Exponent®
Engineering & Scientific Consulting

Jessica Isaacs, Ph.D., P.E.

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Professional Profile

Dr. Isaacs is a biomechanical engineer who specializes in injury causation, occupant kinematics, and product performance across transportation, consumer products, and recreational activities.

At Exponent, she applies a multidisciplinary background in biomechanics, materials science, and mechanical engineering to evaluate injury mechanisms and risk in motor vehicle and transit bus collisions, construction and occupational incidents, and product-related and recreational scenarios, including snow sports. Her expertise spans low-energy injury analysis through full-scale crash and rollover events, and includes the biomechanical evaluation of product design and performance, with particular experience in occupant protection systems, head impact assessment, and helmet testing. She integrates experimental testing, advanced measurement techniques, and engineering analysis to assess human motion, loading, and injury potential across a wide range of real-world conditions.

Dr. Isaacs has extensive experience designing and executing experimental testing to evaluate human and surrogate response, including full-scale automotive crash testing, sled testing, dolly rollover testing, handling testing, and component- and system-level evaluations using anthropomorphic test devices (ATDs). She has conducted research and testing involving passenger vehicles, transit buses, rail vehicles, trucks, and pedestrians to assess occupant kinematics, restraint system performance, and injury potential. Her work includes specialized biomechanical evaluations such as head impact testing and helmet performance, and she is well-versed in Injury Assessment Reference Values (IARVs) and their application to real-world scenarios.

Her expertise includes advanced measurement and analysis techniques, including photogrammetry, which she has applied for more than a decade to obtain precise and reliable measurements from photographs and video across a wide range of testing and accident reconstruction scenarios. She has designed and conducted laboratory-based and field-based experiments, including human subject testing and testing with ATDs, for both fundamental research and case-specific investigations. Through this work, she has provided scientific consultation on injury mechanisms and tolerance, experimental design, data collection and analysis, regulatory compliance (including Federal Motor Vehicle Safety Standards), and product and prototype evaluation.

Dr. Isaacs has published and presented research on occupational and automotive injuries, spine biomechanics, and sports-related trauma. Her prior research focused on spine biomechanics, particularly the effects of degeneration and aging on the intervertebral disc, as well as the development of injectable hydrogels. As a Fulbright Fellow at Tel Aviv University, she investigated computational biomechanical models for the diagnosis and management of lumbar spine pathologies and studied fiber-reinforced bio-composite materials.

Before joining Exponent, Dr. Isaacs served as a visiting assistant professor in the mechanical engineering department at Widener University. There, she taught undergraduate engineering courses, advised

student chapters of the Society of Automotive Engineers and Engineers without Borders, and participated in numerous STEM outreach initiatives. She was featured on the CBS television program *Mission Unstoppable* (Season 7, Episode 14), demonstrating biomechanical principles of helmet design and injury mitigation using ATDs. In recognition of her contributions to biomechanics and the application of STEM in sports and safety, Dr. Isaacs was selected as a 2026 “Game Changer” as part of the IF/THEN Initiative’s IfThenSheCan – The Exhibit, a national public exhibit debuting during the 2026 FIFA World Cup Fan Festival in Dallas. The exhibit highlights leaders whose work demonstrates the critical role of science and engineering in advancing athletic performance, safety, and the broader sports industry.

She holds a B.S. in Mechanical Engineering from Widener University and M.S. and Ph.D. degrees in Mechanical Engineering and Mechanics from Drexel University, and is a registered Professional Engineer in Delaware.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering and Mechanics, Drexel University, 2012

M.S., Mechanical Engineering and Mechanics, Drexel University, 2009

B.S., Mechanical Engineering, Widener University, 2006

ASME Nominee New Faces of Engineering, 2015

Fulbright Scholar, Tel Aviv University, 2012-2013

United States Department of Education GAANN Fellow, 2007-2011

Widener University's Service and Leadership Award, 2006

Tau Beta Pi Honor Society

Licenses and Certifications

Professional Engineer Mechanical, Delaware, #21997

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

MTA NYC Transit Track Safety Certification

Academic Appointments

Visiting Assistant Professor, Mechanical Engineering Department, Widener University, 2013-2015

Post-doctoral Appointment, Mechanical Engineering Department, Tel Aviv University, 2012-2013

Professional Affiliations

American Society of Mechanical Engineers (member)

ASTM International, F-27 Snow and Water Sports (member)

Biomedical Engineering Society (member)

Publications

Isaacs JL, George J, Campolettano E, Cutcliffe H, Miller B. “The role of three-point restraints for occupants in moderate severity frontal collisions.” Society of Automotive Engineers (SAE) Technical Paper 2022-01-0845, 2022

Toney Bolger M, Isaacs JL, Rapp van Roden E, Croteau J, Dibb A. “Seat belt latch plate design and pretensioner deployment strategies have limited effect on in- and out-of-position occupants in high-severity rear-end collisions.” SAE Technical Paper 2022-01-0849, 2022

Croteau J, Toney Bolger M, Isaacs JL, Shurtz B, Zolock J. “Seatback strength and its effect on in-position and out-of-position atd loading in high-speed rear impact sled tests.” SAE Technical Paper 2022-01-0856, 2022

Isaacs JL, Campbell IC, Watson H, Toney Bolger ME. "Head and neck loading trends in IIHS side impact testing." Topic Key Note Presentation/Paper, Fédération Internationale des Sociétés d'Ingénieurs des Techniques de l'Automobile (FISITA) World Congress, Prague, Czech Republic (virtual), September 14-16, 2021. Outstanding Paper Award

Toney Bolger M, Sherman S, Isaacs JL, Garman C, Dibb A. “An evaluation of near- and far-side occupant responses to low- to moderate-speed side impacts.” SAE Technical Paper 2020-01-1218, 2020

Davis MS, Isaacs JL, Graber MA, Fisher JL. “Thoracic spine extension injuries in occupants with pre-existing conditions during rear end collisions.” SAE Technical Paper 2019-01-1222, 2019

Scanlon JM, Isaacs JL, Garman CMR. “Head and neck loading conditions over a decade of IIHS rear impact seat testing.” SAE Technical Paper 2019-01-1227, 2019

Sharabi M, Benayahu D, Benayahu Y, Isaacs JL, Haj-Ali R. “Laminated collagen-fiber bio-composites for soft-tissue bio-mimetics.” Composites Science and Technology, 2015; 117:268-276.

Isaacs JL, Vresilovic E, Sarkar S, Marcolongo M. “Role of biomolecules on annulus fibrosus mechanics: Effect of enzymatic digestion on micromechanics.” Journal of the Mechanical Behavior of Biomedical Materials, 2014; 40:75-84.

Cannella M, Isaacs JL, Allen S, Orana A, Vresilovic E, Marcolongo M. Nucleus Implantation: “The biomechanics of augmentation versus replacement with varying degrees of nucleotomy.” Journal of Biomechanical Engineering, 2014; 136(5).

Isaacs JL. “Micromechanics of the annulus fibrosus: Role of biomolecules in mechanical function.” Doctoral Dissertation, Drexel University, 2012.

Invited Talks

"The Automated Vehicle User Experience." Panel Discussion, FISITA World Congress, Barcelona, Spain, June 5, 2025.

"How my Career ended up in Failure." ASME FutureME Presentation, International Mechanical Engineering Congress & Exposition (IMECE), Pittsburgh, PA, November 11, 2018.

Media Appearances

“Noggins, Nucleotides, and Nuclear Fusion,” Mission Unstoppable with Miranda Cosgrove (Season 7, Episode 14), CBS, February 21, 2026.

Selected Presentations and Published Abstracts

Isaacs JL, Mortensen J, O'Brien K, Imler S. "Wearable devices can detect differences in alpine ski ability." Podium Presentation, International Society of Snowsports Safety (ISSS) / Société Internationale de Traumatologie et de Médecine des Sports d'Hiver (SITEMSH) Congress, Kranjska Gora, Slovenia, March 10-16, 2024.

Isaacs JL, Toney Bolger ME, Campbell IC. "Cervical spine loading during asymmetrical non-injurious physical activities." Podium Presentation, XXVII Congress of the International Society of Biomechanics (ISB) /43rd Annual Meeting of the American Society of Biomechanics (ASB), Calgary, Canada, July 31 - August 4, 2019.

Davis MS, Isaacs JL, Graber MA, Fisher JL. "Thoracic spine extension injuries in occupants with pre existing conditions during rear-end collisions." Podium Presentation, IMECE, Pittsburgh, PA, November 11-15, 2018.

Isaacs JL, Bellezza A, Brown, V. "Sports concept design: An entrepreneurial co- and extra-curricular activity." Podium Presentation, Spring 2015 Mid-Atlantic American Society for Engineering Education (ASEE) Conference, Villanova, PA, April 2015.

Isaacs JL, Binetti V, Lowman A, Marcolongo MS. "Testing methods for evaluation of injectable nucleus replacement." Podium Presentation, Philadelphia Spine Research Symposium (PSRS), Philadelphia, PA, October 2014.

Isaacs JL, Vresilovic E, Marcolongo MS. "Role of biomolecules on cross-ply mechanics of annulus fibrosus." Podium Presentation, Society for Biomaterials Meeting (SFB), Orlando FL, April 2011. STAR (Student Travel Award Recognition) Honorable Mention

Isaacs JL, Vresilovic E, Marcolongo MS. "Micromechanical characterization of Annulus Fibrosus Lamellar." Poster Presentation, SFB, Orlando, FL, April 2011.

Selected Poster Presentations

Isaacs JL, Campbell IC. "Cervical spine loading during vigorous activities: Consolidation of previously published and unpublished data." Poster Presentation, Biomedical Engineering Society (BMES) 2025 Annual Meeting, San Diego, CA, October 8-12, 2025.

Mattucci M, Jendrus J, Angelucci M, Neidert J, Mauger J, Isaacs JL. "Posterior vertebral fixation: Screw-to-screw cross-connection concept investigation." Poster Presentation, BMES 2015 Annual Meeting, Tampa, FL, October 7-10, 2015.

Isaacs JL, Binetti V, Lowman A, Marcolongo MS. "Test methodology of characterizing the behavior of injectable hydrogels: An in vitro model." Poster Presentation, SFB, Charlotte, NC, April 2015.

Isaacs JL, Vresilovic E, Marcolongo MS. "Role of macromolecules on micromechanics of the annulus fibrosus." Poster Presentation, Orthopedic Research Society Meeting (ORS), San Francisco, CA, February 2012.

Isaacs JL, Vresilovic E, Marcolongo MS. "What role does macromolecules play in annular mechanics?" Poster Presentation, Philadelphia Spine Research Society International Meeting, Philadelphia, PA, December 2011. Best Poster Award: Biomechanics and Imaging.

Isaacs JL, Vresilovic E, Marcolongo MS. "Role of biomolecules on circumferential mechanics of the annulus fibrosus." Poster and Podium Presentations, International Society for the Study of the Lumbar Spine Meeting (ISSLS), Gothenburg, Sweden, June 2011. Distinguished Poster Award.

Isaacs JL, Vresilovic E, Marcolongo MS. "Enzymatic digestion effects on mechanics of radial annulus

fibrosus samples." Poster Presentation, ORS, Long Beach, CA, January 2011.

Isaacs JL, Bonfiglio D, Gidvani S, Vresilovic E, Marcolongo MS. "Effect of enzymatic digestion on mechanics of in-plane annulus fibrosus lamellae." Poster Presentation, ORS, New Orleans, LA, March 2010.

Isaacs JL, Gidvani S, Sarkar S, Bonfiglio D, Vresilovic E, Doehring T, Marcolongo MS. "The role of macromolecular components in the micromechanics of the annulus fibrosus." Poster Presentation, SFB), San Antonio, TX, April 2009.

Isaacs JL, Gidvani S, Sarkar S, Bonfiglio D, Vresilovic E, Doehring T, Marcolongo MS. "Toward a model of intervertebral disc herniation using normal and degenerative failure criteria based on annulus fibrosus laminar micromechanics." Poster Presentation, PSRS, Philadelphia, PA, November 2008.