

# Zuriel Erikson Joven

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## RESEARCH INTERESTS

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Through advanced bioimaging methods, minimally-invasive medical interventions, and open-source dissemination of knowledge, I strive to combat disparities in clinical and educational outcomes.

My research interests span the fields of biophotonics (e.g., **spatially offset Raman spectroscopy**, **quantitative phase imaging**, **Brillouin microscopy**), robotics (e.g., **minimally-invasive surgical robotics**, **adaptive control**), and mathematical modeling (e.g., **correlation spectroscopy**).

A few key skills of mine include vibrational spectroscopy, mammalian cell culture, rigid and soft robotics, mathematical image analysis, fabrication of PDMS-based microfluidics, and MATLAB programming.

## EDUCATION

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- **Johns Hopkins University** Baltimore, MD  
*Master's of Science in Engineering, Mechanical Engineering* *Jan 2024 - May 2025*
  - Specializations: BioMechanical Engineering & Robotics, Systems Modeling, Dynamics, and Control
- **Johns Hopkins University** Baltimore, MD  
*Bachelor's of Science, Mechanical Engineering* *Aug 2021 - May 2025*
  - Minors: Applied Mathematics and Statistics & Robotics

## JOURNAL PUBLICATIONS, REFEREED

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- Joven, Z.E., Raj, P., Barman, I. (2024, Oct 8). *Material-Agnostic Characterization of Spatially Offset Raman Spectroscopy in Turbid Media via Monte Carlo Simulations*. *Analyst*, 149, 5463-5475. [150<sup>th</sup> Anniversary Collection: Raman Spectroscopy and SERS]

## CONFERENCE POSTERS

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- Joven, Z.E., Raj, P., Barman, I. (2024, October 20-26). *Material-Agnostic Characterization of Spatially Offset Raman Spectroscopy in Turbid Media via Monte Carlo Simulations*. SciX 2024, Raleigh, NC, United States. [First Place FACSS Student Poster Award]
- Brown, D., Joven, Z.E., Dillman, N., Yang, E., Johnson, C., Nakuchima, S., Tressler, C., Glunde, K. (2024, May 4-9). *MALDI-MRS-SHY: Statistical Heterospectroscopy of MALDI Imaging and Magnetic Resonance Spectroscopy*. International Society for Magnetic Resonance in Medicine & International Society for MR Radiographers and Technologists 2024 Annual Meeting & Exhibition, Singapore.
- Brown, D., Joven, Z.E., Dillman, N., Yang, E., Johnson, C., Nakuchima, S., Glunde, K., Tressler, C. (2023, Nov 14). *Statistical Heterospectroscopy of MALDI Imaging and NMR Spectroscopy Data for Evaluation of Breast Tumor Models*. Johns Hopkins Medicine: 2023 Radiology Research Day, Baltimore, MD, United States. [Pre-Clinical Poster Award Winner]
- Brown, D., Joven, Z.E., Dillman, N., Yang, E., Johnson, C., Nakuchima, S., Glunde, K., Tressler, C. (2023, Oct 23-25). *Statistical Heterospectroscopy of MALDI Imaging and NMR Spectroscopy Data for Evaluation of Breast Tumor Models*. 1st International Mass Spectrometry Imaging Society Conference, Montreal, Quebec, Canada.
- Brown, D., Tressler, C., Joven, Z.E., Johnson, C., Nakuchima, S., Yang, E., Glunde, K. (2023, June 4-8). *Statistical Heterospectroscopy of MALDI Imaging and NMR Spectroscopy Data for Evaluation of Breast Tumor Models*. American Society for Mass Spectrometry 71<sup>st</sup> Conference on Mass Spectrometry and Allied Topics, Houston, TX, United States.

## RESEARCH EXPERIENCE

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- **Johns Hopkins University, Mechanical Engineering** Baltimore, MD  
*Research Assistant in the Barman Lab—PI: Dr. Ishan Barman* *Sep 2023 - Present*
  - Photonics in biology and medicine. Developed systematic Monte Carlo simulations and nondimensionalization framework to characterize spatially offset Raman spectroscopy (SORS) in samples of varying turbidity and geometry. Applying SORS and Brillouin microscopy for the depth-resolved interrogation of cartilage degradation. Enabling label-free imaging of oocysts in *Plasmodium*-infected mosquito midguts via quantitative phase imaging (QPI). Analyzing QPI timelapses to quantify nucleolar dynamics under anticancer drug-induced stress. Combining microfluidics and QPI to characterize and optimize methods for cellular nanoparticle delivery.
- **Johns Hopkins School of Medicine, Koch Cancer Research Building** Baltimore, MD  
*Research Assistant in the Applied Imaging Mass Spectrometry Lab—PI: Dr. Cay Tressler* *Mar 2023 - Sep 2023*
  - Molecular imaging of cancer. Implemented statistical heterospectroscopy (SHY) to identify potentially correlated metabolites and lipids in tumor cell cultures by analyzing Pearson's correlation matrices between matrix-assisted laser desorption/ionization (MALDI) mass spectra and nuclear magnetic resonance (NMR) spectra on cohorts of MDA-MB-231 and SUM-159 cell line samples.
- **Benchmark Research** Sacramento, CA  
*Assistant Clinical Research Coordinator—PI: Dr. Masaru Oshita, M.D.* *Jun 2020 - Sep 2020*
  - Conducting investigational studies for the development of new vaccines and medicines. Spearheaded transfer of paper records to electronic databases for 300 subjects in Moderna's mRNA COVID-19 vaccine Phase III trial and 100 subjects in Regeneron's monoclonal antibody COVID-19 treatment Phase I trial. Developed automated workflows for iMedidata and MyClinicalCoordinator platforms using Selenium and Python to reduce manual data entry workload.

## TEACHING EXPERIENCE

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- **Johns Hopkins University, Mechanical Engineering** Baltimore, MD
  - *Head Teaching Assistant for EN.530.646: Robot Devices, Kinematics, Dynamics and Control* *Fall 2024 - Present*
  - Teaching Assistant for EN.530.646: Robot Devices, Kinematics, Dynamics and Control* *Fall 2023 - Spring 2024*
    - Graduate-level introduction to the mechanics of robotic systems with emphasis on the mathematical tools for kinematics and dynamics of robotic systems. Hosts weekly office hours to about 20 attendees to assist with proof-based problem sets and hands-on programming lab assignments in ROS and MATLAB. Grades problem sets, lab reports, exams, and final project demonstrations where students utilize course concepts to perform a given task on a UR5 serial robotic manipulator with multiple control paradigms using exponential coordinates for rigid transformations (special Euclidean groups).
- **Johns Hopkins University, Applied Mathematics and Statistics** Baltimore, MD
  - *Head Teaching Assistant for EN.553.291: Linear Algebra and Differential Equations* *Spring 2023 - Present*
  - Teaching Assistant for EN.553.291: Linear Algebra and Differential Equations* *Spring 2022 - Spring 2023*
    - Key concepts in linear algebra, matrix theory, and differential equations crucial for engineering and science. Leads a team of 25 course assistants and supports  $\approx 150$  students per semester. Prepared  $\text{\LaTeX}$  lecture notes for differential equations and exam reviews; composing course textbook for *Mathematical Image Analysis*, a graduate-level applied math elective under the same professor (Dr. Micheli). Proofreads exams, delivers review sessions and substitute lectures, and manages the Gradescope interface for students to submit assignments and request regrades.
- **Johns Hopkins University, Mechanical Engineering** Baltimore, MD
  - *Teaching Assistant for EN.530.241/243: Electronics and Instrumentation & Lab* *Spring 2023*
    - Introduction to basic analog electronics and instrumentation with emphasis on basic electronic devices and techniques relevant to mechanical engineering. Facilitated weekly lab sessions to engage students in practical electronics skills, circuit design and analysis, oscilloscope usage, and even soldering for some students. Spearheaded a shift from the previous pen-and-paper course structure to digital submissions for assignments. Graded problem sets, lab reports, and exams. Assisted students in both understanding theoretical concepts such as phasor analysis and active filtering as well as applying these concepts to a final circuit design project.

## EDUCATIONAL OUTREACH

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- **Maryland Book Bank** Baltimore, MD  
*Volunteer: Affiliated with Alpha Phi Omega, Kappa Mu Chapter* *Fall 2022 - Present*
  - Expanding equitable access to books within under-resourced schools and communities. Regular volunteer sorting donated books for distribution to children in Baltimore communities and beyond. Leads and organizes the Bookmobile, a “library-on-wheels” project sponsored by the Baltimore Ravens. Leads other volunteers from Alpha Phi Omega at Hopkins, organizing transportation and training first-time volunteers with the Book Bank.
- **Johns Hopkins University, Center for Educational Outreach** Baltimore, MD  
*Engineers Week Volunteer Teacher @ Barclay Elementary School* *Feb 22, 2024*
  - Improving student achievement in science, technology, engineering and math. Taught two cohorts of 7<sup>th</sup> graders the basic idea of electromagnetism through a hands-on engineering activity building electromagnetic fishing poles from wood, batteries, wires, and paperclips. Helped students make connections between the activity and electromagnetism in everyday life (e.g., maglock doors, electric fans, headphones).
- **University of California, Davis** Davis, CA  
*C-STEM Center Robotics-Math Volunteer Intern* *Jul 2022 - Sep 2022*
  - Transforming TK-12 math education with coding and robotics. Developed virtual robotics-based activities on the RoboBlockly and ChIDE platforms to teach Algebra II concepts in West Sacramento public schools. Collaborated with undergraduate and graduate student researchers and Barobo employees to ensure bug-free learning experiences and Common Core standard-compliant lessons.
- **Johns Hopkins University, Center for Educational Outreach** Baltimore, MD  
*Science and Engineering Expo Volunteer @ Barclay Elementary School* *Apr 20, 2023*
  - Bringing engaging STEM experiences to all Barclay students. Ran multiple activity booths for the after-school program, including a communication task challenging a designer to verbally direct a builder to construct a LEGO arrangement with zero visual exchanges. Emphasized the importance of specific, actionable instructions for communication between engineers and society to achieve desired results for all end users and stakeholders.

## SELECTED PROJECTS (FULL PORTFOLIO: [ZURIELJOVEN.COM/PROJECTS](http://ZURIELJOVEN.COM/PROJECTS))

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- **Metabolic Oligosaccharide Engineering in Highly Confluent Populations** Baltimore, MD  
*Project for EN.580.452: Cell and Tissue Engineering Lab* *Spring 2024*
  - Successfully incorporated 1,3,4-O-Bu<sub>3</sub>ManNAz on CHO-K1 cell surfaces in cancer-mimicking confluence. Demonstrated analog incorporation on cell surface via click chemistry of AlexaFluor fluorophore and image analysis in ImageJ, and that incorporation efficacy does not suffer with increasing cell density.
- **Robotic-Assisted Laparoscopic Myomectomy (RALM)** Baltimore, MD  
*Project for EN.530.721: Medical Robotics System Design* *Fall 2023*
  - Validated RALM as a minimally invasive alternative to open uterine surgery. Designed and performed a mock RALM operation using a UR5 robotic manipulator, a laser pointer end-effector to represent the electrocautery tool, an Intel Realsense D415 camera for mock fibroid contour detection and laser dot recognition, and Reflexxes ROS library for inverse kinematics-based laser dot position control. Held the laparoscopic constraint on the laser pointer to submillimeter RMS error, and laser dot position RMS error to < 5 mm.
- **“Crafting the Curve:” Low-Cost 3D-Printed Face Shields for Nurses** Sacramento, CA  
*Self-Founded Volunteer Group* *Mar 2020 - May 2021*
  - Started and managed a group of 30+ volunteers to assemble and distribute face shields to local nurses. Raised over \$5000 and recruited 14 3D-printers to fund the production of hundreds of face shields. Iterated on custom design for face shield to ensure quality and comfort to ensure compliance.
- **Low-Cost Robotic Transradial Prosthesis Using Binary Force Myography** Cambridge, MA  
*Massachusetts Institute of Technology, THINK Program* *Dec 2017 - Jun 2018*
  - Developed a novel form of upper-limb robotic prosthesis control, employing force myography techniques for muscular control for \$0.50 per muscle group and \$40 for the prosthetic arm. Collaborated with a project teammate, MIT student mentors, and seed funding program managers to secure over \$3,000 in grant funding, travel expenses, and prize money.