Exponent®
Engineering & Scientific Consulting

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Professional Profile

Dr. Courtney provides technical expertise in the area of injury biomechanics, including orthopaedic, spine, and traumatic brain injury, blast injury, and ballistics. She addresses issues related to traumatic events, motor vehicle safety, and product safety. She has been active in research on the material and structural properties of musculoskeletal tissues in normal, aging, and disease conditions for 35 years. Her ballistics expertise includes the safe operation of small arms and the internal physics, trajectories, and terminal behavior of ammunition. In addition to her engineering training and expertise, her doctoral studies in the Harvard/MIT Division of Health Sciences and Technology included medical coursework and clinical training at Harvard Medical School. Her research is documented in more than 70 publications in the medical and scientific literature.

Prior to joining Exponent, Dr. Courtney was a researcher in the Department of Biomedical Engineering at The Cleveland Clinic Foundation and the Orthopedic Biomechanics Laboratory of Beth Israel Hospital and Harvard Medical School. She also held an appointment as Assistant Professor teaching physics at the United States Military Academy at West Point.

Dr. Courtney has designed and conducted laboratory-based and field-based experiments, human subject testing, and testing with Anthropomorphic Test Devices (ATDs, or crash test dummies) for basic scientific purposes as well as to investigate specific situations. She has provided scientific consultation in the areas of injury mechanisms and injury tolerance, experimental design, techniques for data collection and analysis, and prototype evaluation. Her work includes novel experiments and mathematical modeling of internal, external, and terminal ballistics of small arms. She collaborated in the invention and characterization of novel experimental tools and techniques for laboratory-based blast experiments. She also teaches seminars on injury biomechanics, blast injury and ballistics for corporate, legal, and military groups.

Academic Credentials & Professional Honors

Ph.D., Engineering Sciences, Harvard University, 1994

M.S., Engineering Sciences, Harvard University, 1991

B.S., Engineering Mechanics, Michigan State University, 1989

Department of the Army, Commander's Award for Public Service

International Society of Biomechanics Promising Scientist Award

National Science Foundation Graduate Fellow

MSU Alumni Distinguished Scholar

Licenses and Certifications

Certified Abbreviated Injury Scale Specialist

Certified Pistol Instructor

High Master Classification, High Power Rifle Competition

Professional Affiliations

International Ballistics Society, Senior Member

American Society for Bone and Mineral Research

Association for the Advancement of Automotive Medicine (AAAM)

Publications

Biomechanics and Injury Mechanisms

Parenteau C, Courtney A, Campbell I, and Lau E. An Update on front-seat occupant injury rates in frontal crashes: focus on modern vehicles. IRCOBI, September 8-10, 2021. Paper No. IRC-21-50.

Kirschman J, Pokutta-Paskaleva A, Courtney A, Courtney M. Blast pressures and waveforms of consumer firecrackers. Shock Waves 2021, 31:301-306 doi 10.1007/s00193-021-01013-x.

Parenteau C, Lau E, Campbell I, Courtney A. "Prevalence of spine degeneration diagnosis by type, age, gender, and obesity using Medicare data" Nature: Scientific Reports 2021 DOI 10.1038/s41598-021-84724-6.

Pasquesi SA, Bruno A, Courtney A, Imler SM et al. Risk of concussion in low- to moderate-speed frontal and rear end motor vehicle collisions evaluated using head acceleration-based metrics. SAE Technical Paper 2019-01-1218, 2019, doi:10.4271/2019-01-1218.

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Courtney A, Courtney M. The complexity of biomechanics causing primary blast-induced traumatic brain injury: a review of potential mechanisms. Frontiers in Neurology 6:221 DOI 10.3389/fneur.2015.00221, 2015.

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Courtney M, Courtney A. Working toward exposure thresholds for blast-induced traumatic brain injury: Thoracic and acceleration mechanisms. NeuroImage 2011; 54:S55-S61.

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Courtney A, Courtney M. Links between traumatic brain injury and ballistic pressure waves originating in the thoracic cavity and extremities. Brain Injury 2007; 21:657-662.

Courtney M, Courtney A. Apparent measurement errors in "Development of biomechanical response corridors in the thorax to blunt ballistic impacts." Journal of Biomechanics 2007; 41:486-487.

Perusek G, Davis B, Courtney A, D'Andrea S. An extensometer for global measurement of bone strain suitable for use in vivo in humans. Journal of Biomechanics 2001; 34:385-391.

Courtney A, Davis B, Manning T, Kambic H. Effects of age, density and geometry on the bending strength of human metatarsals. Foot & Ankle International 1997; 18(4):216-221.

Hayes W, Myers E, Robinovtich S, Van Den Kroonenberg A, Courtney A, McMahon T. Etiology and prevention of age-related hip fractures. Bone 1996; 18(1) Supplement.

Courtney A, Hayes W, Gibson L. Age related differences in post-yield damage in human cortical bone — Experiment and model. Journal of Biomechanics 1996; 29(11):1463-1471.

Courtney A, Wachtel E, Myers E, Hayes W. Age-related reductions in the strength of the femur tested in a fall-loading configuration. Journal of Bone and Joint Surgery 1995; 77-A(3):387-396.

Bouxsein M, Courtney A, Hayes W. Ultrasound and densitometry of the calcaneus correlate with the failure loads of cadaveric femurs. Calcified Tissue International 1995; 56(2):99-103.

Courtney A, Wachtel E, Myers E, Hayes W. Effects of loading rate on strength of the proximal femur. Calcified Tissue International 1994; 55:53-58.

Courtney A, Myers E, Wachtel E, Hayes W. Multiple angle and anteroposterior dual energy x-ray absorptiometry predict femoral strength in vitro. J Bone Miner Res 8(Supp 1):S350, 1993.

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Ballistics and Blast

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International Symposium on Ballistics, September 2017.

Courtney ER, Courtney A, Courtney M. External ballistics and accuracy of lead free bullets in 5.56 x 45 mm NATO. Accepted to Proceedings of the 30th International Symposium on Ballistics, September 2017.

Courtney ER, Courtney A, Couvillion R, Courtney M. Effects of sound suppressors on muzzle velocity, bullet yaw, and drag. Accepted to Proceedings of the 30th International Symposium on Ballistics, September 2017.

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Courtney E, Courtney AC, Andrusiv LP, Courtney MW. Experimental test of the acoustic impedance model for underwater blast wave transmission through plate materials. J Engineering Mechanics 143(4):06017001, 2017.

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Courtney AC, Andrusiv LP, Courtney MW. A test of the acoustic impedance model of blast wave transmission. Journal of Battlefield Technology 2013; 16(3):1-4.

Gaylord S, Blair R, Courtney M, Courtney A. Bullet retarding forces in ballistic gelatin by analysis of high speed video. Cornell University Library, Medical Physics, 2013.

Sherrill M, Powers R, Courtney A, Courtney M. Relative armor penetration of jacketed lead, solid copper, solid brass and steel core bullets. Defense Technology Information Center 2012; ADA567525.

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Courtney ER, Courtney A, Courtney W. Detecting pitch and yaw and in-flight damping with optical chronographs. Defense Technology Information Center 2012; ADA570911.

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Courtney M, Courtney A. Using sound of target impact for acoustic reconstructions of shooting events. Medicine, Science, and the Law 2012; 52(2):89-92.

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Quantitative Fisheries Science

Courtney J, Courtney A, Courtney M. Nutrient loading increases red snapper population in the western Gulf of Mexico. Hypotheses in the Life Sciences 2013; 1:7-14.

Courtney J, Courtney A, Courtney M. Do rainbow trout and their hybrids outcompete cutthroat trout in a lentic ecosystem? Fisheries and Aquaculture Journal 2013; FAJ-78.

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STEM (Science, Technology, Engineering and Mathematics) Education

Courtney A, Courtney M. Illuminating Fourier series with audacity. Cornell University Library, Physics Education, 2012.

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Peer Reviewer

Journal of Biomechanics

Journal of Neurotrauma

Advances in Life Sciences and Medicine

NeuroImage

Journal of Neuroscience Research

Defence Technology

International Journal of Energetic Materials and Chemical Propulsion

Shock Waves

Journal of Visual Experiments (JoVE)