

**Joshua E. Johnson**  
**The University of Iowa**  
**Orthopaedic Biomechanics Laboratories**

---

---

2181J-1 Westlawn  
200 Newton Road, Iowa City, IA 52242

(319) 335-0695  
joshua-e-johnson@uiowa.edu

---

**KEY EXPERTISE**

Research engineer with experience in the implementation of interdisciplinary collaborative projects; **experimental design, quantitative MRI and CT analysis, cadaveric mechanical testing, environment health and safety, patient-specific finite element modeling and validation, image processing, quality control, statistical analysis, and documentation.**

---

**EDUCATION**

- **Worcester Polytechnic Institute**, Worcester, MA  
**Postdoctoral Research Fellow** in Bioengineering  
National Institutes of Health (NIH) Fellowship  
Mentor: Karen Troy, PhD  
August 2013–June 2018
  - **University of Kansas**, Lawrence, KS  
**PhD** in Mechanical Engineering (Honors)  
**Master of Science** in Mechanical Engineering  
University of Kansas Medical Center collaboration  
Advisor: Kenneth Fischer, PhD  
January 2013  
December 2008  
Advisor: Terence McIff, PhD
  - **University of Botswana**, Gaborone, Botswana  
**Bachelor of Engineering** in Mechanical Engineering  
June 2006
- 

**RELEVANT EXPERIENCE**

**Postdoctoral Research Fellow**

**Worcester Polytechnic Institute**, Worcester, MA

August 2013–June 2018

Project Title: *Smoking effects on bone microstructure, mechanical strength, and fracture healing*

- **Developed** novel multiscale mechanical simulation (**finite element analysis** using **3-matic, Abaqus**) and image processing (clinical and high-resolution **CT** using **Mimics, Matlab**) techniques.
  - Implemented large-scale (~10 million degrees of freedom) multiscale finite element models using high performance computing.
- **Validated** multiscale models with experimental strain data (using **strain gage rosettes, signal conditioners**) collected from cadaveric specimens under standardized mechanical tests (using **Instron**).
- **Safety:** Established and implemented procedures in conjunction with Environment Health and Safety to manage and dispose biohazardous waste.
- **Result:** Implemented simulation and image processing techniques to demonstrate that smoking is associated with increased cortical bone porosity and diminished stiffness using statistical comparisons (**SPSS**) for an NIH fellowship.

Project Title: *A prospective study of human bone adaptation using a novel in vivo loading model*

- **Applied** mechanical simulation and image processing techniques to clinical CT datasets to investigate the effects of exercise on bone health in women for an NIH grant.
  - Quantified changes in distal radius microstructure as a result of an exercise intervention from high-resolution CT images acquired at serial time-points.
  - Created inhomogeneous FE models from clinical-resolution CT images to determine mechanical behavior under physiologic loading and relate strain distribution to structural response.
  - Developed image processing techniques for the analysis of serial micro-CT data to observe local adaptive changes.
- **Aided** with laboratory infrastructure setup and facilitated collaborations with local resources.
- **Trained** new graduate and undergraduate students in laboratory methods and general best practices and developed documentation (**Standard Operating Procedures**).

### **Graduate Research Assistant**

**University of Kansas**, Lawrence, KS

August 2009–May 2013

Project Title: *Effects of surgical repair/reconstruction on wrist joint mechanics*

- **Developed** mechanical simulation (**finite element analysis** using **ScanFE, Abaqus**) and image processing (**MRI** using **ScanIP, Geomagic, Analyze, Matlab**) techniques.

#### *Finite element modeling (FEM)*

- Developed methodology (contact interaction, interaction properties, sliding formulation, multipoint constraints etc.) for articular joint contact analyses.
- Determined contact parameters using kinematic boundary conditions.
- Performed mesh convergence studies and sensitivity to contact interaction, material properties.
- Compared FEM results to a more efficient surface-based contact modeling method.

#### *Surface-based contact modeling (SCM)*

- Demonstrated the practicality of SCM as an efficient contact analysis method to obtain clinically relevant data.
- **Validated** joint contact models with experimental pressure data (using **Tekscan, Fuji film**) collected from cadaveric specimens.
- **Result:** Applied simulation and image processing techniques to evaluate surgical efficacy, and to demonstrate the benefits of surgery in restoring wrist contact mechanics to normal after ligament injury, using statistical comparisons (**SPSS**) for an NIH grant.
- **Coordinated** patient recruitment with KU Medical Center, and collaborated with physicians and imaging staff for patient screening and data collection.
- **Supervised** lab researchers' grant related work and provided feedback through quality control.
  - Temporary lab manager (July – December 2007).

### **Graduate Research Assistant**

KUMC Orthopedic Research Center, Kansas City, KS

July–December 2007

Project Title: *A comparison of peripheral nerve strain measuring techniques*

- **Result:** Demonstrated the importance of the location of strain measurement in peripheral nerve specimens, whether surface (using a **videoextensometer**) or internal (using **DVRT**).
- **Designed** a low-cost freeze clamp system for specimen mounting and testing.

---

### **LAB AND PROJECT EXPERIENCE**

- Collected and analyzed experimental data for Experimental Methods in Biomechanics class.
  - Force plate measurements to investigate static posture and for gait analysis.
  - Motion (Optotrak) measurements to analyze 2D rigid body kinematic parameters.
  - EMG data collection and processing.
  - Investigated effects of loading conditions on forearm and upper-arm muscle activity and kinematics.

---

### **ADDITIONAL EXPERIENCE**

#### **Graduate Teaching Assistant**

University of Kansas, Lawrence, KS

Spring 2008–Spring 2009

- Taught computer graphics (**Inventor**) and basic programming during lab sessions of over 50 students.
- Explained methods to solve problems and provided help and feedback during office hours.
- Graded homework, exams, and projects, and helped monitor student performance.

#### **Assistant Engineer**

Kentz Botswana (Pty) Ltd

Internship January–July 2005

- Organized schematics of HVAC installations for the Scottish Livingston Hospital Project.
- Supervised installation of HVAC units.

#### **Volunteer Work**

- **Teamed** with Working for Worcester and Convoy of Hope volunteers to provide needed community services for the residents of Worcester, Massachusetts.
- **Teamed** with Children of the Nations staff to assist with community work for the residents of Barahona, Dominican Republic.
- **Partnered** with disaster relief volunteers to repair and restore tornado affected sites in Joplin, Missouri.
- **Counseled** elementary school students at a youth camp in Jonesville, Virginia.
- **Supported** new international students by helping them get familiarized with the city of Lawrence as part of the international tour of Lawrence team.

## RESEARCH SKILLS

### Software

Abaqus, Simpleware (ScanIP/FE), Materialise (Mimics, 3-matic), Analyze, SPSS, Geomagic, Photoshop, Matlab, EndNote, I-Scan, Bluehill, ImageJ, Autodesk Inventor, Statview, Microsoft Office (Word, Excel, PowerPoint).

Some experience with HyperMesh, ProEngineer, LabVIEW, C++.

### Hardware

High Performance Computing (Unix), Strain Gage, Instron, Tekscan, Fuji Film, Videoextensometer, DVRT, MTS, Force Plate, Signal Conditioner.

Some experience with Motion Capture, EMG.

---

## ACTIVITIES AND HONORS

Member, ORS	2014–present
Member, BMES	2014–2015
Member, ASME	2012–2013
Member, Graduate Engineering Association, University of Kansas (KU)	2007–2012
▪ Assisted with graduate student recruitment.	
Associate Member, Sigma Xi	2008–2009
Vice-President, Christian Fellowship, University of Botswana (UB)	2005–2006
▪ Helped organize campus events.	

- Invited to present at the Subject-specific Articular Joint Modeling special session at the 11<sup>th</sup> International Symposium of the CMBBE conference, 2013
- Orthopaedic Research Society Best Poster Award in the Hand and Wrist Session, 2013
- Dr. Ernest Lyder Memorial Fellowship, KU, Spring 2009, Fall 2009
- Mechanical Engineering Scholarship, KU, Spring 2007, Spring 2009, Fall 2009
- Vice-Chancellor's Prize, UB (Awarded to the best all-round graduating student)
- Dean's Prize, UB (Awarded to the most outstanding student in engineering)
- Botswana Institution of Engineers Prize, UB (Awarded to the most outstanding graduating student)
- CISNA'93 Prize: Engineering and Technology, UB (Awarded to the best student in engineering)

---

## PUBLICATIONS

- **Johnson, JE**, Caceres, AP, Anderson, DD, Patterson, BM, Post-Impingement Instability Following Reverse Shoulder Arthroplasty: A Parametric Finite Element Analysis. *Seminars in Arthroplasty: JSES*, 2020. <https://doi.org/10.1053/j.sart.2020.10.005>.
- **Johnson, JE**, Brouillette, MJ, Permeswaran, PT, Miller, BJ, Goetz, JE. Simulated Lesions Representative of Metastatic Disease Predict Proximal Femur Failure Strength More Accurately Than Idealized Lesions. *Journal of Biomechanics*, 2020. 106:109825.
- Troy, KL, Mancuso, ME, **Johnson, JE**, Wu, Z, Schnitzer, TJ, Butler, TA. Bone Adaptation in Adult Women Is Related to Loading Dose: A 12-Month Randomized Controlled Trial. *Journal of Bone and Mineral Research*, 2020. 35(7):1300-1312.

- Askarinejad, S, **Johnson, JE**, Rahbar, N, Troy, KL. Effects of Loading Rate on the Mechanical Behavior of the Femur in Falling Condition. *Journal of the Mechanical Behavior of Biomedical Materials*, 2019. 96:269-278.
- **Johnson, JE** and Troy, KL. Moderate-to-Heavy Smoking in Women is Potentially Associated with Compromised Cortical Porosity and Stiffness at the Distal Radius. *Archives of Osteoporosis*, 2018. 13(1):89.
- Troy, KL, Mancuso, ME, Butler, TA, **Johnson, JE**. Exercise Early and Often: Effects of Physical Activity and Exercise on Women's Bone Health. *International Journal of Environmental Research and Public Health*, 2018. 15(5):878.
- Mancuso, ME, **Johnson, JE**, Ahmed, SS, Butler, TA, Troy, KL. Distal Radius Microstructure and Finite Element Bone Strain Are Related to Areal Bone Mineral Density and Site-Specific Loading in Premenopausal Women. *Bone Reports*, 2018. 14(8):187-194.
- **Johnson, JE** and Troy, KL. Simplified Boundary Conditions Alter Cortical-Trabecular Load Sharing at the Distal Radius; A Multiscale Finite Element Analysis. *Journal of Biomechanics*, 2018. 3(66):180-185.
- **Johnson, JE** and Troy, KL. Validation of a New Multiscale Finite Element Analysis Approach at the Distal Radius. *Medical Engineering and Physics*, 2017. doi: 10.1016/j.medengphy.2017.03.005.
- **Johnson, JE** and Fischer, KJ. Results of automatic image registration are dependent on initial manual registration. *Computer Methods in Biomechanics and Biomedical Engineering*, 2015. 18(16):1856-61.
- Bhatia, VA, Edwards, WB, **Johnson, JE**, Troy KL. Short-Term Bone Formation is Greatest within High Strain Regions of the Human Distal Radius: a Prospective Pilot Study. *Journal of Biomechanical Engineering*, 2015. 137(1) doi: 10.1115/1.4028847.
- **Johnson, JE**, Lee, P, McIff, TE, Toby, EB, Fischer, KJ. Validation of radiocarpal joint contact models based on images from a clinical MRI scanner. *Computer Methods in Biomechanics and Biomedical Engineering*, 2014. 17(4):378-87.
- **Johnson, JE**, Lee, P, McIff, TE, Toby, EB, Fischer, KJ. Computationally Efficient Magnetic Resonance Imaging Based Surface Contact Modeling as a Tool to Evaluate Joint Injuries and Outcomes of Surgical Interventions Compared to Finite Element Modeling. *Journal of Biomechanical Engineering*, 2014. 136(4).
- **Johnson, JE**, Lee, P, McIff, TE, Toby, EB, Fischer, KJ. Effectiveness of Surgical Reconstruction to Restore Normal Wrist Joint Mechanics after Scapholunate Ligament Injury. An In Vivo Modeling Study. *Journal of Biomechanics*, 2013. 46(9):1548-53.
- **Johnson, JE**, Lee, P, McIff, TE, Toby, EB, Fischer, KJ. Scapholunate Ligament Injury Adversely Alters In Vivo Wrist Joint Mechanics. An MRI-based Modeling Study. *Journal of Orthopedic Research*, 2013. 31(9):1455-60.
- Fischer, KJ, **Johnson, JE**, Waller, AJ, McIff, TE, Toby, EB, Bilgen, M. MRI-Based Modeling for Radiocarpal Joint Mechanics: Validation Criteria and Results for Four Specimen-Specific Models. *Journal of Biomechanical Engineering*, 2011. 133(10): p. 101004.
- Loukanov, IA and **Johnson, JE**. Design Features and Experimental Analysis of a Resonance Vibrating Pump for boreholes in Botswana. *Mechanics of Machines*, 2007. 71(5): 15-19.

---

## CONFERENCE PROCEEDINGS

- Linderman SE, **Johnson JE**, Anderson DD, Patterson BM. Influence of Subscapularis Stiffness and Glenosphere Lateralization on Impingement-Free Range of Motion, Joint Torque, and Subluxation Risk in Reverse Shoulder Arthroplasty. Proceedings of the 38<sup>th</sup> Annual Meeting of the Mid-America Orthopaedic Association, Amelia Island, FL, September 29–October 3, 2021.
- Patterson BM, **Johnson JE**, Caceres AP, Anderson DD. Finite Element Analysis of Glenosphere Lateralization, Retentive Liners, and Subscapularis Repair on Impingement and Subluxation Risk in Reverse Shoulder Arthroplasty. Proceedings of the Annual Meeting of the American Academy of Orthopedic Surgeons, Orlando, FL, March 24-28, 2020.
- **Johnson JE** and Troy KL. Boundary Conditions Influence Cortical and Trabecular Load Sharing at the Distal Radius. Proceedings of the 63<sup>rd</sup> Annual Meeting of the Orthopaedic Research Society, San Diego, CA, March 19-22, 2017.
- Tevenan J, Mancuso ME, Butler TA, **Johnson JE**, Troy KL. Effects of Vitamin D and Handedness on Bone Microstructure. 40<sup>th</sup> Annual Meeting of the American Society of Biomechanics, Raleigh, NC, August 2-5, 2016.
- **Johnson JE**, Hulburt TC, Magit D, Troy, KL. Development of an Anatomically Accurate Elbow Finite Element Model for Normal and Pathologic Simulations. Proceedings of the 62<sup>nd</sup> Annual Meeting of the Orthopaedic Research Society, Orlando, FL, March 5-8, 2016.
- **Johnson JE** and Troy KL. Subchondral Strains and Initiation of Osteoarthritis in the Radiocarpal Joint. 39<sup>th</sup> Annual Meeting of the American Society of Biomechanics, Columbus, OH, August 5-8, 2015.
- Fang Y, Smith N, **Johnson JE**, Troy KL. Comparison of Tibia Strain between Simulated Exoskeleton-Assisted Gait and Normal Gait. 39<sup>th</sup> Annual Meeting of the American Society of Biomechanics, Columbus, OH, August 5-8, 2015.
- **Johnson JE** and Troy KL. Application and Validation of Multiscale Modeling to the Distal Radius. Proceedings of the 61<sup>st</sup> Annual Meeting of the Orthopaedic Research Society, Las Vegas, NV, March 28-31, 2015.
- **Johnson JE** and Troy KL. A Multiscale Approach For The Simultaneous Analysis Of Continuum And Micro-FE Models. Annual Meeting of the Biomedical Engineering Society, San Antonio, TX, October 22-25, 2014.
- Anjonrin-Ohu O, Butler TA, **Johnson JE**, Troy KL. Hand Dominance and Physical Activity History Have Little Effect on Distal Radius Microstructure. Annual Meeting of the Biomedical Engineering Society, San Antonio, TX, October 22-25, 2014.
- **Johnson JE** and Troy KL. Higher Strains In Extension Than Flexion Might Partially Explain The Mechanism Of Distal Radius Fractures. 7<sup>th</sup> World Congress of Biomechanics, Boston, MA, July 6-11, 2014.
- Troy KL, Edwards WB, Bhatia VA, **Johnson JE**. Individual variations in bone mechanical strain environment: implications for osteogenic exercise. 7<sup>th</sup> World Congress of Biomechanics, Boston, MA, July 6-11, 2014.
- Chappell ID, **Johnson JE**, Zheng Q, Lee P, McIff TE, Toby EB, Fischer KJ. Long-term Effects of Injury and Surgical Repair on Radiocarpal Joint Mechanics for Wrists with Scapholunate Ligament Injury. 7<sup>th</sup> World Congress of Biomechanics, Boston, MA, July 6-11, 2014.
- **Johnson JE**, Lee P, McIff TE, Toby EB, Fischer KJ. Comparison of Finite Element

Modeling and Surface-based Contact Modeling Method for Normal, Injured and Surgically Repaired Wrists. 11<sup>th</sup> International Symposium of the Computer Methods in Biomechanics and Biomedical Engineering Conference, Salt Lake City, UT, April 3-7, 2013.

- **Johnson JE**, Lee P, McIff TE, Toby EB, Fischer KJ. Does SL Ligament Injury Adversely Alter In Vivo Wrist Joint Mechanics? An MRI-based Modeling Study. American Academy of Orthopaedic Surgeons Annual Meeting, Chicago, IL, March 19-23, 2013.
- **Johnson JE**, Lee P, McIff TE, Toby EB, Fischer KJ. Is Surgical Reconstruction Effective in Restoring Normal Wrist Joint Mechanics after SL Ligament Injury? An In Vivo Modeling Study. Proceedings of the 59<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, San Antonio, TX, January 26-29, 2013.
- **Johnson JE**, Lee P, McIff TE, Toby EB, Fischer KJ. Does SL Ligament Injury Adversely Alter In Vivo Wrist Joint Mechanics? An MRI-based Modeling Study. Proceedings of the 59<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, San Antonio, TX, January 26-29, 2013.
- **Johnson JE**, Lee P, McIff TE, Toby EB, Fischer KJ. Finite Element Analysis of In Vivo Radiocarpal Contact Mechanics Resulting from Scapholunate Ligament Injury. American Society of Mechanical Engineers Summer Bioengineering Conference, Fajardo, PR, June 20- 23, 2012.
- **Johnson JE**, Lee P, McIff TE, Toby EB, Fischer KJ. Comparing Finite Element and Contact Modeling Techniques to Evaluate Radiocarpal Joint Mechanics. Proceedings of the 58<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, San Francisco, CA, February 4-7, 2012.
- **Johnson JE**, Lee S-P, McIff TE, Toby EB, Fischer KJ. Effects of Surgical Repair or Reconstruction on Radiocarpal Mechanics from Wrists with Scapholunate Injury. American Society of Mechanical Engineers Summer Bioengineering Conference, Farmington, PA, June 22-25, 2011.
- **Johnson JE**, Lee S-P, McIff TE, Toby EB, Fischer KJ. Radiocarpal Mechanics from Injured Wrists with Scapholunate Dissociation Compared to Contralateral Controls. 19<sup>th</sup> Annual Symposium on Computational Methods in Orthopaedic Biomechanics, Long Beach, CA, January 12, 2011.
- **Johnson JE**, Fischer KJ. Effect of Initial Manual Registration on the Final Results of Image Registration on Kinematics and Contact Analyses in the Radiolunate Joint. American Society of Biomechanics Meeting, Providence, RI, August 18-21, 2010.
- **Johnson JE**, Fischer KJ. Effect of Initial Manual Registration on the Final Results of Image Registration for Kinematics. The 10th Annual New Technology in Upper Extremity Surgery: The Cutting Edge combined with the 7th Triennial International Hand and Wrist Biomechanics Symposium, Cleveland, OH, June 21-23, 2010.
- **Johnson JE**, McIff TE, Lee S-P, Toby EB, Fischer KJ. Validation of Radiocarpal Joint Contact Models Based on Images from a Clinical MRI Scanner. Proceedings of the 55<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, Las Vegas, NV, February 22-25, 2009.
- **Johnson JE**, McIff TE, Fischer KJ. Peripheral Nerve Strain: A Comparison of Strain Measuring Techniques. American Society of Mechanical Engineers Summer Bioengineering Conference, Marco Island, FL, June 25-29, 2008.