Alexandra Davis, PhD

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Education

Washington University in St. Louis — St. Louis, MO
Doctor of Philosophy in Biomedical Engineering — *Aug 2019 – Dec 2025*
Dissertation Title: Elucidating the Role of the Synovial Matrix in Drug Transport and Disease
Advisor: Dr. Lori Setton

University of Chicago — Chicago, IL
Bachelor of Science in Molecular Engineering, Minor in Germanic Studies — *Sep 2015 – Jun 2019*

Technical Experience

Setton Lab, Washington University in St. Louis — St. Louis, MO
Postdoctoral Research Associate — *Dec 2025 – Jul 2026*

- Completed and submitted manuscripts from doctoral work, including first- and second-author papers on collagen-induced arthritis now under review

Graduate Research Assistant — *Aug 2019 – Dec 2025*

- Investigated how properties of model drugs and composition of synovium govern small-molecule transport in the joint, informing the rational design of intra-articular therapies
- Developed a quantitative image analysis pipeline using optical tissue clearing, multiphoton microscopy, and texture analysis to characterize collagen organization, evaluating 320+ datapoints per sample to distinguish healthy from diseased synovial morphology in a model of inflammatory arthritis
- Contributed image analysis and joint inflammation expertise to a six-laboratory ARPA-H program engineering smart cells to regenerate arthritic joints

Tay Lab, University of Chicago — Chicago, IL
Undergraduate Research Assistant — *Jun 2017 – Apr 2019*

- Optimized proximity ligation assay protocols coupled with droplet digital PCR to measure protein expression with femtomolar sensitivity

Science Policy Experience

National Science Policy Network — Remote
Science Diplomacy Committee Member — *May 2023 – May 2025*

- Co-authored policy analysis with fellow NSPN member on dual-use potential of emerging biotechnologies, synthesizing 100+ scientific articles and pieces of legislation to identify where technical capabilities outpace governance frameworks
- Collaborated with network members to identify policy barriers preventing Cuban biotherapeutics from reaching millions of US patients, combining informational interviews with US-Cuba science diplomacy practitioners and Cuban scientists with analysis of legislation and scientific literature
- Conceptualized and moderated a **webinar** in the Data Diplomacy Series on e-governance and equitable digital infrastructure, featuring a United Nations policy practitioner and Estonia's former cybersecurity director

EUChicago — Chicago, IL
Science & Technology Cohort Leader — *Sep 2017 – May 2019*

- Led a research cohort in a student chapter of European Horizons, culminating in articles on **higher education in France** and **green energy in Estonia**

Communication Experience

The BALSA Group — St. Louis, MO
Consultant — *Sep 2026 – Present*

- Translating technical material into blog posts tailored to scientific audiences for a biotech client

Enago — Remote
Top Impact Scientific Editor — *Dec 2022 – Present*

- Edited 180+ scientific articles for publication in top biomedical, engineering, and environmental science journals, working across subject areas outside of my own specialization

- Advised non-native English-speaking authors on syntax, clarity, style, and framing of scientific significance for target journals under tight deadlines

Staff Photographer Chicago, IL

The Chicago Maroon *Sep 2016 – Sep 2017*

- Contributed weekly photographs of various events on campus and in Hyde Park community for the University of Chicago's newspaper; planned the newspaper's photography agenda and story ideas at weekly staff meetings

Policy Writing

- Guin RN, Requeiro L, & **Davis AL**. "What the Embargo of Cuba Costs US Public Health." Science Politics. (2026).

- **Davis AL** & Coltoff EC. "Emerging biotechnologies: Dual-use potential and strategies to prevent misuse." MIT Science Policy Review (2025).

Scientific Publications

- Akanda SR, Jain E, Longobardi L, Decuzzi P, **Davis AL**, & Setton LA. "A Two-Compartment Finite Element Model of Intra-Articular Drug Clearance From Sustained-Release Carriers." Submitted.

- **Davis AL**, Akanda SR, Reals RF, Castile RM, Pham CTN, Jing L, Lake SP, & Setton LA. "Characterization of rat synovium during collagen-induced arthritis using quantitative second harmonic generation microscopy and nanoindentation." Under review.

- Reals RF, **Davis AL**, Castile RM, Sun Y, Jarrell GV, Havlioglu N, Zmistowski B, Setton LA, & Lake SP. "Collagen-Induced Arthritis Model Causes Mechanical and Histological Changes in the Rat Elbow." Under review.

- **Davis AL**, Vaidyanathan A, Owusu Sachie S, Rohanifar M, Jing L, Akanda SR, & Setton LA. "An experimental-computational approach for measuring charged solute diffusivity through human synovium." Journal of Biomechanics (2025).

- Akanda SR, Walter C, **Davis AL**, Jing L, Pathak A, & Setton LA. "Interspecies Comparison of Multilayer Mechanical Properties of Synovium Using Atomic Force Microscopy." Tissue Engineering Part A (2025).

- Keshav KA, Akanda SR, **Davis AL**, Crandall CL, Zaghloul MS, Setton LA, Halabi CM, Zayed MA, & Wagenseil JE. "Transport across the thoracic aortic wall: implications for aneurysm pathobiology, diagnosis, and treatment." American Journal of Physiology - Heart and Circulatory Physiology (2025).

- Keshav KA, Akanda SR, **Davis AL**, Crandall CL, Castro LA, Setton LA, & Wagenseil JE. "A multiphasic model for determination of mouse ascending thoracic aorta mass transport properties with and without aneurysm." Biomechanics & Modeling in Mechanobiology (2025).

- Rohanifar M, Johnston BB, **Davis AL**, Guang Y, Nommensen K, Fitzpatrick JAJ, Pham CTN, & Setton LA. "Hydraulic permeability and compressive properties of porcine and human synovium." Biophysical Journal (2022).

- Guang Y, **Davis AL**, McGrath TM, Pham CTN, Fitzpatrick JAJ, & Setton LA. "Size-Dependent Effective Diffusivity in Healthy Human and Porcine Joint Synovium." Annals of Biomedical Engineering (2021).

Presentations

- **Davis AL**, Akanda SR, Reals RF, Castile RM, Lake SP, & Setton LA. "Characterization of rat synovium in collagen-induced arthritis using quantitative second harmonic generation microscopy and nanoindentation". WashU Cartilage & Osteoarthritis Symposium, St. Louis, MO (2026).

- **Davis AL**, Guin R, & Fluegel LL. "Fitful progress in the quest to bring more Cuban therapeutics to U.S. clinical trials." Global Health Annual Conference at WashU, St. Louis, MO (2025).

- **Davis AL**, Reals RF, Castile RM, Lake SP, & Setton LA. "Image texture analysis reveals changes in synovial collagen morphology during collagen-induced arthritis." Rheumatic Diseases Research Resource-Based Center Mini Symposium, St. Louis, MO (2025).

- **Davis AL**, Akanda SR, Guang Y, Rohanifar M, Johnston BB, Vaidyanathan A, Owusu Sachie S, & Setton LA. "Modeling drug clearance through the synovium." ARPA-H's annual on-site NITRO visit, St. Louis, MO (2024).

- **Davis AL**, Vaidyanathan A, Rohanifar M, & Setton LA. "Quantification of Cationic Solute Diffusion and Fixed Charge Density in Synovium." Annual Meeting of the Biomedical Engineering Society, Seattle, WA (2023).
- **Davis AL**, Vaidyanathan A, Rohanifar M, & Setton LA. "Quantification of Cationic Solute Diffusion and Fixed Charge Density in Synovium." Summer Biomechanics, Biongineering, and Biotransport Conference, Vail, CO (2023).
- **Davis AL**, Guang Y, McGrath TM, Pham CTN, Fitzpatrick JAJ, & Setton LA. "Size-dependent solute diffusivity in synovial explants parallels solute transport following intra-articular drug delivery in vivo." Summer Biomechanics, Biongineering, and Biotransport Conference, [Virtual] (2021).
- **Davis AL**, Guang Y, McGrath TM, Pham CTN, Fitzpatrick JAJ, & Setton LA. "Size-dependent solute diffusivity in synovial explants parallels solute transport following intra-articular drug delivery in vivo." Annual Meeting of the Orthopaedic Research Society, [Virtual] (2021).
- **Davis AL**, Vistain LF, & Tay S. "Digital Proximity Ligation Assay for Single-Cell Protein Detection." Annual Biomedical Research Conference for Minority Students, Indianapolis, IN (2018).
- **Davis AL**, Vistain LF, & Tay S. "Digital Proximity Ligation Assay for Single-Cell Protein Detection." Midstates Consortium for Math and Science Undergraduate Research Symposium, Chicago, IL (2018).
- **Davis AL**, Vistain LF, & Tay S. "Optimizing DNA-Antibody Conjugation for Multiplex Protein Detection." University of Chicago Undergraduate Research Symposium, Chicago, IL (2017).

Teaching and Mentoring

Research Mentor St. Louis, MO
Washington University in St. Louis *Feb 2022 – May 2026*

- Mentored two undergraduate and international visiting students in project on drug delivery, who presented independently at research symposia, co-authored peer-reviewed manuscripts, and were admitted to top medical and doctoral programs
- Advised an undergraduate capstone team developing a method to extract synovial fluid from the porcine knee joint for early detection of post-traumatic osteoarthritis (PTOA); team secured $2000 from Sling Health, a St. Louis healthcare accelerator

Citizenship Tutor St. Louis, MO
Monarch Immigrant Services *Sep 2022 – Apr 2024*

- Tutored 3 senior Chinese and Armenian immigrants to pass the American citizenship exam in English or Russian

Co-Founder St. Louis, MO
McKelvey First gEN *Jan 2021 – May 2023*

- Established one-on-one mentoring program pairing first-gen engineering undergraduate and graduate students

Assistant Instructor, Bioengineering Thermodynamics St. Louis, MO
Washington University in St. Louis *Aug 2020 – Jan 2021, Aug 2021 – Dec 2021*

- Prepared and delivered weekly recitations to 50+ students for two semesters; graded examinations and problem sets

Professional Development

- BlueDot Impact — Biosecurity Fundamentals Course, Oct 2026.
- NSPN $\times$ Meridian International Diplomatic Skills for Scientists Training Course, Summer 2024.

Awards

- GAIN26 Conference Travel Award, German Academic International Network (2026).
- GAIN25 Conference Travel Award, German Academic International Network (2025).
- First Place, Master-Level Poster Competition, Summer Biomechanics, Biongineering, and Biotransport Conference (2021).
- Jeff Metcalf Undergraduate Research Fellowship, $4000 (2018).
- Dean's List, University of Chicago (2017–2019).

Skills

Languages: English (native), German (Goethe-Zertifikat C2), Russian (advanced; used in volunteer instruction and tutoring for citizenship exam), Turkish (novice)
Technical: Multiphoton microscopy, drug delivery, quantitative image analysis, histological staining, mammalian cell culture, statistical analysis, experimental design, MALTLAB, LaTeX, ImageJ, GraphPad Prism, Python