Lauren N. Heckelman, Ph.D.

www.laurenheckelman.com
lnh2117@columbia.edu

Education

❖ **Duke University** **Durham, NC**
- Doctor of Philosophy (Ph.D.), Biomedical Engineering 2017–2022
  - Advisor: Louis E. DeFrate, Sc.D.
  - Dissertation: "Multimodal Musculoskeletal Imaging Techniques to Non-Invasively Assess *In Vivo* Soft and Hard Tissue Biomechanics"
  - Committee: Louis E. DeFrate, Sc.D. (chair), Elizabeth K. Bucholz, Ph.D., Kathryn R. Nightingale, Ph.D., Brian J. Soher, Ph.D., Charles E. Spritzer, M.D.
- Master of Science (M.S.), Biomedical Engineering 2016–2017
  - Advisor: Louis E. DeFrate, Sc.D.
  - Project: "*In vivo* Behavior of Patellar Cartilage in Response to and Twenty-Four Hours following Running"
  - Committee: Louis E. DeFrate, Sc.D. (chair), Elizabeth K. Bucholz, Ph.D., Fan Yuan, Ph.D.
- Bachelor of Science in Engineering (B.S.E.), Biomedical Engineering 2012–2016

Academic Employment

❖ **Columbia University** **New York, NY**
- Lecturer in the Discipline of Biomedical Engineering July 2022–Present
  - Courses Taught:
    - BMEN E3810: Biomedical Engineering Laboratory I Fall 2022 & 2023
    - BMEN E3820: Biomedical Engineering Laboratory II Spring 2023 & 2024
    - BMEN E3910: Biomedical Engineering Design Fall 2022 & 2023
    - BMEN E3920: Biomedical Engineering Design II Spring 2023 & 2024

Teaching Experience - Duke University

❖ **Modern Diagnostic Imaging Systems** **Durham, NC**
- Lab/Recitation Instructor Spring 2022
  - Served as primary instructor for all laboratory and recitation sessions, developed exams, new lab, and recitation curriculum (in addition to all roles previously performed as a teaching assistant)
- Teaching Assistant Spring 2018 & 2019
  - Attended and assisted all lectures, coordinated and ran laboratory sessions, held weekly office hours and recitation sessions, developed a MATLAB-based Escape Room challenge, graded laboratory assignments and exams, and occasionally guest lectured

❖ **Biomedical Engineering Graduate Teaching Assistant Seminar** **Durham, NC**
- Course Facilitator Fall 2020–Present
  - Provided instruction to all graduate teaching assistants (TAs) during their first and second semesters of required departmental teaching service
  - Due to the COVID-19 pandemic, the course was primarily geared toward online and hybrid pedagogy during the 2020-21 academic year, which involved online TAing tips, monitoring students' mental and physical health remotely, equitable grading strategies, online assessments, and enhancing classroom engagement

❖ **Engineering Design and Communication** **Durham, NC**
- Technical Mentor Fall 2021
  - Met with first-year engineering student teams weekly to ensure their projects remained on schedule and abided by proper engineering design protocols

❖ **Duke University Pratt in Costa Rica Study Abroad Program** **San José, Costa Rica**
- Teaching Assistant for Signals & Systems Summer 2017 & 2018
  - Attended and assisted in all lectures and laboratory sessions, held office hours, graded all homework and laboratory assignments, and designed specialized laboratory activities to take advantage of Costa Rica's unique learning environment

❖ **Magnetic Resonance Imaging Principles & Sequence Design** **Durham, NC**
- Grader Spring 2017
  - Attended all lectures and graded homework assignments

❖ **Signal Processing & Applied Mathematics** **Durham, NC**
- Teaching Assistant Fall 2016
  - Attended and assisted in all lectures and laboratory sessions, guest lectured, held weekly office hours, and graded laboratory assignments, quizzes, and exams

Teaching Experience - Other

❖ **Summer High School Academic Program for Engineers (SHAPE)** **New York, NY**
- Instructor Summer 2023 & 2024
  - Designed and led two three-week sessions of a course entitled "Biomedical Engineering: Where Biology, Medicine & Design Meet" for academically gifted high school students
  - Students learned about various sub-disciplines of biomedical engineering, rapid prototyping techniques, and the basis for engineering design
  - Helped coordinate collaboration between SHAPE and HYPOTHEkids to enable students from underrepresented groups in New York City to attend SHAPE free-of-charge

❖ **HYPOTHEkids - Hk Maker Lab** **New York, NY**
- Instructor Summer 2022
  - Led a group of New York City high school students from underserved backgrounds through a 6-week summer engineering design and entrepreneurship program
  - Students worked in teams to identify a biomedical need, to determine appropriate design requirements & constraints, and to produce a prototype to solve the selected problem

❖ **Duke University Talent Identification Program (TIP)** **Durham, NC**
- Imaging the Human Body – Instructor October 2019
  - Developed and facilitated a one-day exploration of medical imaging for a group of academically gifted fifth & sixth grade students through the Duke TIP Academic Adventures program
  - Students were introduced to the way x-ray, computed tomography (CT), magnetic resonance imaging (MRI), and ultrasound imaging works using interactive demonstrations and activities
- Biomedical Engineering – Instructor November 2018
  - Designed and led a weekend course as part of the Duke TIP Scholar Weekends program to introduce eighth through eleventh grade academically gifted students to biomedical engineering
  - Students were exposed to the fundamentals of six different core areas of biomedical engineering (bioinstrumentation, bioelectricity, biomechanics, biomaterials, medical imaging, and transport phenomena), in line with Duke's undergraduate BME curriculum

❖ **Academic Tutoring*** **Durham, NC**
- Duke University Athletics Fall 2017–Fall 2020
- Duke University Biomedical Engineering Fall 2019–Spring 2020
- Duke STEM Pathways for Inclusion, Readiness, & Excellence Spring 2020–Fall 2021
- Private Tutoring Fall 2017–Spring 2023

**For a complete list of courses tutored, please refer to the end of this document.*

❖ **Scientific Research and Education Network (SciREN Triangle)** **Raleigh, NC**

- Researcher & Instructor 2018–2022
  - Developed a lesson plan designed for students of all ages to investigate why so many people suffer anterior cruciate ligament (ACL) injuries and ways we can potentially avoid them
  - Designed and helped implement a lesson entitled “Cartilage: Solid, Liquid, or Both" for groups of elementary school students so they could explore viscoelasticity by making Oobleck

❖ **The Perry Initiative** **New Orleans, LA & Durham, NC**
- Engineering Instructor 2018–2019
  - Discussed the educational path required to become an engineer and various career options that are available with an engineering degree, as well as led two hands-on activities designed to introduce high school girls to different femoral fracture reduction techniques: external fixation and placing an intramedullary nail (April 2019)
  - Led a group of aspiring female physicians, engineers, and scientists in a hands-on activity designed to teach the fundamentals of casting hands and wrists using medical grade fiberglass casting materials at the 2018 Orthopaedic Research Society Annual Meeting (March 2018)

❖ **National Biomechanics Day** **Durham, NC**
- Instructor April 2019
  - Celebrated National Biomechanics Day at a local school with 150 sixth grade students by leading an activity about ACL injuries. Students learned about biomechanics, current research techniques to study human motion, and explored the function of the ACL and the position that puts the knee at the greatest risk for ACL injury using custom 3D printed knees

❖ **Duke University Splash!** **Durham, NC**
- Orthopaedic Biomechanics: ACL Injury Mechanisms 2019
  - Discussed knee anatomy and ACL injury mechanisms and prevention practices with a group of high school students
- Magnetic Resonance Imaging Basics 2016–2018
  - Taught high school students about magnetic resonance imaging physics and modern applications
- Guitar 101: How to Impress your Friends without Reading Music 2013–2014
  - Introduced a group of high school students to guitar tablature

❖ **Females Excelling More in Mathematics, Engineering & Science** **Durham, NC**
- FEMMES Capstone Event 2016, 2018–2022
  - Introduced middle school girls to the engineering design process. Students had to build the tallest and strongest paper tower they could given specific supplies. (2016 & 2018)
  - Helped middle school girls learn about computed tomography (CT). Students had to image a wooden block by tracing shadows created by shining a flashlight at their object at different projection angles and then perform backprojection to reconstruct their image. (2019–2022)
- FEMMES Summer Program August 2014
  - Led science-related activities throughout a week-long camp for fifth and sixth grade girls

❖ **Duke-Durham School Days** **Durham, NC**
- Instructor November 2018 & 2019
  - Discussed orthopaedic biomechanics with a group of first generation eighth grade students from the Durham public school systems

Continuing Education & Training

❖ **Certificate in College Teaching (CCT) Program** 2017-2022
- Courses Taken:
  - GS 750: Fundamentals of College Teaching
  - GS 755: College Teaching & Course Design
  - GS 770: Topics and Careers in Higher Education

- **Discover Sign Language** Fall 2021
  - Durham Technical Community College
- **Preparing Future Faculty Program** 2020-2021
  - Faculty Mentor: Naji Sami Husseini, Ph.D.
    - Joint Department of Biomedical Enginering at North Carolina State University & the University of North Carolina at Chapel Hill
    - Teaching Assistant Professor & Associate Director of Undergraduate Studies
- **Name Pronunciation Workshop** April 2021
- **Duke Center for Sexual and Gender Diversity** 2021
  - Pursuing Respect, Inclusion/Intersectionality, Diversity, and Equity (P.R.I.D.E.) Training
- **Preparing Future Engineering Faculty Program** Fall 2020
- **Certificate of Accomplishment in Teaching Writing in the Disciplines** 2020
- **Duke University Graduate Summer Academy - Online Teaching** July 2020
- **Graduate Symposium on Innovative Pedagogy** March 2020
- **Duke University Machine Learning Summer School** June 2019

Invited Talks & Guest Lectures

- **Magnetic Resonance Imaging (MRI) & Applications** December 2023
  - Invited Speaker, Stuyvesant High School, New York, NY
- **ACL Injury Mechanisms** October 2023
  - Guest Lecturer, Engineering E1102: The Art of Engineering (Instructor: David Vallancourt, Ph.D.), Columbia University
- **ACL Injury Mechanisms** September 2023
  - Invited Speaker, 2023 Science Honors Program, New York, NY
- **Faculty Panel Insights: Working with Faculty** August 2023
  - Panelist, 2023 Columbia Engineer Your Ph.D. Orientation Week, New York, NY
- **Junior Faculty Panel** August 2023
  - Panelist, 2023 Columbia Engineering New Faculty Orientation, New York, NY
- **Career Navigation & Post-Undergraduate Path Building** April 2023
  - Panelist, 2023 Society of Women Engineers Engineering Week, New York, NY
- **Teaching Faculty Roles at R1 Institutions** February 2023
  - Invited Speaker, 2023 Orthopaedic Research Society Annual Meeting, Dallas, TX
- **Semi-Automatically Isolating Bones from MR & CT Images** July 2022
  - Guest Lecturer, Applied Digital Signal Processing (Instructor: Jessica Centers), Duke Pre-College Program
- **Biomedical Engineering Ph.D. Student Association Alumni Career Panel** May 2022
  - Panelist, Department of Biomedical Engineering, Duke University
- **How Does Running Impact our Knees & Hips?** March 2022
  - Guest Lecturer, KN 362: Tissue Mechanics (Instructor: Kharma Foucher, M.D., Ph.D.), University of Illinois at Chicago
- **How Does Running Impact our Knees & Hips?** Februrary 2022
  - Guest Lecturer, Biomedical Sciences I & II (Instructor: Shannon Mackes), Pleasant Valley High School - Brodheadsville, PA
- **Biomedical Engineering Ph.D. Student Recruitment** Spring 2022
  - Panelist, Department of Biomedical Engineering, Duke University
- **Pratt School of Engineering TA Training** January 2022
  - Panelist, Department of Biomedical Engineering, Duke University

- **Biomedical Engineering Open House** November 2021
  - Panelist, Department of Biomedical Engineering, Duke University
- **Advice for Prospective Graduate Students** September 2021
  - Panelist, Society of Women Engineers, Duke University
- **Convolutions in Real Life** September 2021
  - Guest Lecturer, BME 271D: Signals & Systems
    (Instructor: Elizabeth Bucholz, Ph.D.), Duke University
- **Engaging Students in Large Classes with Active Learning** March 2021
  - Panelist, Duke Learning Innovation, Duke University
- **Biomedical Engineering Ph.D. Student Recruitment** Spring 2021
  - Panelist, Department of Biomedical Engineering, Duke University
- **What I'd Wish I'd Known About Teaching at Duke** February 2021
  - Panelist, Duke Learning Innovation, Duke University
- **Signal Processing in MATLAB** November 2020
  - Guest Lecturer, BME 201: Computer Methods in Biomedical Engineering
    (Instructor: Naji Sami Husseini, Ph.D.), North Carolina State University
- **Panel of Experienced Teaching Assistants** February 2021
  - Panelist, GS 750: Fundamentals of College Teaching, Duke University
- **Magnetic Resonance Imaging (MRI): k-Space & Pulse Sequences** March 2019
  - Guest Lecturer, BME 303L: Modern Diagnostic Imaging Systems
    (Instructor: Junjie Yao, Ph.D.), Duke University
- **Ultrasound Imaging: Wave Transmission & Matching Layers** March 2019
  - Guest Lecturer, BME 303L: Modern Diagnostic Imaging Systems
    (Instructor: Elizabeth Bucholz, Ph.D.), Duke University
- **Ultrasound Imaging: Acoustic Impedance & Interfaces** March 2019
  - Guest Lecturer, BME 303L: Modern Diagnostic Imaging Systems
    (Instructor: Elizabeth Bucholz, Ph.D.), Duke University
- **History of CT Imaging & Biplanar Fluoroscopy** February 2019
  - Guest Lecturer, BME 303L: Modern Diagnostic Imaging Systems
    (Instructor: Elizabeth Bucholz, Ph.D.), Duke University
- **Magnetic Resonance Imaging (MRI): The Bloch Equation** April 2018
  - Guest Lecturer, BME 303L: Modern Diagnostic Imaging Systems
    (Instructor: Junjie Yao, Ph.D.), Duke University
- **Biplanar Fluoroscopy & Orthopaedic Research Applications** February 2018
  - Guest Lecturer, BME 303L: Modern Diagnostic Imaging Systems
    (Instructor: Elizabeth Bucholz, Ph.D.), Duke University
- **Continuous Convolutions & Image Filtering in MATLAB** September 2016
  - Guest Lecturer, BME 790L: Signal Processing & Applied Mathematics
    (Instructor: Elizabeth Bucholz, Ph.D.), Duke University
- **Panel of Undergraduate Engineering Students** April 2016
  - Panelist, Girls Advancing in STEM (GAINS) Conference

Leadership Experience

- **Columbia Girls' Science Day**
  - Faculty Advisor 2023-Present
    - Supervised on-campus STEM programming for middle school girls from New York City schools

- **The Roger Lehecka Double Discovery Center** **New York, NY**
  - Course Supervisor 2023-Present
    - Supervised an undergraduate student-led laboratory course entitled "Glass Half Full or Empty," for first-generation youth from low-income communities in the New York City area
    - Students learned laboratory skills such as micropipetting, PCR, DNA extraction, concentration measurements via a spectrophotometer, and DNA sequencing
- **Orthopaedic Research Society Education & Outreach Research Interest Group**
  - Organizer 2022-Present
    - One of six founding organizers of the Orthopaedic Research Society (ORS) Education & Outreach Research Interest Group (RIG). This RIG is held at the ORS Annual Meeting each year to promote careers related to education & outreach in the field of orthopaedics.
- **Sakai Conversations Development Team**
  - Team Member 2021
    - Part of faculty committee working with Duke Learning Innovation and representatives from Longsight to develop a class discussion tool integrated with Sakai to replace Piazza
- **Duke University Athletics**
  - Mentor 2020–2021
    - Guided first-year members of the Duke football team through their transition to college life, including the added challenges associated with the COVID-19 pandemic
    - Met weekly throughout the academic year to help monitor academic progress, to develop study and organizational skills, and to promote an effective mentor-mentee relationship
- **Duke University Biomedical Engineering Ph.D. Student Mentorship Program**
  - Mentor/Mentee 2017–2021
    - Mentorship program designed to pair first year biomedical engineering Ph.D. students with more senior students to help ease the transition to graduate school and to provide an outside prospective from someone in a different research sub-specialty
- **Duke University Pratt School of Engineering Alumni Council Mentorship Program**
  - Mentor 2020–2021
    - Mentorship program designed to pair Pratt alumni with undergraduate engineering students
- **Duke University COVID-19 Engineering Response Team**
  - Volunteer Summer 2020
    - Assembled protective face shields for Duke University Health System first responders in an effort to prevent the spread of COVID-19
- **Engineering a Community Mentorship Program**
  - Mentor 2019–2020
    - Mentorship program designed to pair Duke engineering graduate students with engineering undergraduates from historically underrepresented backgrounds to inspire inclusivity throughout the Pratt School of Engineering
- **Duke University Harmonies for Health**
  - Volunteer Minstrel 2014–2017
    - Visited the Durham Ronald McDonald House or the Durham Nursing and Rehabilitation Center biweekly to help rehabilitate individuals through music
- **Duke University Society of Women Engineers**
  - Vice President (2015), Secretary (2014) 2014–2016
    - Organized community-building, networking, and career-oriented activities for female-identifying engineering students
    - Planned a trip to the 2015 SWE national conference in Nashville, TN
- **DukeMakers 3D Printing Club**
  - Student Member 2014–2016
    - Developed a variety of 3D printed designs to solve engineering problems

Research/Professional Experience

- **DeFrate Musculoskeletal Bioengineering Laboratory** **Durham, NC**
  - Graduate Research Assistant August 2015–May 2022
    - Investigated exercise-induced cartilage deformations in the human knee, shoulder, and hip joints *in vivo*, using magnetic resonance imaging (MRI) and 3D solid modeling techniques
    - Implemented quantitative MRI to analyze the structure and composition of cartilage non-invasively to assess tissue health
    - Developed image processing techniques to semi-automatically segment bone from MR images
    - Designed quantitative tools to assess hip fracture risk in diabetic adults
- **National Institutes of Health** **Durham, NC**
  - Duke Summer Clinical Practicum with Dr. George Truskey, Ph.D. May–July 2015
    - Conducted observations in the Duke University Speech Pathology and Audiology Clinic, identified potential needs, and developed a prototype of a modified hospital call button for use by patients with a variety of physical impairments
- **AlliedOP Orthotics & Prosthetics** **East Stroudsburg, PA**
  - Clinical Shadowing/Hands-On Experience with Jack Lenze, C.P.O. June–August 2014
    - Assisted in the entire prosthetic and orthotic fitting process including, but not limited to, taking casts of patients' limbs, making molds, affixing and interchanging mechanical parts, aligning prosthetic legs, and modifying orthotic devices to maximize patient comfort and ease of use
- **Bangor Podiatry, LLC** **Brodheadsville, PA**
  - Clinical Shadowing with Dr. Kathleen Hope, D.P.M. May 2014
    - Introduced to lower-limb biomechanics, with an emphasis on how alterations in normal joint biomechanics can cause stability and comfort issues in patients
- **Nicolelis Neuroprosthetics Laboratory** **Durham, NC**
  - Undergraduate Student Researcher August 2013–January 2014
    - Worked to help verify results previously obtained and published by other research groups by writing and implementing MATLAB codes to replicate data analysis processes

Lab Mentorship

- **Avery Kratzer, B.S.E.** September 2021–May 2022
  - Ph.D. Student, Duke Biomedical Engineering
  - Project: "Running-induced Knee Cartilage Deformations"
- **Xingqi Su, B.S.** September 2021–May 2022
  - Master's Student, Duke Biomedical Engineering
  - Project: "Running-induced Changes in Knee Cartilage T1rho Relaxation Times"
- **Krystal Tamayo, B.S.** August–September 2020
  - Research Technician, Duke Orthopaedic Surgery
  - Project: "Reformatting MR Images in Orthogonal Planes using MATLAB"
- **Ben Wesorick, B.S.E.*** August 2019–May 2020
  - Undergraduate Student, Duke Biomedical Engineering
  - Project: "Calculating the Minimum Moment of Inertia of the Femoral Neck to predict Hip Fracture Risk in Diabetic Patients"
- **Olivia Gwynn, B.S.E.** August 2018–May 2019
  - Undergraduate Student, Duke Biomedical Engineering
  - Project: "Quantifying the Biomechanical and Biochemical Response of Knee Cartilage to Running"
- **Wyatt Smith, B.S.** January 2017–May 2019
  - Research Technician, Duke Orthopaedic Surgery
  - Project: "Quantifying the Biochemical Response of Knee Cartilage to Running"

- **Micaela Kulvaranon, B.S.*** May 2016–May 2018
  - Undergraduate Students, Duke Biophysics
  - Project: "Obesity Alters the In Vivo Biochemical and Biomechanical Properties of Articular Cartilage"

**Graduated with Departmental Distinction*

Professional Organizations

- American Society for Engineering Education
- Biomedical Engineering Society
- National Center for Faculty Development & Diversity
- Orthopaedic Research Society
- Society of Women Engineers

Academic Service

- **Columbia Biomedical Engineering Department**
  - *Member*, Undergraduate Studies Committee 2022-Present
  - *Member*, ABET Committee 2022-Present
  - *Chair*, Laboratory Committee 2023-Present
  - *Member*, Diversity, Equity, and Inclusion (DEI) Committee 2023-Present
  - *Academic Advisor*, BME Undergraduate Students 2022-Present
  - *Member*, Master's Lecturer in Discipline Search Committee 2022
- **Reviewer for Journal Manuscripts**
  - *American Society for Engineering Education*
  - *Annals of Biomedical Engineering*
  - *ASME Journal of Medical Devices*
  - *Journal of Biomechanics*
  - *Journal of Orthopaedic Research*
  - *Medicine & Science in Sports & Exercise*
  - *NMR in Biomedicine*
  - *Scientific Reports*

Awards

- **Duke University Dean's Award for Excellence in Teaching** (2022)
  - Awarded to celebrate and honor exemplary teaching by currently enrolled Ph.D. students who are engaged in teaching Duke undergraduate or graduate students
  - Presented to those who best exemplify the characteristics of effective college teaching as they prepare for lives of service, leadership, and teaching
- **Duke University Biomedical Engineering Departmental Service Award** (2021)
  - Awarded in recognition of the time, energy, and commitment dedicated to help the department thrive
- **Duke University Biomedical Engineering TA of the Year** (2018)
  - Presented to one BME Ph.D. student for excellence as a teaching assistant in the Spring 2018 semester
- **Duke University Regeneration Next Initiative Student Travel Grant** (2017)
  - Awarded to graduate students invited to present research related to tissue regeneration at academic conferences to help cover travel expenses and conference registration fees

- **Duke University Biomedical Engineering Master's Student Research Fellowship** (2017)
  - Granted to select Duke University biomedical engineering master's students to fund individualized research projects based on written proposals
- **Theo C. Pilkington Memorial Award** (2016)
  - Awarded to one graduating Duke University undergraduate student in recognition of outstanding perseverance and accomplishment in the study of biomedical engineering

Languages, Software, and Programming

- **Languages**
  - English (fluent), Spanish (intermediate)
- **Software**
  - Word/Image Processing: Microsoft Office, LaTeX, Adobe Photoshop, Adobe Illustrator
  - Audio/Video Production: Logic Pro X, Adobe Premiere, Adobe AfterEffects, iMovie
  - Solid Modeling: Rhinoceros, Geomagic, SolidWorks, Autodesk Inventor, Fusion 360, SketchUp
  - Finite Element Analysis: ANSYS, COMSOL, LS-DYNA, FE Bio
- **Programming**
  - MATLAB, Python, Arduino, Mathematica

Publications

- **Manuscripts**

1. **Heckelman LN**, Kratzer AL, Spritzer CE, Soher BJ, Lewis BD, DeFrate LE (2023). Influence of Running on Femoroacetabular Bone-to-Bone Distances. *Journal of Orthopaedic Research*.
2. **Heckelman LN**, Soher BJ, Spritzer CE, Lewis BD, DeFrate LE (2022). Design and validation of a semi-automatic bone segmentation algorithm from MRI to improve research efficiency. *Scientific Reports*, 12(7825).
3. Tamayo KS, **Heckelman LN**, Spritzer CE, DeFrate LE, Collins AT (2022). Obesity Impacts the Mechanical Response and Biochemical Composition of Patellofemoral Cartilage: An *in vivo*, MRI-based Investigation. *Journal of Biomechanics*, 134.
4. **Heckelman LN**, Wesorick BR, DeFrate LE, Lee RH (2021). Diabetes is Associated with a Lower Minimum Moment of Inertia Among Older Women: An Analysis of 3D Reconstructions of Clinical CT Scans. *Journal of Biomechanics*, 128.
5. **Heckelman LN**, Riofrio AD, Vinson EN, Collins AT, Gwynn OR, Utturkar GM, Goode AP, Spritzer CE, DeFrate LE (2020). Dose- and Recovery-Response of Patellofemoral Cartilage Deformations to Running. *Orthopaedic Journal of Sports Medicine*, 8(12).
6. **Heckelman LN**, Bucholz EK (2020). Designing a MATLAB-based Escape Room. *Proceedings of the 127 th American Society for Engineering Education Annual Conference & Exposition.*[†]
7. **Heckelman LN**, Smith WAR, Riofrio AD, Vinson EN, Collins AT, Gwynn OR, Utturkar GM, Goode AP, Spritzer CE, DeFrate LE (2020). Quantifying the biochemical state of knee cartilage in response to running using T1rho magnetic resonance imaging. *Scientific Reports*, 10(1870).
8. Taylor KA, Collins AT, **Heckelman LN**, Kim SY, Utturkar GM, Spritzer CE, Garrett WE, DeFrate LE (2018). Activities of Daily Living Influence Tibial Cartilage T1rho Relaxation Times. *Journal of Biomechanics*, 82, 228-233.

[†]American Society for Engineering Education conference proceedings are peer-reviewed via a multi-step, double-blind process and are highly regarded in the field of engineering education.

9. Zhang H, **Heckelman LN**, Spritzer CE, Owusu-Akyaw KA, Martin JM, Taylor DC, Moorman CT, Garrigues GE, DeFrate LE (2018). *In Vivo* Assessment of Exercise-Induced Glenohumeral Cartilage Strain. *Orthopaedic Journal of Sports Medicine*, 6(7).
10. Owusu-Akwaw KA, **Heckelman LN**, Cutcliffe HC, Sutter EG, Englander ZE, Spritzer CE, Garrett WE, DeFrate LE (2018). A Comparison of Patellofemoral Cartilage Morphology and Deformation in Anterior Cruciate Ligament Deficient versus Uninjured Knees. *Journal of Biomechanics*, 67, 78-83.

❖ **Manuscript(s) in Preparation**

1. Bradley PX, Kim-Wang SY, Blaisdell BS, Riofrio AD, Collins AT, **Heckelman LN**, Okafor EC, Widmyer MR, Paranjape CS, Crook BS, Lad NK, Sutter EG, Mann BP, Spritzer CE, DeFrate LE. Automated Segmentation of Knee MRI Scans for Measuring Cartilage Thickness: Application to Running-Induced Tibiofemoral Cartilage Strain.

❖ **Conference Presentations**

1. Nelson TM, Zhang DJ, Sorid S, Chang T, Bajaj N, Viola J, **Heckelman LN**, Pollack RE, Yamasaki L. Glass Half Full or Empty: Illuminating the Human Transcriptome - Inspiring Underserved High School Students with an Experiential Biology Laboratory Research Experience. Poster presented at: American Society for Biochemistry and Molecular Biology Annual Meeting; 2024 Mar 23-26; San Antonio, TX.
2. Bansal S, Drazan JF, **Heckelman LN**, Loya AK, Marvin JC, Panebianco CL. 2023 ORS Education Rig: Orthopaedic Research - Beyond The Lab And Into The Classroom. Paper presented at: Orthopaedic Research Society Annual Meeting; 2024 Feb 2-6; Long Beach, CA.
3. Bradley PX, Kim-Wang SY, Blaisdell BS, Riofrio AD, Collins AT, **Heckelman LN**, Okafor EC, Widmyer MR, Paranjape CS, Crook BS, Lad NK, Sutter EG, Spritzer CE, DeFrate LE. Automated Segmentation Of Knee MRI Scans For Measuring Cartilage Thickness And Running-Induced Strain. Paper presented at: Orthopaedic Research Society Annual Meeting; 2024 Feb 2-6; Long Beach, CA.
4. **Heckelman LN**. Implementing Various Forms of Science Communication in a BME Laboratory Course. Paper presented at: Biomedical Engineering Society Annual Meeting; 2023 Oct 11-14; Seattle, WA.
5. **Heckelman LN**, Kratzer AL, Spritzer CE, Soher BJ, Lewis BD, DeFrate LE. The influence of running on femoroacetabular joint mechanics as quantified by decreases in bone-to-bone distance. Paper presented at: Orthopaedic Research Society Annual Meeting; 2022 Feb 4-8; Tampa, FL.
6. **Heckelman LN**, Soher BJ, Spritzer CE, Lewis BD, DeFrate LE. Design and Validation of a Semi-Automatic Bone Segmentation Algorithm from MRI to Improve Research Efficiency. Poster presented at: Orthopaedic Research Society Annual Meeting; 2022 Feb 4-8; Tampa, FL.
7. Tamayo KS, **Heckelman LN**, Spritzer CE, DeFrate LE, Collins AT. Obesity Impacts the Biochemical Composition of Patellar Cartilage: An In Vivo MRI-Based Study. Poster presented at: Orthopaedic Research Society Annual Meeting; 2022 Feb 4-8; Tampa, FL.
8. **Heckelman LN**, Wesorick BR, DeFrate LE, Lee RH. Diabetes is Associated with a Lower Minimum Moment of Inertia Among Older Women: An Analysis of 3D Reconstructions of Clinical CT Scans. Poster presented at: Orthopaedic Research Society Annual Meeting; 2021 Feb 13-16; Long Beach, CA *(*Online due to COVID-19).*
9. **Heckelman LN**, Bucholz EK. Designing a MATLAB-based Escape Room. Presented at: American Society for Engineering Education Annual Conference & Exposition; 2020 Jun 21-24; Montréal, Quebec, Canada *(*Online due to COVID-19).*

10. **Heckelman LN**, Riofrio AD, Vinson EN, Collins AT, Gwynn OR, Utturkar GM, Spritzer CE, DeFrate LE. Quantifying Patellofemoral Cartilage Strains in Response to Running. Poster presented at: Orthopaedic Research Society Annual Meeting; 2020 Feb 8-11; Phoenix, AZ.
11. **Heckelman LN**, Smith WAR, Riofrio AD, Vinson EN, Collins AT, Gwynn OR, Utturkar GM, Spritzer CE, DeFrate LE. Knee Cartilage T1rho Relaxation Times Decrease Immediately After Running and Recover within 24 Hours. Paper presentation at: Orthopaedic Research Society Annual Meeting; 2019 Feb 2-5; Austin, TX.
12. **Heckelman LN**, Smith WAR, Riofrio AD, Vinson EN, Collins AT, Utturkar GM, Spritzer CE, DeFrate LE. Recovery of Knee Cartilage T1rho Relaxation Times Twenty-Four Hours Following Running. Poster presented at: Orthopaedic Research Society Annual Meeting; 2018 Mar 10-13; New Orleans, LA.
13. Owusu-Akyaw KA, **Heckelman LN**, Cutcliffe HC, Sutter EG, Spritzer CE, Garrett WE, DeFrate LE. The Influence of ACL Injury on *In Vivo* Patellofemoral Joint Articular Cartilage Strain. Poster presented at: Orthopaedic Research Society Annual Meeting; 2018 Mar 10-13; New Orleans, LA.
14. Owusu-Akyaw KA, **Heckelman LN**, Sutter EG, Spritzer CE, Garrett WE, DeFrate LE. Comparison of Site-Specific Patellar Cartilage Strain in ACL Deficient and Uninjured Knees. Presented at: North Carolina Orthopaedic Association Annual Meeting; 2017 Oct 6-8; Colonial Williamsburg, VA.
15. Davis KM, **Heckelman LN**, Cutcliffe HC, Martin JT, Spritzer CE, Garrett WE, DeFrate LE. Cartilage Strain Recovery after Exercise-Induced Loading. Presented at: North Carolina Orthopaedic Association Annual Meeting; 2017 Oct 6-8; Colonial Williamsburg, VA.
16. **Heckelman LN**, Riofrio AD, Vinson EN, Collins AT, Utturkar GM, Spritzer CE, DeFrate LE. *In Vivo* Behavior of Patellar Cartilage in Response to and Twenty-Four Hours following Running. Poster presented at: Orthopaedic Research Society Annual Meeting; 2017 Mar 19-22; San Diego, CA.
17. Zhang H, **Heckelman LN**, Spritzer CE, Owusu-Akyaw KA, Martin JM, Taylor DC, Moorman CT, Garrigues GE, DeFrate LE. *In Vivo* Exercise-Induced Glenohumeral Cartilage Strains. Paper presentation at: Orthopaedic Research Society Annual Meeting; 2017 Mar 19-22; San Diego, CA.
18. Zhang H, **Heckelman LN**, Spritzer CE, Owusu-Akyaw KA, Martin JM, Taylor DC, Moorman CT, Garrigues GE, DeFrate LE. *In Vivo* Glenohumeral Cartilage Strains Following Weight-Bearing Upper-Extremity Exercise. Poster presented at: American Orthopaedic Society for Sports Medicine Annual Meeting; 2017 Jul 20-23; Toronto, ON, Canada.
19. Riofrio AD, Vinson EN, Collins AT, **Heckelman LN**, Utturkar GM, Spritzer CE, DeFrate LE. *In Vivo* Measurement of Localized Patella Cartilage Strain in Response to Running. Poster presented at: Orthopaedic Research Society Annual Meeting; 2016 Mar 5-8; Orlando, FL.

Courses Tutored

- **Duke University Athletics**
  - BME 230L: Global Women's Health Technologies — Spring 2020
  - BME 244L: Quantitative Physiology with Biostatistical Applications — Spring 2020
  - BME 260L: Modeling Cellular & Molecular Systems — Fall 2018 & Fall 2020
  - BME 271: Signals & Systems — Fall 2017, Fall 2018 & Fall 2020
  - BME 354L: Introduction to Medical Instrumentation — Spring 2019

- COMPSCI 94: Introduction to Programming
  - Gentle Introduction to Mobile App Development — Spring 2020
  - Programming & Problem Solving — Summer 2020 & Fall 2020
  - Virtual Worlds — Fall 2019
- COMPSCI 101L: Introduction to Computer Science — Spring 2019 & Fall 2019
- ECE 110L: Fundamentals of Electrical & Computer Engineering — Spring 2020 & Fall 2020
- EGR 103L: Computational Methods in Engineering — Spring 2018, Fall 2018, Spring 2019, Spring 2020 & Fall 2020
- EGR 201L: Mechanics of Solids — Spring 2020
- ME 221L: Structure and Properties of Solids — Fall 2017
- MUSIC 161: Introduction to Music Theory — Fall 2017

❖ **Duke University Biomedical Engineering**

- BME 601L: Introduction to Neural Engineering — Fall 2019
- BME 671L: Signal Processing & Applied Mathematics — Spring 2020
- BME 790: Quantitative Pathophysiology — Fall 2019

❖ **Duke STEM Pathways for Inclusion, Readiness, and Excellence (SPIRE)**

- BME 244L: Quantitative Physiology with Biostatistical Applications — Spring 2020
- BME 271: Signals & Systems — Fall 2020
- BME 302L: Introduction to Biomechanics & Biomaterials — Spring 2021
- BME 303L: Modern Diagnostic Imaging Systems — Fall 2021
- BME 354L: Introduction to Medical Instrumentation — Fall 2021
- EGR 103L: Computational Methods in Engineering — Fall 2020
- EGR 201L: Mechanics of Solids — Fall 2020 & Spring 2021

❖ **Private Tutoring (College Level)**

- AME 451: Linear Control Systems I — Spring 2020
  - Institution: University of Southern California
- APMA 2130: Ordinary Differential Equations — Summer 2020
  - Institution: University of Virginia
- BENG 360: Biomedical Imaging — Fall 2020
  - Institution: George Mason University
- BENG 5963/4963: Modeling Environmental Biophysics — Spring 2020
  - Institution: University of Arkansas
- BGGN 216: Graduate Biostatistics — Spring 2020
  - Institution: University of California San Diego
- BIO 110: Principles of Biology — Spring 2021
  - Institution: Wake Technical Community College
- BME 265: Medical Systems Physiology — Spring 2020
  - Institution: University of Miami
- BME 271D: Signals & Systems — Fall 2021
  - Institution: Duke University

- BME 302L: Introduction to Biomechanics & Biomaterials — Spring 2020
  - Institution: Duke University
- BME 303L: Modern Diagnostic Imaging Systems — Spring 2021
  - Institution: Duke University
- BME 312: Biomedical Statistics and Data Analysis — Spring 2020
  - Institution: University of Miami
- BME 320: Biomechanics — Spring 2020
  - Institution: King Faisal University (Saudi Arabia)
- BME 410: Biomedical Instrumentation — Spring 2020
  - Institution: King Faisal University (Saudi Arabia)
- BME 3300: Biomedical Instrumentation — Fall 2020
  - Institution: Vanderbilt University
- BME 4000: Biomedical Transport Phenomena — Fall 2020
  - Institution: Vanderbilt University
- BME 4230: Biomechanics of Cardiovascular Systems — Spring 2020
  - Institution: Florida International University
- BME 4900w: Biomedical Engineering Laboratory — Fall 2020
  - Institution: Vanderbilt University
- BME 4950-4951: Design of Biomedical Engineering Devices and Systems I-II — Fall 2020
  - Institution: Vanderbilt University
- BMED 2400: Introduction to Bioengineering Statistics — Spring 2021
  - Institution: Georgia Institute of Technology
- BMEN 211: Biomedical Applications of Signals and Systems — Summer 2020
  - Institution: Texas A&M University
- BMEN 345: Biomaterials Lab — Spring 2022
  - Institution: Texas A&M University
- BMEN 420: Medical Imaging — Fall 2020 & Spring 2022
  - Institution: Texas A&M University
- BMME 301: Human Physiology: Electrical Analysis — Spring 2022
  - Institution: University of North Carolina at Chapel Hill
- CHE 305: Numerical and Statistical Analysis for Chemical Engineers — Fall 2020
  - Institution: University of Southern California
- COMP 116: Introduction to Scientific Programming — Fall 2020
  - Institution: University of North Carolina at Chapel Hill
- COMPSCI 101L: Introduction to Computer Science — Fall 2017
  - Institution: Duke University
- CS 1371: Computing for Engineers — Summer 2020
  - Institution: Georgia Institute of Technology
- ECE 157B: Communications Systems Laboratory II — Spring 2020
  - Institution: University of California San Diego
- ECE 2370: Design and Analysis of Signals and Systems — Spring 2021
  - Institution: Southern Methodist University
- EECE 5666: Digital Signal Processing — Summer 2020
  - Institution: Northeastern University
- EE 3054: Signals and Systems — Summer 2020
  - Institution: New York University

- EEL 3135: Introduction to Signals and Systems — Spring 2020
  - Institution: University of Florida
- EGME 205: Digital Computation — Fall 2020
  - Institution: California State University Fullerton
- EGR 201: Mechanics of Solids — Spring 2021
  - Institution: Duke University
- EGR 265: Digital Electronics and Logic Design — Summer 2020
  - Institution: Northern Virginia Community College
- ELEC 3320: Random Signal Analysis — Spring 2020
  - Institution: University of New Haven
- EN.585.725: Biomedical Engineering Practice and Innovation — Summer 2020
  - Institution: Johns Hopkins University
- EN.625.725: Theory of Statistics I — Summer 2020
  - Institution: Johns Hopkins University
- ENGRMAE 10: Introduction to Engineering Computations — Summer 2020
  - Institution: University of California Irvine
- MAC 1114: Trigonometry — Summer 2021
  - Institution: Miami Dade College
- MAE 106: Mechanical Systems Laboratory — Summer 2020
  - Institution: University of California Irvine
- MATH 1: Calculus I — Fall 2020
  - Institution: Las Positas College
- MATH 3C: Calculus III — Summer 2020
  - Institution: College of Alameda
- MATH 39: Trigonometry — Summer 2020
  - Institution: Las Positas College
- MATH 115: Calculus I — Fall 2020
  - Institution: University of Michigan
- MATH 123: Quantitative Reasoning — Summer 2020
  - Institution: Ivy Tech Community College of Indiana
- MATH 124: Survey of Calculus I — Summer 2020
  - Institution: Michigan State University
- MATH 130: Survey of Calculus — Summer 2020
  - Institution: Cypress College
- MATH 233: Calculus of Functions of Several Variables — Fall 2020
  - Institution: University of North Carolina at Chapel Hill
- MATH 353: Ordinary and Partial Differential Equations — Summer 2021
  - Institution: Duke University
- MATH 383: First Course in Differential Equations — Spring 2021 & Fall 2022
  - Institution: University of North Carolina at Chapel Hill
- MATH 383L: First Course in Differential Equations Laboratory — Spring 2020
  - Institution: University of North Carolina at Chapel Hill
- MATH 1000: Algebra & Trigonometry — Summer 2020
  - Institution: Dunwoody College of Technology
- MATH 1241: Calculus I — Summer 2020
  - Institution: Northeastern University

- MATH 2101: Linear Algebra — Fall 2021
  - Institution: Temple University
- MATH 2341: Differential Equations and Linear Algebra — Summer 2020
  - Institution: Northeastern University
- MATH 3304: Introduction to Linear Algebra — Fall 2020
  - Institution: Southern Methodist University
- MATH 3313: Ordinary Differential Equations — Fall 2020
  - Institution: Southern Methodist University
- MATH 3315: Introduction to Scientific Computing — Spring 2021
  - Institution: Southern Methodist University
- MATH 20100: Calculus I — Summer 2020
  - Institution: The City College of New York
- MAT 171: Precalculus Algebra — Fall 2020 & Spring 2021
  - Institution: Wake Technical Community College
- MAT 2010: Introduction to Computational Methods in Mathematics — Spring 2021
  - Institution: California State Polytechnic University, Pomona
- ME 318M: Programming & Engineering Computational Methods — Spring 2021
  - Institution: University of Texas at Austin
- ME 3534: Controls Engineering I — Summer 2021
  - Institution: Virginia Polytechnic Institute and State University
- ME 4005: Mechanical Engineering Laboratory I — Spring 2022
  - Institution: Virginia Polytechnic Institute and State University
- PHY 2010: General Physics I — Summer 2020
  - Institution: South College
- PSY 239: Psychology of Personality — Spring 2021
  - Institution: Wake Technical Community College
- PY 208: Physics for Engineers and Scientists II — Summer 2020
  - Institution: North Carolina State University

❖ **Private Tutoring (High School Level)**

- Arduino & Circuit Design — Fall 2020 & Summer 2022
- College Admissions Preparation — Fall 2021, Fall 2022, & Spring 2023
- Calculus — Summer 2021
- Geometry — Spring 2020 & Spring 2021
- Guitar — Fall 2020–Summer 2021
- MATLAB — Spring 2020–Summer 2022
- Physics — Spring 2021 – Spring 2022
- Python — Summer & Fall 2020
- SAT Math — Summer 2020 & Summer 2021
- SAT Reading — Summer 2020
- Trigonometry — Summer 2021 & Summer 2022