



## **BRIAN J. BENDA, Ph.D.** PROFESSIONAL BIOGRAPHICAL OUTLINE

### **BACKGROUND**

Dr. Benda has over 35 years of experience in developing, managing, and executing solutions to engineering problems. For the first half of his career, he concentrated on aeronautical and structural engineering, doing work in aircraft stress analysis, structural dynamics, and earthquake engineering. In 1990, he left that field to pursue a Ph.D. in medical engineering in an attempt to focus his structural training on the intricacies of the human body. He was accepted into a program jointly offered by MIT and Harvard Medical School, which emphasized an engineering or quantitative approach to human physiology, disease, and injury. In addition to fulfilling the engineering requirements of his degree at MIT, Dr. Benda completed three semesters of coursework at Harvard Medical School and twelve weeks of clinical rotations at Mt. Auburn Hospital in Cambridge, MA. He has added to his knowledge by taking coursework in human anatomy at Temple University Medical School. Because of his academic and professional experience, Dr. Benda brings a unique combination of knowledge in structural mechanics, human anatomy and physiology, and medical therapies and equipment.

Dr. Benda specializes in the study of the structural mechanics of the human body and human injury mechanisms. He continues to work on scientific studies related to structures and human injury risk. In addition, Dr. Benda is also part of a team of engineers and medical care givers assembled to assess the design, use, and failure of medical devices.

### **SUMMARY OF EXPERIENCE**

- Developed and executed crash testing programs to assess occupant kinematics and injury mechanisms in a variety of transportation environments
- Taught Biomechanics at the graduate level at Drexel University, with an appointment as a Visiting Research Assistant Professor
- Developed a research test program that assessed the ability of electrical stimulation to return bladder and bowel function to child patients with spinal cord injury
- Formulated the initial design of and completed a “proof of concept” program for a therapy device to improve ankle control for children with cerebral palsy
- Developed a mathematical model of the human lower extremity and a probabilistic analysis method to assess the likelihood of sustaining a leg injury in the event of an automobile collision
- Assisted in the design and development of a medical device that would be used to estimate the mass of the prostate
- Directed the office and on-site activities of 15 engineers in a \$2.3M project to assess the earthquake safety of a nuclear power plant

### **AREAS OF SPECIALTY**

- Biomechanics
- Human Kinetic Analysis
- Human Injury Analysis
- Structural Analysis
- Dynamics
- Numerical Engineering Analysis



## ACADEMIC BACKGROUND

- Doctor of Philosophy in Medical Engineering, Division of Health Sciences and Technology, Massachusetts Institute of Technology and Harvard Medical School, 1998
- Masters of Science in Structural Mechanics, Stanford University, 1976
- Bachelors of Science in Aeronautical Engineering, Purdue University, 1972

## ACADEMIC APPOINTMENTS

### Visiting Research Assistant Professor (2003-2004)

School of Biomedical Engineering, Science & Health Systems, Drexel University

### Instructor, PT635 Biomechanics (Summer 2003)

Programs in Rehabilitation, Drexel University

## PROFESSIONAL EXPERIENCE

### 2003 – Present | ARCCA, Incorporated | Senior Biomechanist

- Practices basic biomechanics to explore the cause, nature, and severity and risk of injuries
- Provides structural analysis and mathematical computational analysis

### 2001 – 2003 | Shriners Hospitals for Children | Research Associate

- Defined and conducted research in the use of functional electrical stimulation for improving the quality of life for children affected by spinal cord injuries or cerebral palsy
- Developed and tested protocols for assessing the effectiveness of neuromodulation and neurostimulation as a means of treating neurogenic bladder dysfunction
- Defined and evaluated control strategies for electrical stimulation methods that can prolong standing for children with complete spinal cord injuries and cerebral palsy

### 1999 – 2001 | Technology Associates | Forensic Biomechanical Engineer

- Investigated and analyzed accidents that resulted in human injury, with an emphasis on head and neck injuries sustained in automobile crashes, sporting accidents, or falls
- Defined simple experiments that illustrated and confirmed injury mechanisms

### 1998 | Massachusetts Eye & Ear Infirmary | Consultant

- Proposed, defined, and executed experiments to assess whether position and velocity information can be delivered to human subjects through skin-mounted vibrotactors as part of a “proof of concept” experiment in the development of a balance prosthesis

### 1993 – 1998 | Postdoctoral Fellow and Research Assistant in laboratory of Dr. Emilio Bizzi | MIT Department of Brain and Cognitive Sciences

- Defined and conducted research in the neurophysiology of motor control and learning
- Designed, developed, and/or acquired all hardware used in neurophysiological experiments



### 1993 – 1995 | Lawrence Livermore National Laboratory | Consultant

- Developed nonlinear finite element model of lower extremity for use in automobile collision injury analysis
- Developed probabilistic analysis method to quantify risk of injury to lower extremity given automobile accident scenario

### 1994 | Uromed, Inc. | Consultant

- Assisted in the development of a fingertip-mounted probe that would be used to estimate the mass of the prostate

### 1991 – 1993 | Massachusetts General Hospital | Research Assistant at Biomotion Laboratory

- Characterized patients with vestibular deficits to quantify effectiveness of physical therapy by studying movements associated with activities of daily living
- Developed software package that displayed patient data in animated form

## STRUCTURAL AND VIBRATION ENGINEERING

### 1986 – 1990 | EQE Incorporated | Associate

Directed the office and on-site activities of 15 engineers in this as a Project Manager for seismic analysis of safety-related components at Texas Utilities Comanche Peak Station, a \$2.3M project

### 1980 – 1986 | NTS/Structural Mechanics Associates | Project Manager

Worked as a consultant to Lawrence Livermore National Laboratory as part of a national effort funded by the Nuclear Regulatory Commission to develop and apply probabilistic analysis methods to issues of nuclear power plant safety

### 1976 – 1980 | Lawrence Livermore National Laboratory | Engineer

Worked as part of a national effort funded by the Nuclear Regulatory Commission to develop and apply probabilistic analysis methods to issues of nuclear power plant safety

### 1972 – 1975 | McDonnell Douglas Corporation | Engineer

Worked as a structural dynamics engineer analyzing the response of aircraft, missiles, and spacecraft to dynamic load environments

## PROFESSIONAL AFFILIATIONS

- American Society of Mechanical Engineers
- Association for the Advancement of Automotive Medicine
- Society of Automotive Engineers

## PUBLICATIONS

**Brian J. Benda** (2015) Biomechanics – at the Intersection of Engineering and Medicine, Catastrophic Care Society, Traumatic Brain and Spinal Injury Medical/Legal Symposium, Las Vegas, NV

Gary R. Whitman, Dave Scott, Louis D'Aulerio, Larry Sicher, **Brian Benda**, Dennis Shanahan & Alfred Finch (2015): Rollover testing with volunteer live human subject, International Journal of Crashworthiness, DOI:10.1080/13588265.2015.1027563

Whitman, Gary R., Hart, Arlie V., Sicher, Larry, **Benda, Brian**, and D'Aulerio, Louis A. (2013) *Minimizing the Risk of Lap/Shoulder Belted Children Submarining the Lap Belt*. Proceedings of the 23<sup>rd</sup> ESV Conference. May 27-30, 2013.

Whitman, Gary R., Hart, Arlie V., Sicher, Larry, **Benda, Brian**, and D'Aulerio, Louis A. (2013) *Rear-facing Child Safety Seat Performance in Frontal NCAP Level Crashes*. Proceedings of the 23<sup>rd</sup> ESV Conference. May 27-30, 2013.

Whitman, G., D'Aulerio, L., **Benda, Brian J.**, and Sicher, Larry. (2012) *Considerations for Optimizing Occupant Protection to Children in Side Impact Crashes*. Proceedings of the ICRASH 2012 Conference. July 18-20, 2012.

**Benda, B. J.**, L. D'Aulerio, et al. (2006). *Performance of Automotive Seat Belts During Inverted (-Gz) Rollover Drop Tests*. Icrash 2006–International Crashworthiness Conference, Athens, Greece, University of Bolton.

Gushue, D., B. Probst, **B. Benda**, et al. (2006). *Effects of Velocity and Occupant Sitting Position on the Kinematics and Kinetics of the Lumbar Spine during Simulated Low-Speed Rear Impacts*. Safety 2006, Seattle, WA, ASSE.

Johnston, T. E., R. R. Betz, B. T. Smith, **B. J. Benda**, et al. (2005). *Implantable FES system for upright mobility and bladder and bowel function for individuals with spinal cord injury*. Spinal Cord, 43: 713-723.

Kadkade, P.P., **Benda, B.J.**, Schmidt, P.B., and Wall III, C. (2003) Vibrotactile display coding for a balance prosthesis, IEEE Transactions on Neural Systems and Rehabilitation Engineering, 11(4) 392-399.

Gandolfo, F., C. S. R. Li, **B. J. Benda**, et al. (2000). *Cortical correlates of learning in monkeys adapting to a new dynamical environment*. Proceedings of the National Academy of Sciences 97(5): 2259-2263.

**Benda, B. J.**, P. O. Riley, et al. (1992). *Biomechanical relationship between center of gravity and center of pressure during standing*. IEEE Transactions on Rehabilitation Engineering.

Riley, P. O., **B. J. Benda**, et al. (1994). *Phase plane analysis of stability in quiet standing*. Journal of Rehabilitation Resource Development, 2:40-45.

## ABSTRACTS

**Benda, B. J.**, R. R. Betz, et al. (2002). *Controlling Detrusor Hyperreflexia through Neuromodulation of the S3 Sacral Nerve*. Neurosci Abst 68.8.

**Benda, B. J.**, R. T. Lauer, et al. (October 2002). *Quantifying Motor Learning in Children with Cerebral Palsy*. 33rd Annual Neural Prosthesis Workshop. Bethesda, MD.

**Benda, B. J.**, B. T. Smith, et al. (April 2002). *Evaluating the Effectiveness of the Biomechanical Efficiency Quotient (BEQ) as a Measure of Gait Efficiency in Children with Cerebral Palsy*. IEEE 28th Annual Northeast Bioengineering Conference. Philadelphia, PA.

Todorov, E., C. S. R. Li, F. Gandolfo, **B. J. Benda**, et al. (2000). *Cosine Tuning Minimizes Motor Errors: Theoretical Results and Experimental Confirmation*. Neurosci Abst 785.6.

DiLorenzo, D., C. S. R. Li, **B. J. Benda**, et al. (1999). *Neural Correlate of Motor Performance: Transient Behavior of Cells in Primary Motor Cortex in Response to Environmental Perturbations*. Neurosci Abst 870.7.

Li, C. S. R., **B. J. Benda**, et al. (1998). *Neuronal Plasticity in the Motor Cortex of Monkeys Learning to Adapt to a Viscous Force Field*. Neurosci Abst 158.13.

Padoa Schioppa, C., J. Sadr, C.S. R. Li, **B. J. Benda**, et al. (1998). *Psychophysical Correlates of Long-term Force-field Adaptation and Motor Memory Consolidation in Monkey*. Neurosci Abst 159.1.

**Benda, B. J.**, F. Gandolfo, et al. (1997). *Neuronal activities in M1 of a macaque monkey during reaching movements*. Neurosci Abst 607.12.

## INVITED PRESENTATIONS

- November 2015** *Biomechanics – at the Intersection of Engineering and Medicine, Traumatic Brain and Spinal Injury Medical/Legal Symposium – Catastrophic Care Society, Las Vegas, NV*
- August 2015** *Beyond Insurance: Recognizing and preserving an Automobile Defect Claim, with Stewart Eisenberg, Esq., A Day on Personal Injury, The Pennsylvania Bar Institute*
- July 2013** *Biomechanics and Injury Causation – The Engineering Side of Medicine, New Jersey Institute for Continuing Legal Education, New Brunswick, NJ.*
- August 2012** *Human Injury Reconstruction – More than Skid Marks and Sheet Metal, New Jersey Institute for Continuing Legal Education, New Brunswick, NJ.*
- August 2012** *Human Injury Reconstruction in the Low Speed Crash – Same Animal. . .Way Different Stripes, New Jersey Institute for Continuing Legal Education, New Brunswick, NJ.*
- December 2006** *The Soft Tissue Case – a Biomechanical Perspective. Atlantic Provinces Trial Lawyer’s Associate, Halifax, NS, Canada.*
- July & August 2006** *The Soft Tissue Case – a Biomechanical Perspective. Pennsylvania Bar Institute: Preparing and Trying the Soft Tissue Case.*
- September 2004** *Slip, Trip, and Fall: A Technical Approach. 19th Annual Seminar and Expo on Insurance Fraud, International Association of Special Investigation Units, Pittsburgh, PA.*
- October 2002** *Electrical Stimulation and the Management of Bladder/Bowel Function in Patients with Spinal Cord Injury, Temple Neuroscience Seminar, Temple University Medical School.*
- October 1997** *Motor Learning/Adaptation and Its Application in Tendon Transfer Surgery, Billis W. Long Hansen’s Disease Center, Carville, LA.*
- September 1993** *Finite Element Modeling of the Lower Extremity, Lawrence Livermore National Laboratory, Livermore, CA.*