

Exponent®
Engineering & Scientific Consulting

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Professional Profile

Dr. Fuller's expertise is in tissue mechanics and injury biomechanics. His work combines experimental and computational techniques to understand how tissue morphology and biological structures, and the resulting mechanical properties, influence loading characteristics, energy management, and injury potential. Dr. Fuller utilizes his skills and expertise to evaluate injury mechanics and potential in various incidents including motor vehicle collisions, accidental injury reconstruction, and fall events.

Dr. Fuller has extensive experience using mechanical testing systems (MTS), dynamic mechanical analysis (DMA), light microscopy, and scanning electron microscopy (SEM) to characterize biological tissues and structures. These skills are supplemented by hands-on experience in the design and fabrication of custom test fixtures for simulating relevant loading conditions. He has also developed computational models to understand how the architectural parameters of biological tissue influence local stress-strain distributions, energy absorption, and failure potential. By using experimentation and computational modeling, Dr. Fuller takes a broad approach to understanding the underlying conditions of tissue failures and resulting injuries.

Prior to joining Exponent, Dr. Fuller was a Graduate Research Assistant in the Donahue Research Lab at UMass Amherst. His research focused on how the materials and structures of bighorn sheep horns contribute to energy absorption and brain injury mitigation during head-butting. This included experimental characterization of the horn and horncore material properties and computational modeling of the trabecular-like lattice architecture within the horncore. This work led to additional studies aimed at developing bioinspired lattice architectures to provide lightweight solutions for high-performance energy absorption applications, such as improved helmet foams for concussion prevention in humans.

Academic Credentials & Professional Honors

Ph.D., Biomedical Engineering, University of Massachusetts, Amherst, 2023

B.S., Mechanical Engineering, California Polytechnic State University, SLO, 2017

Publications

Fuller LH, Karimy KF, Ruschke, PL, Taghon, MM, Crosby AJ, Donahue SW. Structure-property relationships of velar bone tissue from the energy absorbing horncore of bighorn sheep rams. Acta Biomaterialia 2023

Wheatley BB, Gilmore EC, Fuller LH, Drake AM, Donahue SW. How the geometry and mechanics of bighorn sheep horns mitigate the effects of impact and reduce the head injury criterion. Bioinspiration & Biomimetics 2023

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Ingrole, A, Aguirre TG, Fuller L, Donahue SW. Bioinspired energy absorbing material designs using additive manufacturing. Journal of the Mechanical Behavior of Biomedical Materials 2021

Fuller LH, Donahue SW. Material properties of bighorn sheep (Ovis canadensis) horncore bone with implications for energy absorption during impacts. Journal of the Mechanical Behavior of Biomedical Materials 2021

Aguirre TG, Fuller L, Ingrole A, Seek TW, Wheatley BB, Steineman, BD, Donahue TLH, Donahue SW. Bioinspired material architectures from bighorn sheep horncore velar bone for impact loading applications. Scientific Reports 2020

Aguirre TG, Ingrole A, Fuller L, Seek TW, Fiorillo AR, Sertich JJW, Donahue SW. Differing trabecular bone architecture in dinosaurs and mammals contribute to stiffness and limits on bone strain. PLoS ONE 2020

Presentations

Fuller LH, Karimy KF, Ruschke PL, Taghon MM, Crosby AJ, Donahue SW. Structure-property relationships of the energy absorbing horncore velar bone of bighorn sheep rams. Oral presentation, Society of Integrative and Comparative Biology, Austin, TX, 2023.

Fuller LH, Marcet E, Agarkov L, Singh P, Donahue SW. Morphology and material properties of the bighorn sheep horn-horncore interface. Poster presentation, Society of Integrative and Comparative Biology, Austin, TX, 2023.

Fuller LH. Material properties of bighorn sheep horncore bone with implications for Impact Energy Absorption. Oral presentation, Biomedical Engineering Graduate Student Seminar Series, Amherst, MA, 2022.

Fuller LH, Donahue SW. Material properties of bighorn sheep horncore bone for energy absorption. Poster presentation, American Society of Biomechanics 44th Annual Conference, Virtual, 2020.

Fuller LH, Donahue SW. Bio-inspired solutions for brain injury prevention. Oral Presentation, Center for Evolutionary Materials Research Symposium, Amherst, MA, 2019.