Mitchell Z. **Abrams**

Injury Biomechanics Researcher | Biomedical Engineer | Data Scientist

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Education

Duke University — *Durham, NC*
PhD, Biomedical Engineering | Head Injuries in Multiple Domains — *May 28, 2024*
Certificate in College Teaching
Current Research Foci: Sex Differences in Crash Epidemiology, Traumatic Brain Injury, Head Injury in Sports

Duke University — *Durham, NC*
B.S., Biomedical Engineering | Minor, Computer Science — *May 2019*

Skills

Languages/Tools MATLAB, Python, LaTeX, R, Java, C, C++, Django, Pandas, Numpy, scikit-learn, Matplotlib, Javascript, Docker, HTML, CSS
CAD/CAM Fusion360, Solidworks, OpenSCAD, MasterCAM
FEA/FEM LS-PrePost, LS-DYNA, Ansys Workbench
Electronics/Circuits Altium Designer, Arduino, Raspberry Pi
Manufacturing 3D Printing, Laser Cutting, CNC Machining, Carbon Fiber/Fiberglass, 3D Scanning

Relevant Experience

Duke University Injury Biomechanics Laboratory — *Durham, NC*
PhD Candidate/Graduate Research Assistant — *Aug. 2019–Present*
- Researched sex differences in crash epidemiology, injury and fatality outcomes
- Invited to UNECE Informal Workgroup Meeting (Sept 2023) on Equitable Occupant Protection
- Developed data capture, analysis, and visualization suite for inertial motion unit and motion capture field data
- Organized and led in-field study of head impact exposure in Muay Thai martial arts
- Examined head impact exposure, cumulative impact burden, and injury metric efficacy in Muay Thai martial arts
- Ran finite element simulations (LS-DYNA) of head impacts during Muay Thai active sparring (SIMon Finite Element Head Model)
- Developed and tested second generation PSOC6-based in-ear sensing platform for head impact exposure using Altium Designer
- Designed rig for and conducted experimental testing of human lumbar spines for Warrior Injury Assessment Manikin project

Undergraduate Researcher | Bass Fellow — *Jan. 2017–May 2019*
- Conducted assessments on elementary–high school football players to evaluate the efficacy of oculomotor assessments as an objective measure of mTBI in pediatric populations.
- Led efforts to design and test a portable oculomotor testing suite utilizing an Oculus Rift and electrooculography.
- Trained and mentored new team members through interdisciplinary Bass Connections Project Team.

Duke University Office of Information Technology — *Durham, NC*
DesignHub Student Manager — *Aug. 2018–Jun. 2020*
- Managed team of student designers who produced components for research groups
- Led collaborative design process with Duke "e-NABLE" to develop a prosthetic paw for a canine amputee
- Facilitated communication between clients, design team, and Duke Bluesmith for manufacturing pipeline
- Interviewed candidates for design team

Multimedia Project Studio Student Manager — *May 2017–May 2018*
Consultant and TechTutor — *Sept. 2015 — May 2018*
- Assisted students with graphic design, video, and multimedia projects
- Trained students in one-on-one sessions focused on specific multimedia tasks
- Organized, planned, and led training sessions for approx. 10 employees
- Coordinated shift schedules to staff facility 65+ hours per week
- Completed special projects in collaboration with Duke Innovation CoLab, including repair of large-format 3D printer
- Led training for various patrons and groups with 3D scanning technologies
- Developed user manual for new 3D scanning system for Duke Library system

Duke University Motorsports — *Durham, NC*
Co-President — *May 2018–May 2019*
- Developed in-house carbon fiber mold making techniques
- Spearheaded sponsorship efforts and alumni outreach initiatives
- Organized summer driving events and garage cleaning
- Led weekly summer design meetings and initiated weekly progress report stand-up meetings
- Designed and installed 120V/240V electrical system in team trailer

Core Member: Aerodynamics and Electrics Subsystems *Aug. 2015–May 2019*
- Designed and manufactured critical aerodynamic components for use in the Formula SAE International collegiate competition.
- Utilized CFD and real-world validation methods for aerodynamic analysis.
- Developed flow visualization techniques using smoke grenades to validate airflow over vehicle.
- Developed a real-time data telemetry system for on-track data analysis.

Treasurer *May 2017–May 2018*
- Managed purchases and funds on a budget of approximately $50,000.

Pratt School of Engineering *Durham, NC*
Tour Guide *Jun. 2017–May 2019*
- Led tours of engineering facilities to groups of approx. 5-20 prospective students and families.
- Led small group VIP tours at the request of Pratt Development team.

Honors & Awards

2023-2024	**Rhodes Fellowship**, Bass Connections Program, Duke University	*Durham, NC*
Sept 2022	**Gundolf Beier Award**, International Research Council on Biomechanics of Injury	*Porto, Portugal*
Sept 2022	**Best Presentation in Session**, International Research Council on Biomechanics of Injury	*Porto, Portugal*
2017-2019	**Bass Connections Undergraduate Fellowship**, Duke University	*Durham, NC*

Professional Service

2023-Present	**Scientific Peer Reviewer**, Traffic Injury Prevention	
2020-Present	**Senior Reviewer**, Journal of Emerging Investigators	
2020-Present	**Alumni Mentor**, Duke University Motorsports, Duke University	*Durham, NC*
2020-2021	**Biomedical Engineering Representative**, Engineering Graduate Student Council, Duke University	*Durham, NC*

Teaching

Spring 2024	**BME 302: Fundamentals of Biomaterials and Biomechanics**, Lab Section Teaching Assistant	*Duke University*
Fall 2023	**BME 590: Neurotrauma**, Instructional Teaching Assistant	*Duke University*
Fall 2022	**BME 590: Neurotrauma**, Course Grader	*Duke University*
Spring 2022	**BME 535: Biomechanical Aspects of Blast and Ballistics**, Course Grader	*Duke University*
Fall 2020	**BME 590: Neurotrauma**, Teaching Assistant	*Duke University*
Spring 2020	**BME 535: Biomechanical Aspects of Blast and Ballistics**, Teaching Assistant	*Duke University*
Spring 2019	**EGR 103: Computational Methods in Engineering**, Lab Teaching Assistant	*Duke University*

Selected Publications and Presentations

[1] **Abrams, M. Z.** and Bass, C. R. "Female vs. Male Relative Fatality Risk in Fatal Motor Vehicle Crashes in the US, 1975–2020". *PLOS ONE*, ed. by Q. Yuan, vol. 19, no. 2, Feb. 2024, e0297211. https://doi.org/10.1371/journal.pone.0297211.

[2] **Abrams, M. Z.** et al. "Biofidelity and Limitations of Instrumented Mouthguard Systems for Assessment of Rigid Body Head Kinematics". *Annals of Biomedical Engineering*, 23 June 2024. https://doi.org/10.1007/s10439-024-03563-4.

[3] **Abrams, M. Z.** et al. "Biofidelity and Limitations of Instrumented Boil-and-Bite Mouthguard Systems for Assessment of Rigid Body Head Kinematics during Helmeted Head Impacts". International Research Council on the Biomechanics of Injury, Sept. 2023, pp. 57–71.

[4] **Abrams, M. Z.** and Bass, C. "Female vs. Male Relative Risk of Body System Injuries in Fatal and Non-Fatal Crashes". International Research Council on the Biomechanics of Injury, Sept. 2022, pp. 33–44.

[5] **Abrams, M. Z.** and Bass, C. R. "fars_cleaner: A Python package for downloading and pre-processing vehicle fatality data in the US". *Journal of Open Source Software*, vol. 7, no. 79, 2022, p. 4678. https://doi.org/10.21105/joss.04678.

[6] Eckersley, C., Op 't Eynde, J., **Abrams, M.**, and Bass, C. R. "Using Wavelet Analysis to Distinguish Cavitation Acoustic Emissions From Blunt Impact Noise". *Journal of Biomechanical Engineering*, July 2021. https://doi.org/10.1115/1.4051660.

[7] **Abrams, M. Z.** and Bass, C. "Female vs. Male Relative Fatality Risk in Fatal Crashes". International Research Council on the Biomechanics of Injury, Sept. 2020, pp. 47–85.

[8] Ortiz-Paparoni, M., […], **Abrams, M.**, et al. "Expanded Combined Loading Injury Criterion for the Human Lumbar Spine Under Dynamic Compression". Submitted.

[9] Venkatraman, J. **Abrams, M. Z.** et al. "Biofidelity and Limitations of Instrumented Mouthguard Systems for Assessment of Rigid Body Head Kinematics during Boxing Head Impacts". In Review, Annals of Biomedical Engineering.

Additional publications available on request