

Exponent®
Engineering & Scientific Consulting

Emma Coltoff, Ph.D.

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Professional Profile

Dr. Emma Coltoff is a bio-mechanical engineer, specializing both in orthopaedic biomechanics and quality attributes for product manufacturing. She has developed new methods of spinal biomechanical testing, requiring extensive experience in experimental methods on both cadaveric and surrogate models on both industrial robotic testing systems and traditional load frames. She also has years of experience in diagnosis and rectification of manufacturing deviations and support for resolving customer issues. Her prior experiences equip her with a deep understanding of additive manufacturing processes, computer aided design, and standards development, as well as data visualization strategies and scientific communication for audiences spanning children to federal legislators. Dr. Coltoff applies her expertise on a variety of mechanical and regulatory projects in the biomedical realm.

Dr. Coltoff's background spans both mechanical and biomedical engineering with a focus on human biomechanics and test methodology development. She has experience in experimental design and execution, design for manufacturing, robotics, and additive manufacturing (FDM and Carbon DLS 3D printing). Additionally, she has experience with image segmentation, computer aided design, communication for regulatory and policy settings, and is proficient in MATLAB, Python, and RStudio. Dr. Coltoff’s specific research interests involve challenges that bridge biomechanics, technology, and experimental testing to uncover new dimensions of understanding of human movement. She maintains additional interests in human factors, assistive technology, and prosthetics.

Dr. Coltoff received a PhD in Biomedical Engineering from the joint School of Biomedical Engineering and Sciences at Wake Forest University and Virginia Polytechnic Institute in 2025. While investigating experimental biomechanical testing, Dr. Coltoff developed a novel methodology that combined an industrial robotic system with complex experimental loading to characterize multiplanar spine biomechanics. Prior to graduate school, she gained significant manufacturing and quality knowledge as a senior sustaining engineer in the electrical connector manufacturing industry. In that role, she led numerous investigations to investigate product field failures for clients, directed production changes to maintain product manufacturability and process improvement, and supported development of next-generation products.

Academic Credentials & Professional Honors

Ph.D., Biomedical Engineering, Wake Forest University, 2025

B.S., Mechanical Engineering, Tufts University, 2017

Society of Standards Professionals Student Scholarship, March 2024

Orthopaedic Research Society Spine Section Travel Grant Award, February 2024

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Prior Experience

Graduate Research Assistant, Brown Lab, Wake Forest University, 2021-2025

Wake Forest Online Immersion Program, Course Mentor for Sports Medicine, Women's Medicine, Engineering, & Biomedical Engineering curriculums, 2021-2025

Senior Product Engineer, TE Connectivity, 2021

Product Engineer, TE Connectivity, 2019-2021

Rotational Product Development Engineer, TE Connectivity, 2017-2019

Human Factors & Clinical Engineering Intern, Covidien, 2016

Undergraduate Research Assistant, Injury Biomechanics Lab Laboratory, University of Pennsylvania, 2015

Professional Affiliations

Orthopaedic Research Society (ORS)

International Women in Biomechanics (IWB)

American Society of Mechanical Engineers (ASME)

Publications

Coltoff EC, Marcet PA, Wilson JL, Brown PJ. Multiplanar creep characterizations of the functional spinal units of the Subaxial cervical spine. ASME Journal of Tribology: Special Issue on Orthopedics and Biotribology 2026; 148(5):051112.

Coltoff EC, Davis AL. Emerging biotechnologies: dual-use potential and strategies to prevent misuse. MIT Science Policy Review 2025; 6:23–35.

Coltoff EC, Hezrony BS, Marcet PA, Wilson JL, Brown PJ. A novel methodology for improving understanding of the multiplanar kinematics of the human cervical spine. ASME Journal of Medical Diagnostics: Special Issue on Injury and Damage Mechanics for Biological Structures 2025; 8(4):041107.

Coltoff EC, Nandamuri R, Savoy N, Klein D. TE connectivity – industrial and commercial transportation (ICT) 48V evaluation strategy. Internal White Paper 2020.

Oral Presentations

EC Coltoff, Hezrony BS, Wilson JL, Marcet PA, Brown PJ. Path-dependent multidimensional behavior of the cervical spine. SBES Internal Symposium, Blacksburg, VA, USA, April 28, 2025.

EC Coltoff, Dukkipati ST, Driscoll M, Brown PJ. ORS spine section travel grant 2024: novel spinal modeling & testing methods research exchange. Orthopaedic Research Society 2025 Annual Meeting, Phoenix, AZ, USA, February 7-11, 2025.

Zilevicius KRG, Hederick MK, von Kleeck BW, **Coltoff EC**, Roy T, Graybill B, Wilbur J, Gayzik FS, Brown PJ. A human body model inspired cervical spine surrogate: a pilot study. 52nd NHTSA Workshop on Human Subjects for Biomechanical Research, Columbus, OH, October 21, 2024.

EC Coltoff, Loss JG, Dukkipati ST, Wahbeh JM, Chastain KL, Pelletier MH, Wang T, Brown PJ, Driscoll

M, Sangiorgio S, Enramadas E, Meyers K, Walsh WR, Cornwall GB, Kelly B, Colbrunn RW. Poster teaser talk: temporal variation in artificial composite spinal surrogates through inter-laboratory spine biomechanics testing. Orthopaedic Research Society 2024 Annual Meeting, Long Beach, CA, USA, February 2, 2024.

EC Coltoff, Hezrony BS, Loss JG, Brown PJ, the Participating Labs of the International Spine Biomechanics Consortium. Onwards, upwards, forwards, and backwards: explorations of spinal biomechanical testing variation and novel protocol development. ASTM November 2023 Committee Week, F04.25 Spinal Devices Committee, Washington DC, USA, November 8, 2023.

EC Coltoff. Understanding complex spine biomechanics. ConGregate 9 Science Fiction Conference, Winston Salem, NC, USA, July 15, 2023.

Coltoff EC, Brown PJ. Validation of a multi-planar complex spine mechanics testing protocol. Biomedical Engineering Society Annual Meeting 2022, San Antonio, TX, USA, October 14, 2022.

Workshops & Lectures

Colbrunn R, Cone S, Roth J, Arant L, **Coltoff EC**, Nagle T, Pace E, Loss J, Gillespie C. simVITRO workshop: best practices in 6 degree of freedom robotic in vitro joint testing. Summer Biomechanics, Bioengineering, and Biotransport Conference, Lake Geneva, WI, USA, June 14, 2024.

Coltoff EC, Hezrony B, Brown P. Flower petals: a novel multi-axis testing paradigm: part of the simVITRO workshop at SB3C. Summer Biomechanics, Bioengineering, and Biotransport Conference, Lake Geneva, WI, USA, June 14, 2024.

Poster Presentations

Coltoff EC, Marcet PA, Wilson JL, Brown PJ. Multidimensional mechanical changes of the human cervical spine. Orthopaedic Research Society 2026 Annual Meeting, Charlotte, NC, USA, March 27- 31, 2026.

Puckett CD, Watson S, Vyvyan S, **Coltoff EC**. Priorities and barriers for designers of 3d printed prosthetic devices. 2025 Annual Conference for the Society of Student Run Free Clinics, Chicago, IL, USA, October 4-5, 2025.

Coltoff EC, Hezrony BS, Wilson JL, Brown PJ. Impact of path directionality on the multiplanar biomechanics of the cervical spine following spinal decompression surgery. Orthopaedic Research Society 2025 Annual Meeting, Phoenix, AZ, USA, February 7-11, 2025.

Coltoff EC, Hezrony BS, Wilson JL, Brown PJ. A multiplanar kinematic comparison of cervical spine decompression surgery approaches. Biomedical Engineering Society Annual Meeting 2024, Baltimore, MD, USA, October 23-26, 2024.

Hederick MK, Geary KR, **Coltoff EC**, Von Kleeck BW, Roy TJ, Greybill B, Wilbur J, Gayzik FS, Brown PJ. Pilot evaluation of a cervical spine surrogate for blast and ballistic PPE testing. Biomedical Engineering Society Annual Meeting 2024, Baltimore, MD, USA, October 23-26, 2024.

Coltoff EC, Hezrony BS, Marcet PA, Brown PJ. Exploration of the full-field biomechanics of the human spine. Summer Biomechanics, Bioengineering, and Biotransport Conference, Lake Geneva, WI, USA, June 14, 2024.

Coltoff EC, Loss JG, Dukkipati ST, Wahbeh JM, Chastain KL, Pelletier MH, Wang T, Brown PJ, Driscoll M, Sangiorgio S, Ebramzadeh E, Meyers K, Walsh WR, Cornwall GB, Kelly B, Colbrunn RW. Temporal variability in composite lumbar spine surrogates during multi-laboratory collaborative testing. Summer Biomechanics, Bioengineering, and Biotransport Conference, Lake Geneva, WI, USA, June 12, 2024.

Coltoff EC, Loss JG, Dukkipati ST, Wahbeh JM, Chastain KL, Pelletier MH, Wang T, Brown PJ, Driscoll M, Sangiorgio S, Ebramzadeh E, Meyers K, Walsh WR, Cornwall GB, Kelly B, Colbrunn RW. Biomechanical variability in composite lumbar spine surrogates during multi-laboratory collaborative testing. Summer Biomechanics, Bioengineering, and Biotransport Conference, Lake Geneva, WI, USA, June 12, 2024.

Coltoff EC, Loss JG, Dukkipati ST, Wahbeh JM, Chastain KL, Pelletier MH, Wang T, Brown PJ, Driscoll M, Sangiorgio S, Ebramzadeh E, Meyers K, Walsh WR, Cornwall GB, Kelly B, Colbrunn RW. Biomechanical variability in composite lumbar spine surrogates during multi-laboratory collaborative testing. Summer Biomechanics, Bioengineering, and Biotransport Conference, Lake Geneva, WI, USA, June 12, 2024.

Additional Education & Training

Sigma Xi Science Policy Bootcamp, 2024

Duke University School of Medicine Regulatory Affairs Training Program, 2024

Science Policy & Advocacy Certificate Program, 2023

Editorships & Editorial Review Boards

SciTech Forefront, Associate Editor, 2025