, polyoxotantalate, and tantalum nanoparticle synthesis, including air-free Schlenk-line techniques
- Quantitative and repeatable solution preparation using volumetric glassware and micropipettes
- Compound purification using flash column chromatography and thin-layer chromatography
- Compound/nanoparticle characterization using 1D and 2D multinuclear NMR, CPMG NMR, IR, UV-Vis absorption, and fluorescence spectroscopy

Scientific Communication and Research Development

- Research concept development including grant ideation, literature searching and synthesis, proposal writing, and figure generation
- Scientific communication through posters, oral presentations, and manuscripts
- Peer-review response and manuscript revision, including preparation of point-by-point rebuttal letters and development of additional analyses, figures, and tables in response to reviewer feedback

Software and Research Computing

- MARS Vision, MARS FastMD, ImageJ, Origin, TopSpin, Olex2, MarvinSketch, SpekCalc, GitHub, Visual Studio Code
- Actively developing Python programming proficiency

FELLOWSHIPS AND AWARDS

RPI
NIGMS T32 Training Program in Biomolecular Science and Engineering Fellowship | *July 2024 – June 2026*
The Slezak Memorial Graduate Fellowship | *May 2026*
Professor Ronald A. Bailey Graduate Student Travel Award | *May 2026*
5th Annual NY Capital Region Society for Applied Spectroscopy Symposium Best Oral Presentation Award | *May 2026*
49th National Organic Chemistry Symposium Best Poster Award, Poster M34 | *June 2025*

SUNY Oneonta
Academic Achievement Award in Chemistry | *May 2023*
ACS Undergraduate Award in Analytical Chemistry | *May 2023*
ACS Undergraduate Award in Inorganic Chemistry | *May 2023*
ACS Undergraduate Award in Physical Chemistry | *May 2023*
Chemistry and Biochemistry Department Scholarship | *Aug. 2021 – May 2022, Aug. 2022 – May 2023*
Richard Siegfried Student Award for Academic Excellence | *Nov. 2022*

SUNY Adirondack
Ross Klinck Outstanding Organic Chemistry Student Award | *May 2021*
Mathematics Tutoring Award | *Apr. 2021*
Engineering Science Award | *Apr. 2021*
Harold "Hal" Burrell Freshman Chemistry Achievement Award | *May 2020*
Wenk, Daly & Barthel Scholarship | *Sept. 2019 – May 2020*
Rick Patrick Scholarship | *Sept. 2019 – May 2020*

TEACHING AND MENTORING EXPERIENCE

Undergraduate Research Mentor, Bonitatibus Lab, RPI, Troy, NY
Jun. 2024 – Present
Provide daily mentorship to an undergraduate researcher in experimental design, laboratory safety and techniques, instrumentation use, data analysis, scientific communication, and academic integrity.

Guest Lecturer, High School Chemistry, Hartford, New York | *May 2024*
Delivered an invited lecture on redox chemistry to homeschooled high-school students; demonstrated electrochemical principles through a hands-on galvanic cell experiment using an apple and galvanized nail electrodes.

Laboratory Teaching Assistant, General Chemistry II (CHEM 1200), RPI, Troy, NY | *Jan. – Apr. 2024*

Led two weekly laboratory sections totaling 102 students; graded pre- and post-laboratory assignments for 60 students; held weekly office hours and helped proctor exams to ensure academic integrity.

Laboratory Teaching Assistant, Experimental Chemistry III (CHEM 4020), RPI, Troy, NY | *Aug. – Dec. 2023*
Led a weekly upper-level laboratory section totaling 13 students; collaborated with two teaching assistants to grade pre- and post-labs across all course sections totaling 19 students; held weekly office hours.

Academic Peer Mentor, Introductory Algebra, SUNY Adirondack, Queensbury, NY | *Sep. – Dec. 2020, Jan. – May 2021*
Mentored students through weekly check-ins, office hours, and in-class assistance to encourage student engagement and promote academic success.

Mathematics Tutor, Mathematics, Engineering, and Computer Science Tutoring Center, SUNY Adirondack, Queensbury, NY | *Sep. – Dec. 2019, Jan. – May 2020*
Tutored walk-in students at the Mathematics, Engineering, and Computer Science Tutoring Center providing one-on-one help with homework assignments and material comprehension.

SERVICE, OUTREACH, and LEADERSHIP

Member of the NIGMS T32 Training Program in Biomolecular Science and Engineering Fellowship Executive Committee, RPI, Troy, NY | *Aug. 2026 – Present*
Review and grade training program applications and work with other committee members to finalize selection of fellowship awardees.

Interactive Virus Exhibit Design, SUNY Oneonta, Oneonta, NY | *Jun. – Oct. 2022*
Designed an interactive virus exhibit for the *A. J. Read Science Discovery Center* to promote public understanding of viral structure and function as a part of the SUNY Oneonta iGEM outreach initiative.

Young Adult Small Group Leader, Open Arms Church, Schenectady, NY | *Oct. 2024 – Present*
Prepare and lead biweekly biblical/theological small-group discussions for young adults, including discussion planning, facilitation, and group engagement.

Sunday School Teacher, Open Arms Church, Schenectady, NY | *Jan. 2024 – Present*
Prepare and teach weekly Bible lessons for approximately 15 students; lead age-appropriate discussion, music, crafts, and activities.

ADDITIONAL EXPERIENCE

Manager/owner of Aubrey Brothers' Sugarhouse, Hartford, NY **|** *Jan. 2017 – Jul. 2021*
Co-managed and co-owned a family maple sugaring business; handled sales, production, quality control, maintenance, and company growth; applied engineering skills in designing new machinery to streamline syrup production and ensure syrup quality.