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Engineering & Scientific Consulting

Allison McCrady, Ph.D.

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Professional Profile

Dr. McCrady is a biomedical engineer specializing in musculoskeletal biomechanics, clinical imaging, and computational modeling. She holds a Ph.D. in Biomedical Engineering from the University of Virginia and has extensive experience in translational research aimed at improving musculoskeletal health and performance. Her expertise spans clinical biomechanics, ultrasound and MRI-based imaging, and finite element modeling to assess muscle structure, quality, and function in both healthy and diseased states. She has led and contributed to projects involving neuromuscular diseases (e.g., Duchenne muscular dystrophy, spinal muscular atrophy, facioscapulohumeral muscular dystrophy), injury prevention in military populations (e.g. bone stress injuries, exercise-induced muscle damage), and development of novel imaging biomarkers (e.g. magnetic resonance, ultrasound). She is skilled in computational modeling (e.g. finite element, statistical) and advanced image processing techniques (e.g. automated segmentation, textural analyses), with a strong record of interdisciplinary collaboration across engineering, clinical, and military research environments. Recognized with numerous awards, Allison combines technical innovation with practical application to advance human health and performance.

Prior to joining Exponent, Dr. McCrady was a postdoctoral researcher at the U.S Army Research Institute of Environmental Medicine in the Military Performance Division. Her postdoctoral research focused on quantifying sex-based differences in muscle recovery post-exercise through applying ultrasound, biopsies, and physical performance metrics. Additionally, she incorporated wearable health metrics to assess coast guard cadet physical health changes during initial training. In her doctoral research at the University of Virginia, Dr. McCrady applied translational medical imaging and computational modeling methods to reveal the complex relationships between muscle size, quality, and strength in patients with neuromuscular diseases. She leveraged ultrasound imaging and statistical modeling to develop a novel multivariable biomechanics-based biomarker to estimate strength of patients with spinal muscular atrophy and Duchenne muscular dystrophy. Additionally, she developed novel magnetic resonance image–derived finite element models of the tibialis anterior muscle incorporating anatomical fat infiltration patterns to quantify the impact of regional fat infiltration on muscle force generation. During her doctoral education, Dr. McCrady also participated in a three-month externship with Pfizer's Digital Science and Translational Imaging group where she completed a project assessing potential new MR-based biomarkers and the correlation to ambulatory function for use in future Duchenne muscular dystrophy clinical trials.

Academic Credentials & Professional Honors

Ph.D., Biomedical Engineering, University of Virginia, 2024

B.S., Biomedical Engineering, Trine University, 2019

Rising Star in Mechanical Engineering, Massachusetts Institute of Technology, 2025

Danaher Corporation Scholar, Achievement Rewards for College Scientists (ARCS) Foundation, 2023

Fellow, Coulter Center for Translational Research, 2023

Trainee, National Institutes of Health (NIH) T32 Biotechnology Training Program, 2021-2023

Prior Experience

ORISE Postdoctoral Research Fellow, Military Performance Division, U.S. Army Research Institute for Environmental Medicine (USARIEM), 2024-2025

Graduate Research Assistant, Multiscale Muscle Mechanophysiology Lab, University of Virginia, 2019-2024

Clinical Imaging Research Scholar, Digital Medicine and Translational Imaging Group, Pfizer, 2023

Undergraduate Research Assistant, Biomedical Engineering Department, Trine University, 2017-2019

Undergraduate Research Assistant, NSF Bioengineering Research Experience for Undergraduates, Worcester Polytechnic Institute, 2017

Professional Affiliations

American Society of Biomechanics – 2020-Present

International Society of Women in Biomechanics – 2020-Present

Biomedical Engineering Society – 2017-2018

Publications

Kumar S, Rahman A, Gutierrez R, Livermon S, McCrady AN, Blemker SS, Scharf R, Srivastava A, Barnes LE. A shape-based functional index for objective assessment of pediatric motor function. PLoS One, October 2025.

McCrady AN, Friedman SD, Wang L, Shaw DW, Tawil R, Statland JM, Tapscott SJ, Blemker SS. 3D finite element models reveal regional fatty infiltration modulates tibialis anterior force generating capacity in FSHD. PLoS One, July 2025.

Hu X*, McCrady AN*, Bukovec K*, Yuan C, Crump KB, Bour R, Bruce A, Peirce S, Grange R, Blemker SS. A novel ex vivo protocol that mimicked length and excitation changes of human muscles during walking induced force losses in EDL but not in soleus of mdx mice. PLoS One, April 2025. *co-first authors contributed equally

Sherlock SP, McCrady AN, Palmer J, Aghamolaey H, Ahgren A, Widholm P, Leinhard OD, Karlsson M. Relationship between quantitative MRI measures and future functional changes in patients with Duchenne muscular dystrophy (DMD). Muscle & Nerve, December 2024.

McCrady AN, Masterson CD, Barnes L, Scharf R, and Blemker SS. Development of an ultrasound-based metric of muscle functional capacity for use in patients with neuromuscular disease, Muscle & Nerve, October 2024.

Gutierrez RJ*, McCrady AN*, Masterson CD, Tolman SA, Boukhechba M, Barnes L, Blemker SS, Scharf R. Upper EXTremity Examination for Neuromuscular Diseases (U-EXTEND): Protocol for multi-modal feasibility study, JMIR Research Protocols, October 2022. *co-first authors contributed equally

Kumar S, Gutierrez RJ, Datta D, Tolman SA, McCrady AN, Blemker SS, Scharf R, Boukhechba M, Barnes L. Shape Analysis for Pediatric Upper Body Motor Function Assessment, ISWC '22: Proceedings of the 2022 ACM International Symposium on Wearable Computers, December 2022.

Presentations

Newman AA, McCrady AN, Young M, Owens B, Dummar AR. Health trends and injury patterns among female U.S. Army Soldiers: A 2022 Analysis Using SPHERE Data. Poster Presentation, Military Health System Research Symposium, Kissimmee, FL, 2025.

McCrady AN, Masterson CD, Barnes L, Scharf R, Blemker SS. Ultrasound Images predict upper extremity functional capacity for patients with neuromuscular disease. Poster Presentation, Muscular Dystrophy Association (MDA) Scientific & Clinical Conference, Orlando, FL, 2024.

McCrady AN, Masterson CD, Gutierrez RJ, Tolman, SA, Barnes L, Scharf R, Blemker SS. How do changes in muscle structure and tissue quality relate to strength changes over time in Duchenne muscular dystrophy? Poster Presentation, American Society of Biomechanics (ASB) Meeting, Knoxville, TN, 2023.

McCrady AN, Gutierrez RJ, Masterson CD, Boukhechba M, Barnes L, Scharf R, Blemker SS. How do muscle form and function relate in spinal muscular atrophy and Duchenne muscular dystrophy? Podium Presentation, North American Congress on Biomechanics (NACOB), Ottawa, ON, Canada, 2022.

McCrady AN, Gutierrez RJ, Masterson CD, Boukhechba M, Barnes L, Scharf R, Blemker SS. In vivo measurements of muscle structure and function in patients with spinal muscular atrophy and Duchenne muscular dystrophy. Poster Presentation, MDA Scientific & Clinical Conference. Nashville, TN, 2022.

McCrady AN*, Kasen EL*, Slane LC. Achilles tendon maximum strain and thickness is subject dependent. Poster Presentation, American Society for Engineering Educators (ASEE) Illinois – Indiana Section Conference, West Lafayette, IN, 2018. *co-first authors contributed equally

McCrady AN*, Kasen EL*, Slane LC. Ultrasound-based observations of apparent Achilles tendon shortening. Poster Presentation, Biomedical Engineering Society (BMES) Annual Meeting, Atlanta, GA, 2018. *co-first authors contributed equally

McCrady AN, Ding I, Peterson A. First layer material variation in PEMs influences surface topography and fibroblast behavior. Poster Presentation, BMES Annual Meeting, Phoenix, AZ, 2017.

Peer Reviews

Military Medicine