David W. Wagner, Ph.D.

Curriculum Vitae

Education

University of Michigan, Ann Arbor, MI 2008
Ph.D. in Industrial and Operations Engineering
Thesis: Classification and Modeling of Acyclic Stepping Strategies Used During Manual Material Handling Transfer Tasks
Co-Advisors: Matthew P. Reed and Don B. Chaffin

University of Michigan, Ann Arbor, MI 2004
M.S. in Industrial and Operations Engineering, Physical Ergonomics

University of California Berkeley, Berkeley, CA 2002
B.S. in Manufacturing Engineering

Previous Experience

Jan. 2010-Sept. 2013 **VA Palo Alto Health Care System**, *Palo Alto*, CA
Research Biomedical Engineer
Improving the application of imaging technologies (X-ray, DXA, pQCT, microCT) in conjunction with new engineering analysis tools to provide improved estimates of bone strength in individuals at risk for osteoporosis. The long-term goal of this research is to provide additional and better ways to identify individuals who would benefit from pharmacological interventions or lifestyle changes, thereby reducing both the near-term and long-term risks and costs of osteoporosis related fractures.

Feb. 2008-Dec. 2009 **Ozen Engineering**, *Sunnyvale*, CA
Project Manager
Research and development related to integrating musculoskeletal models and finite element analysis tools for improved evaluation and design of joint replacements, fixed plate implants, and other implantable medical devices.

May 2003-2007 **University of Michigan**, *Ann Arbor*, MI
Graduate Research Assistant
Human Motion Simulation Laboratory (HUMOSIM). Modeling transition stepping behaviors for use with Digital Human Models. NIOSH Education and Research Center Trainee recipient - Occupational Safety Engineering and Ergonomics (OSE).

May 2001-August 2001 **Kensington Labs/Newport Corporation**, *Richmond*, CA
Manufacturing Engineering Intern
Worked with Operations Manager in planning production floor layout and updating inventory control and flow systems.

May 2000-Aug. 2000 **Intel Corporation**, *Santa Clara*, CA
Technical Intern
Worked in System Level Debug Lab characterizing and debugging problems with pre-release processors.

Technical Expertise

Engineering programming and development (Matlab, Java)
Statistical modeling and analysis (JMP, R)
Design and fabrication (AutoCad, Solidworks; mill, lathe, and machine shop expertise)
Mechanical and cadaveric testing
Clinical DXA and Imaging (Osirix, microCT, peripheral QCT)
Optimization (AMPL, Matlab, modeFrontier)

Other Proficiencies

Analog/Digital data collection and synchronization, Discrete event simulation (Sigma), Electromyography, Ergonomics evaluation (Jack), Finite element modeling, Force plates and strain gauging, Image segmentation and registration (Matlab, Mimics), Motion capture (Ascension Flock of Birds, Qualisys, Vicon), Musculoskeletal modeling (AnyBody, Opensim), Operating Systems (Linux, Mac OSX, Windows)

Professional Affiliations

Orthopedic Research Society (ORS), 2010-present
Human Factors and Ergonomics Society (HFES), 2005-2010
American Society of Biomechanics (ASB), 2004-present
International Society of Biomechanics (ISB), 2004-2010
Society of Automotive Engineers (SAE), 2003-present
Associate Ergonomics Professional, Board of Certification in Professional Ergonomics, 2007-present

Session Moderator at Scientific Meetings

2013 Spotlight Session: Fracture Repair and Augmentation, 59th Annual Meeting of the Orthopaedic Research Society

Manuscript Reviewer

Bone
Journal of Biomechanical Engineering
Journal of Musculoskeletal and Neuronal Interactions
Orthopaedic Research Society Annual Conference, 2012
American Society of Biomechanics Annual Conference, 2013

Professional Development

2011 ORS/OREF 7th Annual Grant Writing Workshop, January 12, Long Beach, CA

Research Mentoring Experience

Kinjal Prajapati, MS, San Jose State University, 2009, Masters Thesis Committee Member: Dynamic force response of a human body due to vertical jump

Srikanth Ravuri, MS, San Jose State University, 2009, Master Thesis Committee Member: Dynamic response of human legs due to long jump

Yogesh Sitapara, MS, San Jose State University, 2010, Master Thesis Committee Member: Estimation of muscle force in the lumbar spine using finite element method

Megan Matal, MS, San Jose State University, 2012, Master Thesis Committee Member: Factors contributing to spiral humerus fracture during muscle-up exercise

Christien Burkard, San Jose State University, (2013), Master Thesis Committee Member: The causes and levels of force and momentum of a rear end collision resulting in spondylolysis.

Selected Honors, Awards, and Invited Talks

Invited Talk, Clemson University International Center for Automotive Research, February 18th, 2009
Invited Talk, ASME Seminar, Cardiovascular Devices and Human Biomechanics, December 6th, 2008
Invited Talk, IEEE-EMBS Section Meeting, April 16th, 2008
Invited Talk, Seminar in Human Performance, University of Michigan, December 4th, 2007
Society of Automotive Engineers Arch T. Colwell Merit Award, 2006
University of Michigan College of Engineering Outstanding Mentor Award, 2006
University of Michigan Industrial and Operations Engineering Fellowship, 2002
George Epstein Scholarship (awarded by the Society of Plastics Engineers), 1998-2001
University of California Alumni Leadership Scholarship, 1998

Previous Research Support

1IK2RX001252-01 (Wagner) Government priority score: 120 VA Career Development Award – 2 Role: PI (left VA prior to start of funding)
Title: Skeletal Health and SCI: Using Musculoskeletal Models to Address Clinical Needs
Summary: The goal of this project is to combine current understanding of bone adaptation theory with musculoskeletal models modified to the spinal cord injury population to estimate using simulation the most likely deficiencies of current interventions and to assess the potential for modified or new interventions for mitigating bone loss after SCI. Activities to be studied include standing frame therapy, walking with and without assistance, and rowing with and without functional electrical stimulation.

1R03AR064570-01 (Wagner) PAIRE on hold to resubmit
NIH/NIAMS Role: PI
Title: Novel DXA Processing to Obtain Structural Properties of Small Animal Long Bones
Summary: The goal of this project is to expand the current capability of DXA scanning to calculate structural-based parameters for preclinical osteoporosis research, specifically to provide a better estimate of long bone strength in small animals in vivo than is currently available with traditional DXA measures.

F0920-P (Beaupre) Government 7/1/13 – 6/30/15
VA Merit Review Pilot Role: Research Biomedical Engineer
Title: Assessing Skeletal Risk During Rehabilitation in Patients after Chronic Disuse
Summary: The goals of this study are to: 1) eliminate a critical barrier to progress in using DXA technology for deriving structural-based metrics by developing and validating a method for reconstructing pixel-by-pixel bone maps from raw DXA data; 2) determine the accuracy and precision of reconstructing engineering-based bone strength metrics using single, perpendicular, and triple-oriented DXA scans; and 3) determine the predictive strength of DXA-derived engineering-based metrics for estimating the bending and torsional strength of the midshaft and distal regions of the femur.

<u>Completed</u>
A6816R (Beaupre) Government 10/01/09 – 09/30/12
VA Merit Review Role: Biomedical Engineer
Title: Combining Imaging and Modeling in Osteoporosis Fracture Risk Assessment
Summary: The objectives of this study are to evaluate the ability of several currently used technologies in conjunction with new analysis techniques to provide improved estimates of bone strength at the distal radius (Colles fractures) and to characterize the capability of those measures for predicting fracture strength at the hip during a fall to the side.

1R43OH009681-01 (Wagner) Ozen Engineering 09/01/09 - 08/31/10
CDC/NIOSH Role: PI
Title: Scalable and Deformable 3D Hand Model for use with Computer Aided Engineering Designs
Summary: The overall goal of this project is to develop a scalable, virtual hand model that can be used to evaluate and determine appropriate hand-tool coupling interfaces, information that can be used to design hand tools to accommodate the hand sizes and hand shapes of end users.

Publications

Journal Articles

Norman, S.C., **Wagner, D. W.**, Beaupre, G. S., Castillo, A. B. (2014). Comparison of Three Methods of Calculating Strain in the Mouse Ulna in Exogenous Loading Studies. Journal of Biomechanics, 48(1):53–8.

Woolson, S. T., Harris, A. H., **Wagner, D. W.**, and Giori, N. J. (2014). Component alignment during total knee arthroplasty using standard or custom instrumentation: A randomized clinical trial using computed tomography for postoperative alignment measurement. *Journal of Bone and Joint Surgery Am., 96(5), 366-72*.

Wagner, D. W., Chan, S., Castillo, A. B., and Beaupre, G. S. (2013). Geometric mouse variation: Implications to the axial ulnar loading protocol and animal specific calibration. Journal of Biomechanics, 46(13):2271–2276.

Wagner, D. W., Stepanyan, V., Shippen, J. M., DeMers, M. S., Gibbons, R. S., Andrews, B. J., Creasey, G. H., and Beaupre, G. S. (2013). Consistency among musculoskeletal models: Caveat Utilitor. *Annals of Biomedical Engineering, 41(8), 1788–99*.

Wagner, D. W., and Reed, M. P. (2013). Step scaling and behaviour selection in a constrained set of manual materials handling transfers. *Ergonomics, 56(6), 964–76*.

Wagner, D. W., Lindsey, D. P., and Beaupre, G. S. (2012). Replicating a colles fracture in an excised radius: Revisiting testing protocols. *Journal of Biomechanics*, 45(6):997–1002.

Wagner, D. W., Lindsey, D.L, and Beaupre, G. S. (2011). Deriving tissue density and elastic modulus from microCT bone scans. *Bone*, 49(5), 931–8.

Wagner, D. W. and Beaupre, G. S. (2011). Letter to the editor referring to the article "mineral heterogeneity affects predictions of intratrabecular stress and strain" published in journal of biomechanics (volume 44, issue 3, pages 402-407). *J Biomech*, 44(9), 1826–7.

Wagner, D. W., Reed, M. P., and Chaffin, D. B. (2010). The development of a model to predict the effects of worker and task factors on foot placements in manual material handling tasks. *Ergonomics*, 53(11), 1368–84.

Wagner, D.W., Divringi, K., Ozcan, C., Grujicic, M., Pandurangan, B., and Grujicic, A. (2010). Combined musculoskeletal dynamics/structural finite element analysis of femur physiological loads during walking. *Multidiscipline Modeling in Materials and Structures*, Vol. 6(4), 417-43.

Grujicic, M., Pandurangan, B., Xie, X., Gramopadhye, A. K., **Wagner, D.W.**, and Ozen, M. (2010). Musculoskeletal computational analysis of the influence of car-seat design/adjustments on long-distance driving fatigue. *International Journal of Industrial Ergonomics*, 40(3), 345–355.

Grujicic, M., Arakere, G., Xie, X., LaBerge, M., Grujicic, A., **Wagner, D. W.**, and Vallejo, A. (2010). Design-optimization and material selection for a femoral-fracture fixation-plate implant. *Materials & Design*, 31(7), 3463–3473.

Grujicic, M., Xie, X., Arakere, G., Grujicic, A., **Wagner, D.W.**, and Vallejo, A. (2010). Design-optimization and material selection for a proximal radius fracture-fixation implant. *Journal of Materials Engineering and Performance*, 19(8), 1090–1103.

Wagner, D.W., Kirschweng, R.L., and Reed, M.P. (2009). Foot motions in manual material handling transfer tasks: A taxonomy and data from an automotive assembly plant. *Ergonomics*, Vol. 52(3), 362-383.

Wagner, D.W., Rasmussen, J., and Reed, M.P. (2007). Assessing the importance of motion dynamics for ergonomic analysis of manual materials handling tasks using the AnyBody Modeling System. SAE Technical Paper 2007-01-2504, *SAE Transactions: Journal of Passenger Cars – Mechanical Systems,* Vol. 116(6), 2092-2101.

Reed, M.P., and **Wagner, D.W.** (2007). An integrated model of gait and transition stepping for simulation of industrial workcell tasks. SAE Technical Paper 2007-01-2478, *SAE Transactions: Journal of Passenger Cars – Mechanical Systems,* Vol. 116(6), 2062-2072.

Wagner, D.W., Reed, M.P., and Chaffin, D.B. (2006). A task-based stepping behavior model for digital human models. SAE Technical Paper 2006-01-2364, *SAE Transactions: Journal of Passenger Cars – Electronic and Electrical Systems,* Vol. 115, 1138-1146.

Wagner, D.W., Reed, M.P., and Chaffin, D.B. (2005). Predicting foot positions for manual materials handling tasks. SAE Technical Paper 2005-01-2681. *SAE Transactions: Journal of Passenger Cars – Mechanical Systems,* Vol. 114, 2872-2876.

Reed, M.P., Parkinson, M.B. and **Wagner, D.W.** (2004). Torso kinematics in seated reaches. Technical Paper 2004-01-2176. *SAE Transactions: Journal of Aerospace,* Vol. 113, 167-174.

Peer Reviewed Conference Articles and Presentations

Carrera, R., **Wagner, D.W.**, George, B., Leucht, P., Hunter, D., Helms J., Beaupre, G.S., Castillo, A.B. (2014). Early Axial Compressive Loading Delays Mineralization and Remodeling of a Tibial Cortical Defect in Mice. *Biomedical Engineering Society Annual Meeting*, San Antonio, TX.

Norman, S.C., **Wagner, D.W.**, Beaupre, G.S., and Castillo, A.B. (2014). An Alternative Method of Calculating Strain in Mouse Ulna Loading Studies: Correlation with Bone Formation Rates. *Orthopaedic Research Society Conference*, New Orleans, LA.

Wagner, D. W., Stepanyan, V., Shippen, J. M., DeMers, M. S., Gibbons, R. S., Andrews, B. J., Creasey, G. H., Beaupre, G. S. (2013). Consistency among musculoskeletal models moment arms. *American Society of Biomechanics Conference,* Omaha, NE.

Wagner, D.W., Castillo, A.B, Chan, S., and Beaupre, G.S. (2013). Axial ulnar loading in the C57BL/6 mouse: Contribution of inter-animal geometric variation to midshaft periosteal strain. *Orthopaedic Research Society Conference*, San Antonio, TX.

Lindsey D.P., **Wagner, D.W.**, and Beaupre, G.S. (2013). MicroCT based bone mineral content predictions can be significantly improved with a change in calibration methods. *Orthopaedic Research Society Conference*, San Antonio, TX.

Wagner, D.W., Jaramillo, J., Hong, M., Fong, D., and Kiratli, B.J. (2012). Assessing upper extremity total limb work volume in individuals with spinal cord injury during Wii gaming. *Academy of Spinal Cord Injury Professionals*, Las Vegas, NV.

Wagner, D.W., Lindsey, D.P., and Beaupre, G.S. (2012). Deriving ash fraction from microCT bone scans. *Orthopaedic Research Society Conference*, San Francisco, CA.

Wagner, D.W., Lindsey, D.P., and Beaupre, G.S. (2012). A framework for estimating bone strength along the distal radius and the effect of eccentric axial load position. *Orthopaedic Research Society Conference*, San Francisco, CA.

Wagner, D.W., Lindsey, D.P., and Beaupre, G.S. (2012). Degree of bone mineralization in the ultra distal radius as a function of type and location. *Orthopaedic Research Society Conference*, San Francisco, CA.

Prajapati, K., Kao, J., **Wagner, D.W.**, and Barez, F. (2011). Dynamic force response of human legs due to vertical jumps. IMECE2011-62261. *Proceedings of the ASME 2011 International Mechanical Engineering Congress & Exposition*, Denver, CO.

Wagner, D.W. and Beaupre, G.S. (2011). Effect of strain gauge size and placement during the mouse axial ulnar loading protocol calibration. *American Society of Biomechanics Conference*, Long Beach, CA.

Wagner, D.W. and Beaupre, G.S. (2011). Strain sensitivity of the mouse ulnar midshaft to perturbations of the axial ulnar loading protocol. *Orthopaedic Research Society Conference*, New Orleans, LA.

Wagner, D.W. and Vallejo, A. (2009). Activities of daily living and implant design: Evaluation of a femoral fracture fixed plate implant during bicycle pedaling. *Proceedings of ASME 2009 4th Frontiers in Biomedical Devices Conference*, Irvine, CA.

Wagner, D.W. and Vallejo, A. (2009). Using activities of daily living to evaluate the design and placement of a proximal radius fracture fixation device. *Proceedings of the ASME 2009 Summer Bioengineering Conference*, Lake Tahoe, CA.

Wagner, D.W. and Reed, M.P. (2006). Applying statistical process control to identify transitionary foot motions during manual material Handling Transfer Tasks. *American Society of Biomechanics Conference*, Blacksburg, Virginia.

Hoffman, S.G., Chaffin, D.B., and **Wagner, D.W.** (2006). Shoulder strength and balance guided posture selection during a battery maintenance task. *2006 SAE World Congress*, Detroit, Michigan.

Wagner, D.W. and Reed, M.P. (2005). Dynamic calibration of an extended-range electromagnetic flock of birds motion tracking system. *International Society of Biomechanics Congress*, Cleveland, Ohio.