

Nathan Dau, PhD

Curriculum Vitae

Biocore 1627 Quail Run Charlottesville, VA 22911 ndau@biocorellc.com

EDUCATION

Wayne State University, Detroit, MI

Doctor of Philosophy: Biomedical Engineering

2012

Dissertation: *Development of a Biomechanical Surrogate for the Evaluation of Commotio Cordis Protection*

Concentration: Impact Biomechanics

Wayne State University, Detroit, MI

Master of Science: Biomedical Engineering

2008

Concentration: Impact Biomechanics

Kettering University, Flint, MI

Bachelor of Science: Applied Physics

2001

Concentration: Acoustics

PROFESSIONAL EXPERIENCE

Biocore, Charlottesville, VA

Principal Engineering Consultant

2017 – Present

- Coordinate the development on an advanced On-Field impact measurement system that exceeds the performance of existing commercial and research designs
- Recruit elite and professional athletes for participation in human subject studies
- Train sports team personnel how to manage the daily collection of On-Field impact measurements with a team system
- Deploy instrumented mouthpieces in NFL and NCAA DI football teams
- Manage tech support and inventory management for the On-Field impact measurement system
- Data validation, processing, and application to achieve research goals

Under Armour, Digital Hardware Innovation, Baltimore, MD

Senior Research Scientist

2014 – 2017

- Collected Initial Quickness data during the 2015 NFL Combine On-Field and correlated the novel performance metric to In-Game performance
- Lead technical expert for iterative development testing and validation of the Gemini II Record Equipped (G2RE) smart shoe including hardware, firmware, integration into the shoe, and development software/applications.
- Recruited runners of various performance levels and collected data from controlled and uncontrolled tests to quantify the accuracy and precision of the G2RE speed/distance algorithm & the detection of false positives/negatives for the auto-start/stop algorithm.
- Contributed to the development and validation of key G2RE features including auto-start, which allows users to collect data while leaving their phone at home.
- Collected in-shoe pressure data (Tekscan F-scan) of runners while wearing the G2RE shoes to ensure the electronics did not induce pressure points.
- Procured a \$3.4M grant for Under Armour to develop an intelligent base-layer and software for the Air Force Research Lab 711th Human Performance Wing.

- Created a budget and equipment list to augment the existing laboratory to enable the testing and validation of future products of interest.
- Performed quantitative evaluations of 3rd party products and prototypes and presented results to senior management to identify potential partners and acquisition candidates.
- Evaluated the validity of data and technical claims for Head Health Challenge submissions related to helmets, injury mitigation, and On-Field injury detection.

Legacy Research Institute, Portland, OR

Research Associate

2012 – 2013

- Managed three student researchers
- Validated drop test impactor design and instrumentation
- Upgraded Labview data collection to stream-line test process
- Managed cadaver specimen storage, organization, and records
- Developed standard operating procedures for drop test impactor
- Conducted impact tests and data collection for bicycle helmet research
- Updated drop test instrumentation with 3-2-2-2 accelerometer array, National Instruments data acquisition, and Labview data collection and processing
- Wrote manuscripts for bicycle helmet research
- Wrote grant proposals for commotio cordis research
- Assisted in grant writing and report preparation for bicycle helmet research
- Prepared posters and presentations for conferences

Wayne State University, Detroit, MI

Research Assistant/Lab Manager

2005 – 2012

- Managed lab personnel including four graduate research assistants and seven student assistants
- Maintained lab equipment including sensors, data acquisition systems, high-speed cameras, and various impacting devices
- Managed cadaver specimen procurement, storage, and records
- Developed standard operating procedures and training protocols for cadaver specimen testing
- Conducted impact tests and data collection for sports, ballistics, and blast research
- Designed frangible surrogates to evaluate groin protection in live-fire secondary blast testing
- Developed a test protocol to pressurize the thoracic arterial system of cadavers to measure left ventricular pressure during thoracic sports impacts
- Analyzed and processed data using Diadem (National Instruments)
- Collected data using TDAS hardware and software, high speed video, and Motion Capture software
- Harvested, prepared, and instrumented cadavers
- Designed fixtures for orthopaedic testing
- Hand loaded rounds for ballistics tests
- Instrumented and prepared Hybrid III dummy for tests
- Wrote computer programs in Diadem and Matlab
- Assisted in grant writing and report preparation
- Prepared applications for approval by Institutional Review Boards
- Prepared posters and presentations for international and national conferences

AUTOLIV ELECTRONICS OF AMERICA, SOUTHFIELD, MI
Algorithm Engineer

2001 – 2005

- Collected crash sensor data at test track
- Analyzed and validated vehicle crash barrier data
- Calibrated airbag algorithm for vehicle specific performance
- Presented airbag algorithm performance to various OEMs
- Developed and validated data processing tools using Matlab
- Analyzed field event data from vehicle crashes
- Created reports for field event litigation

TEACHING EXPERIENCE

Wayne State University, Detroit, MI

Instructor, Biomedical Instrumentation

2008

- Selected new course book
- Developed curriculum and labs
- Created online curriculum
- Graded lab reports and exams

Kettering University, Flint, MI

Lab Instructor, Physics

2000

- Oversight of physics lab participation
- Graded lab reports

Wayne State University, Detroit, MI

Lab Manager, Biomedical Research

2005-2012

- Trained new employees on data acquisition systems, data processing, and proper lab techniques
- Evaluated student assistant and graduate research assistant proficiency with lab equipment
- Instructed students on writing manuscripts

PUBLICATIONS AND CONFERENCE PRESENTATIONS

Dissertation

Dau, N: Development of a Biomechanical Surrogate for the Evaluation of Commotio Cordis Protection. Wayne State University, January 2012.

<http://digitalcommons.wayne.edu>

Refereed Journal Articles

- Gabler, LF, Huddleston, SH, **Dau, N**, Lessley, DJ, Arbogast, KB, Thompson, X, Resch, JE, Crandall, JR. (2020) *On-Field Performance of an Instrumented Mouthguard for Detecting Head Impacts in American Football*. Ann Biomed Eng, 48(11): 2599-2612.
- Madias, C, Maron, MJ, **Dau, N**, Estes, NAM, Bir, C. (2018) *Size as an Important Determinant of Chest Blow-induced Commotio Cordis*. Med Sci Sports Exerc, 50(9): 1767-1771.
- Carron, MA, Zuliani, G, Pereira, L, Abuhamdan, M, Thibault, A, **Dau, N**, Bir, CA. (2014) *Stability of Midface Fracture Repair Using Absorbable Plate and Screw System Pilot*

- Holes Drilled and Pin Placement at Angles other than 90°.* JAMA Facial Plastic Surg, 16(1): 42-8.
- Hansen, K, **Dau, N**, Feist, F, Deck, C, Willinger, R, Madey, SM, Bottlang, M. (2013) *Angular Impact Mitigation System for Bicycle Helmets to Reduce Head Acceleration and Risk of Traumatic Brain Injury.* Accid Anal & Prev, 59:109-17.
 - Jadischke, R, Viano, DC, **Dau, N**, King, AI, McCarthy, J. (2013) *On the Accuracy of the Head Impact Telemetry (HIT) System used in Football Helmets.* J of Biomechanics, 46(13): 2310-5.
 - Chacon, Y, Fallat, LM, **Dau, N**, Bir, CA. (2012) *Biomechanical Comparison of Internal Fixation Techniques for the Akin Osteotomy of the Proximal Phalanx.* J Foot Ankle Surg, 51(5): 561-5.
 - **Dau, N**, Cavanaugh, J, S, Bir, C, Link, M. (2011) *Evaluation of Injury Criteria for the Prediction of Commotio Cordis from Lacrosse Ball Impacts.* Stapp Car Crash Journal, 55: 251-79.
 - Dougherty, PJ, Sherman, D, **Dau, N**, Bir, C. (2011) *Ballistic Fractures: Indirect Fracture to Bone.* J Trauma 71(5): 1381-4.
 - Pollard, JD, Deyhim, AD, Rigby, R, **Dau, N**, King, C, Fallat, LM, Bir,CA. (2010) *Comparison of pullout strength between 3.5 mm fully threaded, bicortical screws and 4.0 mm partially threaded, cancellous screws in the fixation of medial malleolar fractures.* J Foot Ankle Surg, 49(3): 437-9.
 - Link, M, Bir, C, **Dau, N**, Madias, C, Estes, M, Maron, B. (2008) *Protecting Our Children from the Consequences of Chest Blows on the Playing Field: A time for science of marketing.* Pediatrics, 122(2): 437-9.

Conference Proceedings

- **Dau, N**, Hansen, K, Madey, S, Bottlang, M. (2012) *Bicycle Helmet Impact Test Method Designed to Induce Rotational Acceleration.* Northwest Biomechanics Symposium, Eugene, OR.
- **Dau, N**, Hansen, K, Madey, S, Bottlang, M. (2012) *A Novel Bicycle Helmet Design for Mitigating Rotational Acceleration Induced MTBI.* Northwest Biomechanics Symposium, Eugene, OR.
- Pollard, JD, Deyhim, AD, Rigby, R, **Dau, N**, King, C, Fallat, LM, Bir,CA. (2010) *Comparison of pullout strength between 3.5 mm fully threaded, bicortical screws and 4.0 mm partially threaded, cancellous screws in the fixation of medial malleolar fractures.* American College of Foot and Ankle Surgeons Annual Scientific Conference, Las Vegas, NV.
- Mack, J, Stojasih, S, Sherman, D, **Dau, N**, Bir, CA. (2010) *Amateur Boxer Biomechanics and Punch Force.* International Society of Biomechanics in Sports Annual Meeting, Marquette, MI.
- **Dau, N**, Bilbrey, C, Wildt, D, Deyhim, AD, Rigby, R, Bir, CA. (2010) *Normalization of Failure Load Data Utilizing Cortical Bone Cross Sectional Area.* Orthopaedic Research Society Annual Meeting, New Orleans, LA.
- McKay, B, **Dau, N**, Staley, S, Dougherty, P, Bir, CA. (2010) *Lower Leg Trauma Related to Anti-vehicular Landmines.* Orthopaedic Research Society Annual Meeting, New Orleans, LA.

- **Dau, N.**, Sherman, D, Bolander, R, Bir, C, Engels, H. (2009) *Acute Effects of Dental Appliances on Upper and Lower Body Isokinetic Muscle Function*, International Society of Biomechanics in Sports Conference, Limerick, Ireland.
- **Dau, N.**, Link, M, Madias, C, Bir, C. (2008) *Correlation of Impact Force and Left Ventricular Pressure for Chest Impacts in an Animal Model for Evaluation of Commotio Cordis Protection*, American Society of Mechanical Engineers Summer Bioengineering Conference, Marco Island, FL.
- **Dau, N.**, Link, M. S., Madias, C., Bir, C. (2007) *Evaluation of Injury Criteria for Predicting Commotio Cordis*. American Society of Biomechanics Conference, Palo Alto, FL.
- **Dau, N.**, Chein, H., Sherman, D., Bir, C. (2006) *Effectiveness of Boxing Headgear for Limiting Injury*. American Society of Biomechanics Conference, Blacksburg, VA.

AWARDS

- Runner's World 15 Cool New Products from CES: Gemini 3RE Shoes **2017**
- Men's Health Best New Tech: Velocity RE Shoes **2017**
- Runner's World 10 Gadgets Runners Will Want **2016**
- Mashable Best of the Consumer Electronics Show **2016**
- Northwest Biomechanics Symposium Best Poster Award **2012**
- ACFAS Excellence in Manuscript Submission 2nd place **2010**
- Engineering Society of Detroit Alpha Award **2009**
- American Society of Biomechanics President's Award **2007**
- Autoliv Electronics of America Gold Star Award **2004**

INVITED LECTURES

NIST CHiMaD Impact Mitigating Materials Workshop, Chicago, IL
Presenter: Evaluating Commotio Cordis Protection in Sports **2016**

Global Brain Health and Performance Summit, Columbus, OH
Presenter: An Intelligent Base-Layer for Real-Time Sensing and Assessment **2016**

US Lacrosse Science in Sport Committee Meeting, Baltimore, MD
Presenter: Effectiveness of Current Lacrosse Chest Protectors in Mitigating Commotio Cordis, and the Progress towards an Equipment Standard **2012**

Rand Corporation, Washington, DC
Presenter: Wayne State University Biomedical Engineering Capabilities for Under Body Blast Mitigation Research **2010**

Lawrence Technological University, Southfield, MI
Guest Lecturer: Seminars in Biomedical Engineering **2008 – 2012**

Wayne State University, Detroit, MI
Guest Lecturer: Biomedical Engineering Seminar **2006 – 2012**