

Kate Benfield, Ph.D.

Associate | Biomechanics
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Professional Profile

Kate Benfield, Ph.D., has more than seven years of experience in joint biomechanics and tissue mechanics. She specializes in mechanical testing, joint kinematics, wear analysis, and injury biomechanics across orthopedic, transportation, and accidental injury applications.

Dr. Benfield has extensive experience in experimental and analytical biomechanics, investigating how loading conditions, whole-body and joint kinematics, and repetitive motion influence the mechanical behavior, damage, and wear of biological tissues and joints. Her work focuses on biomechanical evaluation of injury mechanics and loading conditions resulting from motor vehicle, occupational, recreational, and fall-related incidents.

Dr. Benfield combines mechanical testing, experimental design, mechatronics, and data analysis to evaluate biomechanical questions involving force transmission, tissue response, injury mechanisms, and human movement under complex loading conditions. Her doctoral research incorporated fatigue testing, dynamic mechanical analysis (DMA), tribological testing, robotic joint simulation, and 3D optical scanning to characterize the behavior of biological tissues and joints under complex loading environments. She has designed and developed custom testing systems, instrumentation platforms, and experimental methodologies to generate reliable and repeatable biomechanical measurements.

Prior to joining Exponent, Dr. Benfield earned her M.S. in Mechanical Engineering and Ph.D. in Biomedical Engineering from Boise State University. She was a Graduate Research Assistant and manager in the Northwest Tissue Mechanics Lab, where her research focused on understanding how joint loading and kinematics influence soft-tissue wear and degeneration. Her research provides clinically relevant insight into tissue damage, joint degeneration, and injury risk.

Dr. Benfield has authored and co-authored numerous peer-reviewed journal articles and conference proceedings related to orthopedic biomechanics. She has delivered award-winning presentations at national and international conferences and has received recognition for research excellence, scientific communication, and graduate student mentorship.

Academic Credentials & Professional Honors

Ph.D., Biomedical Engineering, Boise State University, 2026

M.S., Mechanical Engineering, Boise State University, 2020

B.S., Mechanical Engineering, Boise State University, 2019

Engineering Department Award, Boise State University, 2025

PhD Competition Award, American Society of Mechanical Engineers, 2025

Graduate Student Showcase Award, Boise State University, 2024

Graduate Student Spotlight, Boise State University, 2024

Diversity in Research Award, SB3C Conference, 2023

Oregon Bioengineering Symposium Award, Oregon State University 2022

Excellence in Graduate Student Mentorship, Boise State University, 2022

Honorable Mention, NSF Graduate Research Fellowship Program, 2021

Most Outstanding Mechanical Engineer, Boise State University, 2019

Graduate Assistantship Award, Boise State University, 2019-2026

President's Writing Award, Boise State University, 2019

Tau Beta Pi Scholarship, 2018, 2019

Academic Appointments

Teaching Assistant, Experimental Methods I & II, Department of Mechanical and Biomedical Engineering, Boise State University, 2021, 2025

Guest Lecturer, Machine Design I, Department of Mechanical and Biomedical Engineering, Boise State University, 2021

Lead Lab Instructor, Fluid Mechanics, Department of Mechanical and Biomedical Engineering, Boise State University, 2019-2020

Prior Experience

Research Assistant & Lab Manager, Northwest Tissue Mechanics Lab, Boise State University, 2019-2026

Research Intern, Harold K. Dunn Orthopedic Research Lab, University of Utah, 2024

Manufacturing Engineering Intern, Plexus, Nampa, Idaho, Summers 2017 & 2018

Research Assistant, Cold Atmospheric Plasma Lab, Boise State University, 2016-2018

Professional Affiliations

Tau Beta Pi Honor Society, 2017-Present

American Society of Mechanical Engineers, 2019-2020

Sigma Xi Research Society, 2017-2019

Publications

Benfield KJ, Fors KJ, Black TC, Brandes GA, Macaw KM, Bowman V, Keller-Peck C, Lujan TJ.

[Anisotropic wear behavior of meniscus: Influence of cross-shear and loading magnitude](#). Journal of the

Mechanical Behavior of Biomedical Materials 2026; 173.

Benfield KJ, Burrue DE, Lujan TJ. [Guidelines for accurate multi-temporal model registration of 3d scanned objects](#). Journal of Imaging 2023; 9(2):43.

Benfield KJ, Pinkley ZA, Burrue DE, Lewis KJ, Ferguson DS, Lujan TJ. [In vitro method to quantify and visualize mechanical wear in human meniscus subjected to joint loading](#). Journal of the Mechanical Behavior of Biomedical Materials 2022; 133.

Cornell KA, **Benfield KJ**, Berntsen T, Clingerman J, Croteau A, Goering S, Moyer D, Provost M, White A, Plumlee D, Oxford JT, Browning J. [A cold atmospheric pressure plasma discharge device exerts antimicrobial effects](#). International Journal of Latest Trends in Engineering & Technology: IJLTET 2020; 15(3):036–041.

Presentations

Benfield KJ, Fors KJ, Black TC, Macaw KM, Brandes GA, Lujan TJ. Characterizing meniscal wear behavior: influence of cross-shear and loading magnitude. Oral Presentation, Summer Bioengineering Conference, Santa Ana Pueblo, NM, 2025, (3rd Place).

Fors KJ, **Benfield KJ**, Brandes GA, Bowman V, Keller-Peck C, Black TC, Macaw KM, Lujan TJ. Characterizing the effect of mechanical wear on meniscal fiber fraying. Poster Presentation, Summer Bioengineering Conference, Santa Ana Pueblo, NM, 2025, (1st Place).

Benfield KJ, Fors KJ, Black TC, Macaw KM, Brandes GA, Bowman V, Keller-Peck C, Lujan TJ. Characterizing meniscal wear behavior: influence of cross-shear and loading magnitude. Poster Presentation, Graduate Student Showcase, Boise, ID, 2025, (Department Awardee).

Benfield KJ. Becoming weak. Invited Talk, The Story Collider – Resilience Show, Boise, ID, 2025.

Benfield KJ, Fors KJ, Macaw KM, Black TC, Lujan TJ. Unraveling the role of mechanical factors in the wear-and-tear of knee meniscus. Oral Presentation, Utah Biomedical Engineering Conference, Salt Lake City, UT, 2024.

Benfield KJ, Fors KJ, Black TC, Macaw KM, Brandes GA, Bowman V, Keller-Peck C, Lujan TJ. Effect of loading magnitude on the wear behavior of bovine meniscus. Poster Presentation, Graduate Student Showcase, Boise, ID, 2024.

Benfield KJ, Fors KJ, Black TC, Macaw KM, Lujan TJ. Influence of mechanical loading on volumetric wear in bovine meniscus. Poster Presentation, Orthopedic Research Society, Long Beach, CA, 2024.

Fors KJ, **Benfield KJ**, Macaw KM, Black TC, Lujan TJ. The mechanical wear of meniscus tissue is highly depth-dependent. Poster Presentation, Idaho INBRE Summer Research Conference, Moscow, ID, 2023.

Benfield KJ, Fors KJ, Lujan TJ. Influence of multidirectional loading on meniscus wear behavior. Oral Presentation, Summer Biomechanics, Bioengineering, and Biotransport Conference, Vail, CO, 2023.

Fors KJ, Shannon K, **Benfield KJ**, Lujan TJ. Development and assessment of a new web application to measure the orientation and alignment of fibrous tissue. Poster Presentation, Summer Biomechanics, Bioengineering, and Biotransport Conference, Vail, CO, 2023.

Benfield KJ, Semodji AM, Upasani V, Farnsworth C, Nesbit DQ, Mannen EM, Lujan TJ. Cartilage mechanical properties of developmental dysplasia of the hip in a porcine model. Poster Presentation, Graduate Student Showcase, Boise State University, Boise, ID, 2023.

Benfield KJ, Fors KJ, Pinkley ZA, Lujan TJ. Effects of In-Vitro multidirectional loading on bovine meniscus

tissue wear. Poster Presentation, Oregon Bioengineering Symposium, Corvallis, OR, 2022, (1st Place).

Benfield KJ. Humanity. Invited Talk, The Story Collider – Introspection Show, Boise, ID, 2022.

Benfield KJ, Semodji AM, Upasani V, Farnsworth C, Nesbitt D, Mannen EM, Lujan TJ. Cartilage mechanical properties of developmental dysplasia of the hip in a porcine model. Oral Presentation, Summer, biomechanics, Bioengineering, and Biotransport Conference, Cambridge, MD, 2022.

Benfield KJ, Pinkley ZA, Hollar KA, Lewis KJ, Lujan TJ. In Vitro method to quantify and visualize mechanical wear in human meniscus subjected to joint loading. Virtual Oral Presentation, Summer SB3C Conference, Vail, CO, 2021.

Benfield KJ, Berntsen T, Moyer D, Goering S, Provost M, Kennedy Z, Cornell KA, Oxford JT, Browning J. Parallel plate cold atmospheric pressure plasma source for destroying bacteria and biofilms. Poster Presentation, IEEE International Conference on Plasma Science, 2018.