Amy C. Courtney, PhD

curriculum vitae

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Education

Harvard University and the Massachusetts Institute of Technology **1989-1994**
1994 Ph.D. in Medical Engineering & Medical Physics

Harvard University **1989-1992**
1992 M.S. Medical Engineering

Michigan State University **1985-1989**
1989 B.S. Engineering Mechanics with honors, minor in biomedical engineering

Physics Instructor Training, United States Military Academy, West Point **2007**
Full-time, 10-week course including model lectures, practice lectures, lab equipment and execution, classroom technology, teaching style, honor code, academic and military organization.

Research Experience

BTG Research **2001 - present**
Research Scientist. Developed laboratory-scale shock tubes. Measuring blast transmission through bone and candidate armor materials. Quantifying physical mechanisms of blast-related traumatic brain injury. Testing ballistic performance of armor materials. Developing time and frequency domain methods for extracting ballistic and forensic information from audio recordings of ballistic events. Developed phenomenologically-based mathematical models in terminal ballistics showing a ballistic pressure wave contributes independently to mild traumatic brain injury, wounding and incapacitation. Conducting experiments in internal, external and terminal ballistics.

Force Protection Industries, Inc. **2009 – present**
Research Scientist. Developed and taught courses for engineers and blast range personnel on blast physics, blast-induced traumatic brain injury, vehicle vulnerability and blast injuries to lower extremities. Helped expand test and measurement program to incorporate instrumented test dummies; advised on other improvements to test and measurement program; helped keep personnel up to date on relevant published research; evaluated recent scientific collaborative efforts; identified potential new research partners; designed new collaborative study.

Department of Engineering, Western Carolina University **2007**
Research Scientist. Developed program of study and two courses for new Biomechanical Engineering major. Wrote NSF grant with colleagues on developing sensor and control algorithms for an intelligent orthotic device for counteracting pathologic hand tremor. Worked with industrial partners to develop undergraduate engineering projects.

The Cleveland Clinic Foundation, Cleveland, OH **1995-1998**
Post-doctoral fellow, then Project Scientist. Quantified effects of aging and disease processes on bone. Designed experiments to identify strain thresholds for bone mass maintenance by measuring *in vivo* deformation of human calcaneal bone under various exercise and gravitational conditions. Published papers and successfully applied for grants from NASA, American Diabetes Association, and The Whitaker Foundation. Prepared written and oral presentations.

Reebok International, Canton MA **1994**
Designed experiments and statistical analysis paradigms for measuring human performance and properties of athletic equipment. Designed experiments, statistical testing and reporting protocols to quantify material and biomedical performance in prototype athletic footwear and components.

Beth Israel Hospital, Boston, MA **1989-1994**
Designed and performed experiments to quantify the effects of age and bone density on the strength of the human hip. Included mathematical modeling of damage accumulation in bone, bone imaging techniques, and mechanical testing. Part of a larger project that led to the development of a clinical risk index used to quantify an individual's risk of hip fracture due to a fall.

Department of Biomechanics, Michigan State University **1985-1989**
Conducted veterinary clinical experiments investigating the efficacy of knee ligament reconstruction techniques in dogs. Conducted experiments with allografts measuring the mechanical properties of patellar tendons and bone plugs for transplant. Conducted experiments with human subjects measuring human performance and properties of athletic footwear.

Brookhaven National Laboratory **1989**
Conducted experiments to quantify the efficacy of medications to preserve or enhance bone density.

University of Cincinnati **1987**
Conducted experiments on cadaveric specimens *in vitro* and *in situ* quantifying the roles of individual structures in knee stability and the mechanical properties of ligaments and tendons.

Teaching Experience

Hillsdale Academy, Hillsdale, MI **2008-2009**
Science Faculty – teaching science and math courses.

United States Military Academy, West Point **2007 - 2008**
Assistant Professor, Department of Physics and Nuclear Engineering – teaching a full load of four calculus-based introductory physics classes and associated laboratories in core program.

Southwestern Community College, Sylva, NC **2006**
Adjunct Professor – taught anatomy and physiology lecture/lab in undergraduate, transferable course.

The Cleveland Clinic Foundation/Ohio State University **1997-1998**
Adjunct Professor of Biomedical Engineering – supervised undergraduate and masters' degree students in research projects quantifying age- and disease-related changes in bone.

Harvard University **1993**
Teaching Assistant – Calculus I and II

Memberships, Awards and Recognition

USAF FitFamily Perseverance Award (1,000,000 points)
Member, American Association of Physics Teachers (AAPT)
Founding Member, International Ballistics Society (IBS)
2008 Department of the Army, Commander's Award for Public Service
1997 International Society for Biomechanics Most Promising Young Scientist Award
1989 National Science Foundation graduate fellowship
1985 MSU Alumni Distinguished Scholar (full scholarship)

Recent Community Service

Judge, Pike's Peak Regional Science Fair 2011
Physics video-based extra instruction, 2010-2011 (view examples here)
Brain Bowl assistant coach, Monument Academy, 2009 – present
Instructor, Professional Military Ethics Education, United States Military Academy, 2008

Selected Recent Presentations

Attenuation of a blast wave through cranial bone. A. Courtney, M. Courtney 26th Meeting of the International Ballistics Society, Miami, Florida, September 2011 Link to presentation: http://www.dtic.mil/ndia/2011ballistics/11991.pdf

Blast-Induced Injuries: recent advances in understanding, research, mitigation and prevention. Educational Seminar for the Departments of Engineering and of Research & Development, Force Protection Industries, Inc., June 29-30, 2011

Development and characterization of laboratory scale shock tubes for studies of blast wave effects. A. Courtney, M. Courtney Second Traumatic Brain Injury Research Symposium, University of Maryland, May 19, 2011 Link to presentation: http://www.cecd.umd.edu/documents/presentations/symposium-tbi-second/courtney.pdf

Application of a table-top shock tube design to laboratory experiments on treatments for blast-induced traumatic brain injury. A. Courtney and M. Courtney, Department of Neurology, Darby Children's Research Institute, Medical University of South Carolina, September 4, 2010

Blast Physics and Traumatic Brain Injury, A. Courtney, mini-course for the Department of Business Development and Sales, Force Protection Industries, Inc., February, 2010

Blast Physics and Traumatic Brain Injury: 1) Blast-related injuries, 2) Physics of Blast Waves, 3) Understanding and reducing blast-wave damage, 4) Using test data to improve products. A. Courtney Educational Seminar for the Departments of Engineering and of Research & Development, Force Protection Industries, Inc., February, 2010

Working toward Thresholds for Blast-Induced Traumatic Brain Injury, M. Courtney and A. Courtney, International State-of-the-Science Meeting on Non-Impact, Blast-Induced Mild Traumatic Brain Injury, Herndon, VA, May 2009

Everything I Needed to Know I Learned in Physics 201 and 202. A. Courtney and M. Courtney, Colloquium, Department of Physics and Nuclear Engineering, United States Military Academy, West Point, NY. November, 2007

Selected Publications

Physics of Ballistics and Blast - Scholarly

Using Sound of Target Impact for Acoustic Reconstructions of Shooting Events. M. Courtney, A. Courtney, in press, Medicine, Science and the Law, (2012)

Comparing blast pressure variations of lead styphnate based and diazodinitrophenol based primers. M. Courtney, A. Courtney. Weapons Systems Technology Information Analysis Center (WSTIAC) Journal 11(2):3-5, (2011)

Attenuation of a blast wave through cranial bone. A. Courtney, M. Courtney Proceedings of the 26th Meeting of the International Ballistics Society, Miami, Florida, pp. 2096-2107, September 2011 http://files.intellisite.com/9/9/5/2/9.pdf

Oxy-acetylene driven laboratory scale shock tubes for studying blast wave effects. M. Courtney A. Courtney, Cornell University Library, http://arxiv.org/ftp/arxiv/papers/1105/1105.4670.pdf (2011)

Cerebrovascular Injury caused by a high strain rate insult in the thorax. A. Courtney, M. Courtney, Cornell University Library, http://arxiv.org/ftp/arxiv/papers/1105/1105.4738.pdf (2011)

History and evidence regarding hydrostatic shock. M Courtney, A Courtney, Neurosurgery 68(2):E596-E597, (2011)

Working toward exposure thresholds for blast-induced traumatic brain injury: thoracic and acceleration mechanisms. M Courtney, A Courtney. NeuroImage 54 (S1):S55-S61, (2011)

A table-top blast driven shock tube, M Courtney, A Courtney, Review of Scientific Instruments. 81(12):126103, (2010)

A thoracic mechanism of mild traumatic brain injury due to blast pressure waves, A Courtney, M Courtney, Medical Hypotheses, 72(1):76-83 (2009)

Comments on "Ballistics: A Primer for the Surgeon", M Courtney, A Courtney, Injury, 39(8):964-9655, (2008)

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

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

The ballistic pressure wave theory of handgun bullet incapacitation, M Courtney, A Courtney, Cornell University Library, Medical Physics, arXiv:0803.3053v1 (2008).

A method for testing bullets at reduced velocity. M Courtney, A Courtney, Cornell University Library, Medical Physics http://arxiv.org/ftp/arxiv/papers/0812/0812.4934.pdf (2008)

Scientific evidence for hydrostatic shock, M Courtney, A Courtney, Cornell University Library, Medical Physics, arXiv:0803.3051v1 (2008).

A method for testing handgun bullets in deer, M Courtney, A Courtney, Cornell University Library, Medical Physics, arXiv:physics/0702107v2 (2007).

Review of criticisms of ballistic pressure wave experiments, the Strasbourg goat tests, and the Marshall and Sanow data, M Courtney, A Courtney, Cornell University Library, Medical Physics, arXiv:physics/0701268v2 (2007).

Ballistic pressure wave contributions to rapid incapacitation in the Strasbourg goat tests, M Courtney, A Courtney, Cornell University Library, Medical Physics, arXiv:physics/0701267v2 (2007).

Relative incapacitation contributions of pressure wave and wound channel in the Marshall and Sanow data set, M Courtney, A Courtney, Cornell University Library, Medical Physics, arXiv:physics/0701266v2 (2007).

Physics of Ballistics and Blast - Popular

High-speed measurement of rifle primer blast waves. M Courtney, A Courtney, Precision Shooting, February (2011)

Measuring Ballistic Coefficients with A PC Soundcard and Chronograph, M Courtney, A Courtney, Varmint Hunter Magazine, July (2009)

Inaccurate Specifications of Ballistic Coefficients, M Courtney, A Courtney, Varmint Hunter Magazine, January (2009)

Physics Education

Measuring thrust and predicting trajectory in model rocketry, M Courtney, A Courtney, Cornell University Library, Popular Physics, arXiv:0903.1555v1 (2009).

Comments regarding "On the Nature of Science" M Courtney, A Courtney, Physics in Canada, 64:3 (2008)

Epistemological distinctions between science and history, M Courtney, A Courtney, Cornell University Library, History of Physics, arXiv:0803.4245v1 (2008).

Sheep Collisions: The Good, The Bad, and the TBI, M Courtney, A Courtney, (2007) http://arxiv.org/PS_cache/arxiv/pdf/0711/0711.3804v1.pdf

Acoustic Measurement of Potato Cannon Velocity, M Courtney, A Courtney, The Physics Teacher, 45:496-497 (2007)

Five Frequently Fatal Freshman Physics Fantasies, M Courtney, N Althausen, A Courtney, Physics Education 42 116, (2007) Also arxiv.org/ftp/physics/papers/0605/0605152.pdf

Who is the Customer in Higher Education? M Courtney, A Courtney, Cornell University Library, Physics Education, arXiv:physics/0612117v1 (2006).

Biomechanics – (several conference proceedings omitted)

An extensometer for global measurement of bone strain suitable for use in vivo in humans. GP Perusek, BL Davis, JJ Sferra, AC Courtney, SE D'Andrea, J. Biomechanics 34:385-391 (2001)

Effects of age, density and geometry on the bending strength of human metatarsals. Amy C. Courtney, Brian L. Davis, Timothy Manning and Helen Kambic, Foot & Ankle International 18(4): 216-221 (1997)

Etiology and prevention of age-related hip fractures. WC Hayes, ER Myers, SN Robinovitch, A. Van Den Kroonenberg, AC Courtney, TA McMahon, Bone 18(1) Supplement (1996)

Age related differences in post-yield damage in human cortical bone – experiment and model. AC Courtney, WC Hayes, and LJ Gibson, J. Biomechanics 29(11):1463-1471 (1996)

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

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

The effects of test environment and cyclic stretching on the failure properties of human patellar tendons. Roger C. Haut, Amy C. Powlison (Courtney), J. Orthopaedic Research 8:532-540 (1990)