Exponent®
Engineering & Scientific Consulting

Stephanie Molitor, Ph.D.
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Professional Profile

Dr. Molitor specializes in biomechanics, including human movement and human-device interactions. She has expertise in analyzing human kinematics, dynamics, and injury mechanics during motor vehicle collisions, activities of daily living, and sporting activities. She also has experience collecting biomechanical data and reconstructing human movement through musculoskeletal modeling, and has contributed to large-scale biomechanical testing studies to evaluate product performance.

Prior to joining Exponent, Dr. Molitor completed a National Science Foundation Graduate Research fellowship where she studied lower-limb stiffness properties during locomotion for able-bodied individuals as well as those using prosthetic devices. She identified compensatory behaviors present among lower-limb amputees, and developed novel prostheses aimed at preventing secondary injuries.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, University of Texas - Austin, 2025

B.Eng., Biomedical Engineering, Vanderbilt University, 2021

M.S., Biomedical Engineering, Vanderbilt University, 2021

National Science Foundation GRFP Fellow

Dean’s Prestigious Fellow, Cockrell School of Engineering

Thrust 2000 Fellow, Cockrell School of Engineering

STAR Scholar, Philanthropic Educational Organization (PEO)

Best Oral Presentation, STEM Muse Research Symposium

Best Poster Presentation, ME Graduate Student Poster Session

Arnold Award for Best Design in Engineering, Vanderbilt University

Finalist, Procter & Gamble Graduate Research Poster Competition

Searle SyBBURE Undergraduate Research Fellow

Tau Beta Pi Engineering Honor Society

Magna Cum Laude, Vanderbilt University

Prior Experience

Communications Director, Nucleate Texas, 2024-2025

Teaching Assistant, Mechanical Engineering, The University of Texas at Austin, 2021-2025

Teaching Assistant, Electrical and Computer Engineering, Vanderbilt University, 2018-2021

Manufacturing Engineering Intern, Medtronic, 2018

Professional Affiliations

American Society of Biomechanics - ASB, Member (2022-present)

International Women in Biomechanics - IWB, Member (2020-present)

Publications

Molitor SL, Cyr KM, Klute GK, Neptune RR. Lower-limb joint work symmetry responses to load carriage and prosthetic foot type during transtibial amputee walking. Journal of Biomechanics 2026; 194:113047.

Molitor SL, Neptune RR. Individual muscle contributions to lower-limb joint quasi-stiffness during steady-state healthy walking. Journal of Biomechanics 2025; 190:112851.

Ziemnicki DM, McDonald KA, Molitor SL, Egolf JB, Cruz JP, Lee KE, Zelik KE. Development and preliminary evaluation of a bimodal foot prosthesis for walking and running. ASME Journal of Biomechanical Engineering 2024; 146(9):091010.

Pirritano MA, Neuman RM, Molitor SL, Klute GK, Neptune RR, Fey NP. Ability of a robotic ankle prosthesis to augment effective foot-ankle stiffness relative to standalone prosthetic feet. Proceedings of IEEE RAS/EMBS International Conference for Biomedical Robotics and Biomechatronics 2024, 1663–1669.

Molitor SL, Neptune RR. Lower-limb joint quasi-stiffness in the frontal and sagittal planes during walking at different step widths. Journal of Biomechanics 2024; 162:111897.

Molitor SL, Zelik KE, McDonald KA. Lower-limb dominance does not explain subject-specific foot kinematic asymmetries observed during walking and running. Journal of Biomechanics 2024; 162:111877.

Ziemnicki DM, McDonald KA, Wolf DN, Molitor SL, Egolf JB, Gupta M, Zelik KE. Combining an artificial gastrocnemius and powered ankle prosthesis: effects on transtibial prosthesis user gait. ASME Journal of Biomechanical Engineering 2023; 145(6):061009.

Presentations

Molitor SL, Neptune RR. Individual muscle contributions to ankle quasi-stiffness during walking. Poster presentation, 48th Annual Meeting of the American Society of Biomechanics, Pittsburgh, PA, 2025.

Molitor SL, Neptune RR. Individual muscle contributions to ankle quasi-stiffness during healthy walking. Podium presentation, 2025 CARE Research Day, Austin, TX, 2025.

Molitor SL, Neptune RR. Individual muscle contributions to ankle quai-stiffness during walking. Poster presentation, the University of Texas at Austin ME Graduate Student Poster Session, Austin, TX, 2025.

Molitor SL. The effect of load carriage on ankle work symmetry while walking for below-knee prosthesis

users. Podium presentation, STEM Muse Research Symposium, Austin, TX, 2024.

Molitor SL, Cyr KM, Klute GK, Neptune RR. Effect of added load on prosthetic walking symmetry. Poster presentation, Procter & Gamble Graduate Student Poster Competition, Austin, TX, 2024.

Molitor SL, Cyr KM, Klute GK, Neptune RR. The effect of load carriage on ankle work symmetry for transtibial prosthesis users. Poster presentation, 47th Annual Meeting of the American Society of Biomechanics, Madison, WI, 2024.

Molitor SL, Neptune RR. Ankle quasi-stiffness: main muscle contributors and implications for walking performance. Podium presentation, Frontiers of Human Performance, Jackson, WY, 2024.

Molitor SL. Lower-limb joint quasi-stiffness and its applications in rehabilitation engineering. Invited seminar, the University of Texas at Austin Department of Kinesiology and Healthy Education, Austin, TX, 2023.

Molitor SL, Neptune RR. Characterization of changes in lower limb joint quasi-stiffness during walking at various step widths. Poster presentation, 2023 CARE Research Day, Austin, TX, 2023.

Molitor SL, Neptune RR. Quasi-stiffness as a measure for evaluating biomechanical changes across step widths. Poster presentation, 46th Annual Meeting of the American Society of Biomechanics, Knoxville, TN, 2023.

Molitor SL, Fey NP, Klute GK, Neptune RR. Effect of ankle quasi-stiffness on balance control during walking at different speeds. Podium presentation, North American Congress on Biomechanics, Ottawa, Ontario, CA, 2022.

Ziemnicki DM, Molitor SL, Egolf JB, Cruz JP, Zelik KE, McDonald KA. Design and evaluation of a bimodal prosthetic foot for walking and running. Poster presentation, North American Congress on Biomechanics, Ottawa, Ontario, CA, 2022.

Molitor SL, Zelik KE, McDonald KA. On the importance of applying appropriate joint angle normalization to multi-segment foot models. Poster presentation, Biomedical Engineering Society, Virtual, 2020.

Molitor SL, Sulzer J. Myofascial release therapy: a review. Poster presentation, 2022 CARE Research Day, Austin, TX, 2022.

Molitor SL, Zelik KE, McDonald KA. A biomechanical comparison between dominant and non-dominant limbs during locomotion. Poster presentation, 44th Annual Meeting of the American Society of Biomechanics, Atlanta, GA, 2020.

Budzikowski J, Molitor SL, Schmall M, Ufford K, Welscott R. Smart IV tubing clamp for the NICU. Poster presentation, Vanderbilt University Design Day, Nashville, TN, 2020.

Molitor SL, Ziemnicki DZ, Zelik KE. Adding an artificial gastrocnemius to a powered ankle prosthesis. Poster presentation, Vanderbilt University Undergraduate Research Fair, Nashville, TN, 2019.

Project Experience

- Contributed to the development and validation of a novel prosthetic foot for walk-to-run transitions. Conducted mechanical testing, human studies, and feedback surveys to evaluate biomechanical efficacy and user perception.

- Performed injury analyses for occupants in motor vehicle collisions. Combined information from medical records, scene photographs, and surrogate testing to understand potential injury mechanisms.