

Exponent®
Engineering & Scientific Consulting

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Professional Profile

Sarah Sharpe, Ph.D., is a principal in Exponent's Biomechanics practice with over 20 years of experience performing biomechanical research and analyses. She specializes in assessments involving human movement and loading, human motor control and fatigue, and injury mechanics, potential, and mitigation. She applies her expertise in a variety of settings including automotive and industrial investigations, premises liability assessments, product evaluations, and restraint system analyses.

Dr. Sharpe has extensive testing experience and worked for nearly 10 years at Exponent's Phoenix Test and Engineering Center where she performed full scale-automotive crash testing, sled testing, airbag investigations, driving demonstrations, motorcycle-operator testing, and component-level testing involving anthropomorphic test devices (crash test dummies). She has coordinated and conducted large-scale human participant testing to investigate the relationships between product use and human movement, loading, fatigue, and injury risk.

Before joining Exponent, Dr. Sharpe completed a National Science Foundation Integrative Graduate Education and Research Traineeship (IGERT) fellowship where she focused on Neuroengineering. She also served as a Graduate Research Assistant at the Georgia Institute of Technology's Complex Rheology and Biomechanics (CRAB) Lab. Her research involved analysis and integration of the physics of complex substrates during animal movement to understand locomotion neuromechanics on a variety of terrains. Dr. Sharpe has additionally conducted research in the Robotics and Autonomous Controls Laboratory at the University of Central Florida and in the Laboratory for Neuroengineering at the Georgia Institute of Technology.

Automotive Evaluations

Dr. Sharpe has extensive hands-on experience conducting full-scale automotive crash testing, sled testing, and component-level evaluations using anthropomorphic test devices (ATDs), commonly known as crash test dummies. Her testing programs have addressed frontal impacts, side impacts, rear impacts, and rollover scenarios, as well as driving demonstrations and motorcycle operator testing. She has evaluated ATD biofidelity, assessed loading on large-occupant surrogates, and examined facial load using biofidelic tools. Her work supports reconstructing crash scenarios and evaluating occupant responses and injury potential under controlled, repeatable conditions.

Restraint Systems

Dr. Sharpe provides biomechanical evaluations of automotive restraint systems — including airbags, seat belts, seats, and child restraints — to assess their performance and relationship to occupant loading, injury, and injury mitigation in real-world and simulated crash events. She has investigated airbag deployment characteristics, seat belt loading and geometry, and seat structural response in the context of

occupant loading and protection. Her work integrates test data, ATD instrumentation outputs, and biomechanical injury criteria to evaluate restraint systems performance in non-standard test environments such as collisions involving high speeds, multiple impacts, out-of-position occupants, unusual in-vehicle cargo or objects, and occupants of varying size.

Injury Mechanism & Potential

Dr. Sharpe has evaluated injury mechanism and potential across a broad spectrum of incident types, including on- and off-road collisions, premises liability events (slip, trip, and fall), recreational activities, occupational injuries, and theme park incidents. These evaluations include assessing slip resistance, helmet testing, using motion capture and force data collection from human subjects, cadaver testing, testing with physical models, analysis of publicly available field accident and injury databases, and utilizing biomechanical literature and established injury criteria.

Consumer Product Analysis and Design

Dr. Sharpe has conducted both targeted and large-scale human participant testing paradigms designed to characterize the relationship between product use and human movement, loading, comfort, fatigue, and injury risk. Her work encompasses the use of wearable devices, equipment, or clothing/footwear on human locomotion, postural stability, and task performance across a range of environments and populations. She has utilized motion capture (optical and IMU-based), musculoskeletal modeling, electromyography (EMG), strength measurements, and 3D scanning to evaluate product fit, contextualize comfort assessments, and inform wearable product integration with objective, data-driven findings.

Expert Witness Support and Testimony Experience

Dr. Sharpe has been qualified as a biomechanics expert and offered testimony in both state and federal courts on topics including, but not limited to, human movement and motor control, occupant kinematics and loading, injury mechanism, injury potential, and occupant-restraint interactions.

Academic Credentials & Professional Honors

Ph.D., Bioengineering, Georgia Institute of Technology, 2013

B.S., Mechanical Engineering, University of Central Florida, 2007

National Science Foundation IGERT Fellow

Georgia Tech Bioengineering Best Student Publication Award

National Tau Beta Pi Campbell Scholar

Licenses and Certifications

Northwestern University Center for Public Safety, Traffic Crash Reconstruction for Engineers

Professional Affiliations

Society of Automotive Engineers—SAE

American Society of Biomechanics—ASB

Biomedical Engineering Society - BMES

Publications

Sharpe SS, Grijalva S, Allin L, Courtney A, Toney-Bolger M, Pokutta-Paskaleva A, Crosby CC, Carhart M. Evaluation of Occupant Kinematics and Kinetics during Moderate Severity Simulated Frontal Impacts with and without Frontal Airbag Deployment. SAE Technical Paper 2023-01-0559.

George J, Davis M, Sharpe S, Olberding J, Imler S, Bove R. Evaluation of occupant kinematics during low- to moderate-speed side impacts. SAE Technical Paper 2020-01-1222, 2020.

Miller B, Smedley J, Carhart M, Sharpe S, Krishnaswami R. Evaluation of laminated side glazing and curtain airbags for occupant containment in rollover, SAE Technical Paper 2020-01-0976, 2020.

Frank TA, Fowler G, Garman C, Sharpe S. Motorcycle rider inputs during typical maneuvers. SAE Technical Paper 2020-01-1000, 2020.

Astley HC, Mendelson JR, Dai J, Gong C, Chong B, Rieser JM, Schiebel PE, Sharpe SS, Hatton RL, Choset H, and Goldman DI. Surprising simplicities and syntheses in limbless self-propulsion in sand. Journal of Experimental Biology 2020; 223.

Garman CMR, Sharpe SS, Frank TA, Fowler TA. Motorcycle Rider Kinematics during Low and High Speed Turning Maneuvers. SAE Technical Paper 2018-01-0536, 2018.

Hashish R, Toney-Bolger ME, Sharpe SS, Lester BD, Mulliken A. Texting during stair negotiation and implications for fall risk. Gait & Posture 2017; 58.

Sharpe S, Brickerhoff R, Crump C, Young D. Accelerator-to-brake pedal transition movements during on-road stopping in an older population. SAE Technical Paper 2017-01-1396, 2017.

Heller M, Sharpe S, Newberry W, Dibb A, Zolock J, Croteau J, Carhart M, Kerrigan J, Clauser M. Occupant kinematics and injury response in steer maneuver-induced furrow tripped rollover testing. SAE 2015-01-1478.

Sharpe SS, Koehler SA, Kuckuk R, Serrano M, Vela P, Mendelson III J, Goldman DI. Locomotor benefits of being a slender and slick sand-swimmer. Journal of Experimental Biology 2015; 218.

Sharpe SS, Kuckuk R, and Goldman DI. Controlled preparation of wet granular medial reveals limits to lizard burial ability. Physical Biology 2015; 12(046009).

Ding Y, Sharpe SS, Wiesenfeld K, Goldman DI. Emergence of the advancing neuromechanical phase in a resistive force dominated medium. Proceeding of the National Academy of Sciences 2013; 110(25).

Sharpe SS, Ding Y, Goldman DI. Environmental interaction influences muscle activation strategy during sand-swimming in the sandfish lizard (Scincus scincus). Journal of Experimental Biology 2012; 216(2).

Ding Y, Sharpe SS, Goldman DI. Mechanics of undulatory swimming in a frictional fluid. Public Library of Science (PLoS) Computational Biology 2012; 8(12).

Ding Y, Gravish N, Li C, Maladen RD, Mazouchova N, Sharpe SS, Umbanhowar PB, Goldman DI. Comparative studies reveal principles of movement on and within granular media. In: Natural Locomotion in Fluids and on Surfaces, 2012; Springer, New York, pp. 281-292.

Conference Podium Presentations/Abstracts

Miller BD, Elmasry SE, Sharpe SS, Allin LJ, Salipur Z. Effectiveness of Bicycle, Motorcycle, and Skateboard Helmets in Reducing Risk of Concussion and Skull Fracture Across Various Impact Locations and Velocities. American Society of Biomechanics Annual Meeting, Pittsburgh, PA, August 13-16, 2025.

Sharpe S, Brickerhoff R, Crump C, Young D. Accelerator-to-brake pedal transition movements during on-road stopping in an older population. SAE 2017 World Congress and Exhibition, Detroit, Michigan.

Heller M, Sharpe S, Newberry W, Dibb A, Zolock J, Croteau J, Carhart M, Kerrigan J, Clauser M. Occupant kinematics and injury response in steer maneuver-induced furrow tripped rollover testing. SAE 2015 World Congress and Exhibition, Detroit, Michigan.

Sharpe SS, Ding Y, Goldman DI. Neuromechanics of sand-swimming. International Congress of Vertebrate Morphology, Barcelona, Spain, 2013.

Sharpe SS, Masse A, Taz H, Goldman DI. Limb use during burial of the sandfish lizard. Society for Integrative and Comparative Biology Annual Meeting, San Francisco, CA, 2013.

Sharpe SS, Kuckuk RM, Goldman DI. Ground resistance influences lizard burial in dry and wet sand. Division of Fluid Dynamics of the American Physical Society, San Diego, CA, 2012.

Sharpe SS, Goldman DI. Muscle activation strategy in the sand-swimming sandfish lizard (Scincus scincus). American Society of Biomechanics Annual Meeting, Gainesville, FL, 2012.

Sharpe SS, Ding Y, Goldman. Muscle activation strategy in the sandfish. International Physics of Living Systems Meeting, Montpellier, France, 2012.

Sharpe SS, Kuckuk RM, Goldman DI. Resistance force in wet granular media. Soft Materials Workshop, Atlanta, GA, 2012.

Sharpe SS, Judy KN, Daffon K, Goldman DI. Burrowing of the ocellated skink (Chalcides ocellatus). Society for Integrative and Comparative Biology Annual Meeting, Charleston, SC, 2012.

Steinmetz SM, Ding Y, Goldman DI. Sandfish model predicts muscle activation pattern during subsurface sand diving. Society for Integrative and Comparative Biology Annual Meeting, Salt Lake City, UT, 2011.

Steinmetz SM, Ding Y, Maladen RD, Goldman DI. Biomechanical interaction with granular media influences activation strategy during subsurface sand-swimming. Alberta Motor Control, Neurohike Meeting, Alberta, Canada, 2010.

Steinmetz SM, Maladen RD, Ding Y, Goldman DI. Muscle activation during surface and subsurface locomotion in sandfish (Scincus scincus). Society for Integrative and Comparative Biology Annual Meeting, Seattle, WA, 2010.

Steinmetz SM, Goldman DI. Electromyographic study of sand-swimming lizards within granular media. Graduate Research Symposium at Georgia Tech, Atlanta, GA, 2009.

Conference Poster Presentations

Sharpe SS, Kuckuk RM, Goldman DI. Burrowing of the ocellated skink (Chalcides ocellatus) in wet and dry granular media. Georgia Tech Research and Innovation Conference, Atlanta, GA, 2012.

Sharpe SS, Ding Y, Goldman DI. Environmental interaction influences muscle activation strategy during sand-swimming in the sandfish lizard (Scincus scincus). Georgia Tech Research and Innovation Conference, Atlanta, GA, 2011.

Invited Lectures and Seminars

Sharpe SS. Biomechanics: Injury Evaluation and Prevention. ASU Failure Analysis & Prevention Course. Arizona State University, November 2020, November 2021, and October 2022.

Sharpe SS, Grayish ND, Goldman DI. Introduction to electromyography (EMG). Hands-On Research School, Shanghai Jiao Tong University, Shanghai, China, 2012.

Steinmetz SM, Ding Y, Maladen RD, Goldman DI. Interaction with granular media influences activation strategy during subsurface sand-swimming. Georgia Tech Applied Physiology Seminar, Atlanta, GA, 2011.

Steinmetz SM, Ding Y, Li C, Mazouchova N, Maladen RD, Goldman DI. Locomotion on granular media: Biologically inspired physical models enhance understanding. GT^2 Symposium Innovation Workshop, Atlanta, GA, 2010.

Steinmetz SM, Maladen RD, Ding Y, Goldman DI. Muscle activation during surface and subsurface locomotion in sandfish (Scincus scincus). NeuroTalk Seminar at Georgia Tech, Atlanta, GA, 2010.

Project Experience

Automotive Evaluations

- Investigated, analyzed, and authored expert reports and testified in matters involving evaluation of occupant kinematics, occupant loading, and injury mechanics in a variety of crash scenarios. These evaluations involved review of injuries as diagnosed in medical records and radiology, characterizing the magnitude and direction of forces necessary to create such injuries, and placing those parameters in the context of human movement and interior vehicle contacts given known vehicle dynamics.
- Participated in a research program investigating lower speed frontal, rear, and side impacts using instrumented ATDs. Compared ATD responses across the speeds tested, collision direction, and other test data (including human participants). Compared load levels to established injury criteria and forces associated with injury.
- Analyzed human biomechanics during emergency maneuvers, including swerving and hard braking. Characterized the influence of belt use to maintain body orientation and position before an impact or rollover.

Restraint Systems

- Led test series evaluating the role of the frontal airbag in low-moderate and high-moderate severity accidents using crash and sled testing. This included the use of normally seated and forward positioned ATDs, loads generated on the body and face using advanced headforms, and comparison of those loads with established injury criteria and risk functions.
- Evaluated child restraint systems when used properly (e.g., belt positioned per instructions, child seated normally) versus improper or unintended use conditions.

Injury Mechanism & Potential

- Utilized geometric analyses and virtual evaluations to align injury patterns as demonstrated in photographs, medical records, and radiology with corresponding geometric features on industrial equipment including forklifts, augers, and handheld power tools.
- Evaluated allegations surrounding theme park injuries by instrumenting riders with inertial measurement units (IMUs) and conducting inverse dynamic calculations to determine loads on the body. Loads were compared for varying conditions and against established injury criteria.
- Evaluated allegations surrounding fall mechanism, including determining whether the precipitating factor occurred due to a slip, trip, or mis-step. These analyses involved collecting slip resistance measurements, evaluating injury patterns, and determining fall directionality.

Consumer Product Analysis and Design

- Provided contextualization of comfort ratings of wearable devices by performing 3D body scans and device interface pressure measurements across participants of varying gender, height, BMI, and ethnicity.
- Evaluated fatigue and injury risk associated with long duration use of wearable devices or during repetitive task performance using EMG, motion capture, muscular strength measurements, computational modeling, and survey responses.

Peer Reviews

Society of Automotive Engineers

Journal of Experimental Biology