



## CARL JEWELL, Ph.D.

### PROFESSIONAL BIOGRAPHICAL OUTLINE

#### BACKGROUND

Dr. Jewell received a Bachelor of Science in Kinesiology from the University of Massachusetts Amherst. He went on to obtain a Master of Science degree, as well as his Ph.D., in Kinesiology from the University of Massachusetts Amherst. His scientific research has focused on studying the biomechanics behind human movement, sport performance, and mechanisms of injury. Dr. Jewell's graduate study focused on gait mechanics and the influence of muscle activity on the forces experienced throughout locomotion, especially in regards to chronic and acute knee injury. His research included 3-D motion analysis, electromyography, computational modeling, optimization, higher-dimensional analyses, metabolic testing, clinical and athlete testing, mechanical testing and musculoskeletal modeling. Dr. Jewell has completed advanced coursework in the fields of biomechanics, physics, engineering, dynamical systems, mathematics, anatomy, and exercise physiology.

Dr. Jewell has specialized in several research areas focused on studying all facets of human movement, injury, and performance. Currently, he specializes in injury biomechanics, focusing on injury mechanisms and tolerances based on analysis of available movement and force data, in addition to conducting product-based analysis for the design and implementation of sport protective equipment. He has used anthropometric test devices to quantify internal loading conditions resulting from both automotive and non-automotive scenarios. Dr. Jewell has participated in numerous engineering test programs at ARCCA, Inc. focused on how different automobile crash dynamics and occupant positions affect occupant responses. In addition, he has performed tests to evaluate the response of motor vehicle components to a variety of loading conditions.

#### SUMMARY OF EXPERIENCE

- Performed scientific investigations to evaluate the effects of footwear and knee bracing on walking and running mechanics in human volunteers
- Designed and performed experimental protocols to evaluate the influence of chronic and acute injury on movement and muscle activation patterns
- Adapted and applied higher order analysis methods to explore functional movement strategies in injured runners
- Conducted performance evaluations of Division 1 and professional athletes to both improve performance and assess injury risk
- Conducted impact and material testing to evaluate the mechanical performance of differing footwear types
- Currently uses peer-reviewed methods for accident reconstruction and evaluating automotive incident severity using several peer-reviewed and accepted methods
- Currently performs engineering test programs to evaluate the kinematic and kinetic responses of the human body when exposed to a variety of external loading conditions
- Currently conducts testing on protective sports equipment to evaluate design, performance, and risk of injury

## AREAS OF SPECIALTY

- Injury Causation Biomechanics
- Joint Biomechanics
- Gait Biomechanics
- Impact Biomechanics
- Human Kinematics and Kinetics Analysis and Testing
- Injury Mechanism Analysis
- Accident Reconstruction
- Biomechanical Consulting
- Sport Biomechanics
- Sport Equipment Testing

## EDUCATION

- Ph.D. in Kinesiology, University of Massachusetts, Amherst, MA, 2018
  - Dissertation: “The influence of patellofemoral pain on muscle coordination and segment coordination variability in runners”
- M.Sci. in Kinesiology, University of Massachusetts, Amherst, MA, 2014
  - Thesis: “Do footfall patterns in forefoot runners change over a prolonged run?”
- B.S. in Kinesiology, of Massachusetts, Amherst, MA, 2011
  - Honors Thesis: “Rearfoot and forefoot segment coupling during the stance phase of running”

## PROFESSIONAL EXPERIENCE

### September 2018 – Present | ARCCA, Incorporated | Senior Biomechanist

- Performs injury causation analysis using knowledge of anatomy, physics, and biomechanical principles.
- Specializes in crash injury analysis, injury mechanism determination, and crash kinematics
- Explores the relationship between accident kinematics and severity and human response.
- Uses and performs research involving human volunteers and anthropometric test devices to understand human responses to an event, injury mechanisms, and human tolerance.
- Performs sport and safety equipment testing and analysis.

### 2012 – August 2018 | University of Massachusetts | Biomechanics Research Assistant

- Supervisors: Joseph Hamill, Ph.D. & Katherine A. Boyer, Ph.D.
- Lead graduate researcher in charge of subject recruitment, data collection and analyses for comprehensive gait research with Brooks Running Company and Bayer, Inc. Wrote and presented technical reports on footwear research outcomes to Brooks staff and research on knee orthoses for Bayer, Inc.
- Contributed to lab research involving acute pain flares in individuals with osteoarthritis.
- Had ongoing roles in research with Cole Haan, LLC, and The Acushnet Company including mechanical shoe testing (impact, flex, torsion, heat) and in-shoe pressure measurement.

## 2009 – 2011 | University of Massachusetts | Undergraduate Biomechanics Research Assistant

- Supervisor: Joseph Hamill, Ph.D.

## 2010 | Baystate Medical Center | Summer Student Scholar

- Supervisor: Joseph Hamill Ph.D., Steven Malin, Ph.D., & Aryn Breveleri
- Paid, collaborative research internship for rising seniors and first year medical students

## TEACHING EXPERIENCE

### Lead Instructor

- Undergraduate Biomechanics (KIN430) 2014

### Teaching Assistant

- **Biomechanics (Kin430)**, Supervisor: Brian Umberger, Ph.D., 2011, 2017-Present
- **Anatomy & Physiology II (KIN272)**, Supervisor: Jennifer Gordon, Ph.D., 2015-2016
- **Introduction to Kinesiology (KIN100)**, Supervisor: Gary Kamen, Ph.D., 2014-2015
- **Head Teaching Assistant for Introduction to Kinesiology (Kin100)**, Supervisor: Gary Kamen, Ph.D., 2011-2013

## PEER REVIEWED PUBLICATIONS AND PRESENTATIONS

### Manuscripts

1. **Weir, G.**, van Emmerik, R., Jewell, C. & Hamill, J. (2019). Coordination and variability during anticipated and unanticipated sidestepping. *Gait & Posture*. 67: 1-8.
2. Wyatt, H., Weir, G., van Emmerik, R., **Jewell, C.**, & Hamill, J. (2019). Whole-body control of anticipated and unanticipated sidestep maneuvers in female and male team sport athletes. *Journal of Sport Sciences*. In press.
3. Weir, G., **Jewell, C.**, Wyatt, H., Trudeau, M.B., Rohr, E., Brüggemann, G.P., & Hamill, J. (2018). The influence of prolonged running and footwear on lower extremity biomechanics. *Footwear Science*.
4. **Jewell, C.**, Hamill, J., von Tscherner, V., Boyer, K. (2019). Altered multi-muscle coordination patterns in habitual forefoot runners during an exhaustive run. *European Journal of Sport Science* 1-10.
5. Wyatt, H., **Jewell, C.**, Weir, G., Boyer, K.A., & Hamill, J. (2018). Lower-limb coordination responses to knee bracing in females with anterior knee pain. *Sports Injuries and Medicine*. 1: 1-8.
6. Willwacher, S., Fischer, K.M., Dill, S., Schrodter, E., Trudeau, M.B., Rohr, E., **Jewell, C.**, Hamill, J., Brüggemann, G-P. (2018) Footwear effects on free moment application in running. *Footwear Science* 10:1, 57-68.
7. Boyer, K.A., Johnson, R.T., **Jewell, C.**, Banks, J.J., Hafer, J.F. Systematic review and meta-analysis of gait mechanics in young and older adults. *Experimental Gerontology*, Sept, 95: 63-70.

8. Trudeau, M.B., **Jewell, C.**, Fischer, K.M., Hamill, J., Brüggemann, G.P., Rohr, E. (2017). The calcaneus adducts more than the shoe's heel during running. *Footwear Science* 9:2, 79-85.
9. **Jewell, C.**, Boyer, K.A., Hamill, J. (2016). Do footfall patterns in forefoot runners change over an exhaustive run? *Journal of Sports Sciences*: 1-7.

### Conference Abstract and Podium Presentations

1. **Jewell, C.**, von Tscharnner, V., Boyer, K.A. The effects of an exhaustive run on multi-muscle patterns in forefoot runners. NEACSM Annual Meeting, Providence, RI, October 16, 2015.
2. **Jewell C.**, Weir, G., Boyer, K.A., Hamill, J. Muscle activation strategies during an unanticipated stopping task. In proceedings of the 35th International Conference on Biomechanics in Sports, Cologne, Germany, June 14-18th, 2017.
3. **Jewell, C.**, Weir, G., Hamill, J., & Boyer, K.A. The influence of patellofemoral pain on coordination variability over a prolonged treadmill run. In proceedings of the 36th International Conference on Biomechanics in Sports, Auckland, New Zealand, September 10-14, 2018. Presented by Professor Joseph Hamill, PhD.

### Conference Abstract and Poster Presentations

1. **Jewell, C.**, Hamill, J., Boyer, K.A. The influence of a tri-axial hinged knee brace on muscle activity distribution in healthy individuals. In proceedings of the XXV Congress of the International Society of Biomechanics, Brisbane, Queensland, Australia, July 23-27th, 2017.
2. **Jewell, C.**, Trudeau, M.B., Rohr, E., Brüeggemann, G-P, Willwacher, S., Fischer, K., Hamill., J. Calcaneal movement measured by skin versus shoe-mounted markers. 13th biennial Footwear Biomechanics Symposium, Gold Coast, Queensland, Australia, July 20-22nd, 2017.
3. **Jewell, C.**, Rohr, E., Hamill, J., Boyer, K.A. Which is the primary factor influencing running stride parameters: age or lower limb strength? 40th Annual Meeting of the American Society of Biomechanics, Raleigh, NC, August 2-5th, 2016.
4. **Jewell, C.**, Rohr, E., Hamill, J., Boyer, K.A. Which is the primary factor influencing running stride parameters: age of lower limb strength? 19th Annual School of Public Health and Health Sciences Research Day, University of Massachusetts Amherst, April 5th, 2016.
5. **Jewell, C.**, von Tscharnner, V., Boyer, K.A. The effects of an exhaustive run on multi-muscle patterns in forefoot running. 39th Annual Meeting of the American Society of Biomechanics, Columbus, OH, August 5-9th, 2015.
6. **Jewell, C.**, Von Tscharnner, V., Boyer, K. The effects of an exhaustive run on multi-muscle patterns in forefoot runners. 18th Annual School of Public Health and Health Sciences Research Day, University of Massachusetts Amherst, April 6th, 2015.
7. **Jewell, C.**, Boyer, K., Hamill, J. Does footfall pattern in forefoot runners change over a prolonged run? 7<sup>th</sup> World Congress of Biomechanics, Boston, MA, July 8th, 2014.
8. **Jewell, C.**, Boyer, K., Hamill, J. Changes in the vertical ground reaction force component in forefoot runners over the course of a prolonged, intensive run. Graduate Life Sciences Research Symposium, University of Massachusetts Amherst, November 22nd, 2013.

## Scientific Abstracts

1. Weir, G., **Jewell, C.**, Wyatt, H., Trudeau, M.B., Rohr, E., Brüggemann, G.P., & Hamill, J. The influence of prolonged running and footwear on lower extremity biomechanics. In proceedings of the 42nd Annual Meeting of the American Society of Biomechanics, Rochester, Minnesota USA, August 8-12, 2018.
2. Weir, G., **Jewell, C.**, Trudeau, M.B., Rohr, E., Brüggemann, G.P., & Hamill, J. Runners deviate from their habitual motion path during a prolonged treadmill run. In proceedings of the 8th World Congress of Biomechanics, Dublin, Ireland, July 8-12, 2018.
3. Weir, G., **Jewell, C.**, Hamill, J. Running and stopping in sport: implications for injury. 26th International Conference of Biomechanics, Brisbane, Queensland, Australia, July 23-27th, 2017.
4. Amado, A., **Jewell, C.**, Van Emmerik, R.E.A., Hamill, J. Coordinative variability in forefoot runners during an exhaustive run. In proceedings of the 35th International Conference on Biomechanics in Sports, Cologne, Germany, June 14-18th, 2017.
5. Weir, G., **Jewell, C.**, Hamill, J. Lower extremity coordination variability during anticipated and unanticipated sidestepping: implications for ACL injury prevention. In proceedings of the 35<sup>th</sup> International Conference on Biomechanics in Sports, Cologne, Germany, June 14-18th, 2017.
6. Boyer, K.A., **Jewell, C.**, Hafer, J.F. Role of knee mechanics in exercise induced osteoarthritis pain flares. Thematic poster. 40th Annual Meeting of the American Society of Biomechanics. Raleigh, NC, August 2-5th, 2016.
7. Boyer, K.A., **Jewell, C.**, Hafer, J.F. Impacts of age, inactivity and knee osteoarthritis on movement coordination in walking. World Congress on Osteoarthritis. Osteoarthritis Research Society International. Amsterdam, NL. Published in Osteoarthritis and Cartilage, Vol. 24, S102-S103.
8. Boyer, K.A., **Jewell, C.**, Hafer, J. Gait response to an acute physical activity stimulus in individuals with osteoarthritis pain. 25th Congress of the International Society of Biomechanics, Glasgow, Scotland, July 12-16th, 2015.
9. Boyer, K.A., **Jewell, C.**, Hafer, J.F. Gait adaptations to exercise-induced flares of osteoarthritis related knee pain. Osteoarthritis Research Society International, Seattle, WA, 2015.
10. Hartman, E., Desmond, A., Jones, S., **Jewell, C.**, Kent, J. Quantification of Rapid Repetitive Movements by Manual Counting and Force Platform Analysis. American College of Sports Medicine Annual Meeting, San Diego CA, May 31-June 4th, 2015.
11. Hartman, E., Desmond, A., Jones, S., **Jewell, C.**, Kent, J. Quantification of Rapid Repetitive Movements by Manual Counting and Force Platform Analysis. Presented at the New England American College of Sports Medicine Fall Meeting, Providence RI, November 2014.
12. Berthaume, M.A., Shaw, C., **Jewell, C.**, Hamill, J., Ryan, T.M., Holt, B. (2013) Were Neandertal humeri adapted for spear thrusting or throwing? A finite element analysis study. Submitted for AAPA meeting 2014.
13. Gruber, A.H., **Jewell, C.**, del Pilar, S., Hamill, J. (2011) Foot Segment Rotations During Rearfoot and Forefoot Running. Proceedings of the XXIII Congress of the International Society of Biomechanics, July 3-7th, 2011.
14. Gruber, A.H., Umberger, B.R., **Jewell, C.**, del Pilar, S., Hamill, J. (2011) Achilles Tendon Forces in Forefoot and Rearfoot Running. Proceedings of the American Society of Biomechanics Annual Meeting, August 10-13th, 2011.

## PROFESSIONAL MEMBERSHIPS (Past and current)

- American Society of Biomechanics (ASB)
- New England Chapter of the American College of Sports Medicine (NEACSM)
- International Society of Biomechanics (ISB)
- International Society of Biomechanics in Sports (ISBS)
- Footwear Biomechanics Group
- Society of Automotive Engineers (SAE)

## PROFESSIONAL SERVICE

Manuscript review (Ad hoc):

- The Foot
- The Knee
- Medicine and Science in Sports and Exercise
- PLOS ONE
- Journal of Applied Biomechanics
- Part P: Journal of Sports Engineering and Technology

## SCHOLARSHIPS & AWARDS

- School of Public Health and Health Sciences Dean's Summer PhD Fellowship - \$7,000, 2018
- Department of Kinesiology Graduate Travel Award - \$500, 2018
- De Luca Foundation Scholarship - \$13,154, 2018
- ISBS Student Travel Grant - €200, 2017
- ISBS New Investigator Award Finalist, 2017
- UMass Graduate School Dissertation Research Grant - \$1000, 2016
- Department of Kinesiology Graduate Travel Award - \$325, 2015
- NEACSM President's Cup Doctoral Finalist, 2015
- Research Poster Competition: First Place, 18th Annual School of Public Health Research Day, 2015
- Commonwealth College Honors Scholarship, 2007-2011
- Eight Time Dean's List Member, 2007-2011
- 400 Club Member: Athletes with 4.0 GPA, 2008-2010
- Baystate Summer Student Scholar, 2010