

BIOGRAPHICAL SKETCH

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NAME: Glenn N. Williams, PT, PhD, ATC

eRA COMMONS USER NAME: WILLIAMSGN

POSITION TITLE: Associate Professor & Department Chair

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
The Kings College, Briarcliff Manor, NY	BS	1992	Physical Education
Baylor University, Waco, TX	MPT	1994	Physical Therapy
University of Delaware, Newark, DE	PhD	2004	Biomechanics & Movement Science

A. Personal Statement

My research focuses on understanding the adaptations that occur after joint injuries and in response to surgery and-or rehabilitation after these injuries. My overall goal is to improve rehabilitation, clinical outcomes, and the quality of life of people who sustain joint injuries or develop knee osteoarthritis. My current research primarily focuses on anterior cruciate ligament (ACL) and meniscus injuries. I study structural and physiological plasticity of the musculoskeletal and nervous systems, associated changes in human movement and performance, related biopsychosocial adaptations, and the interactions between these parameters.

I've been fortunate to collaborate with leading experts in physical therapy, sports medicine, and orthopaedic biomechanics through my career. Example NIH-funded collaborations include work with the Multicenter Osteoarthritis Study (MOST), the Multicenter Orthopaedic Outcomes Network (MOON Group), the NIAMS CORT on Post-Traumatic Osteoarthritis, and research early in my career with Dr. Lynn Snyder-Mackler and Dr. Tom Buchanan at the University of Delaware. I am also a member of the first cohort of Comprehensive Opportunities in Rehabilitation Research (CORRT) scholars, an NIH funded training award (K12 HD055931).

Over the last several years I've performed a series of clinical and applied research studies related to neuromuscular plasticity after ACL reconstruction and meniscus surgery, particularly early after injury. This innovative work has produced a wealth of novel data that are expected to be influential in advancing the treatment of knee injuries. Papers from this body of work are beginning to emerge and will continue to be published for the next few years.

I'm excited about developing new collaborations at Drexel University and with clinicians and scientists in the greater Philadelphia region. I'm confident that my best work is yet to come and committed to making a difference through innovative science that's practical, influential, and ambitious.

B. Positions and Honors**Positions**

1992-1999	U.S. Army Officer, Army Medical Specialist Corps
1994-1996	Staff Physical Therapist, Keller Army Community Hospital, West Point, NY
1996-1997	Director, Cadet Physical Therapy Clinic, West Point, NY
1997-1999	Director, Physical Therapy Service, Kirk Army Health Clinic, Aberdeen Proving Grounds, MD
1999-2003	Research Asst. to Professor Thomas S. Buchanan, PhD, University of Delaware, Newark, DE
2003-2012	Assistant Professor, Physical Therapy & Rehabilitation Science, University of Iowa, Iowa City
2004-2012	Assistant Professor, Orthopaedics & Rehabilitation, University of Iowa, Iowa City, IA
2012-2016	Associate Professor, Physical Therapy & Rehabilitation Science, University of Iowa, Iowa City

2012-2016 Associate Professor, Orthopaedics & Rehabilitation, University of Iowa, Iowa City, IA
2016- Associate Professor & Department Chair, Physical Therapy & Rehabilitation Sciences, Drexel University, Philadelphia, PA

Other Experience and Professional Memberships

1993- Member, American Physical Therapy Association
2002- Member, National Athletic Trainer's Association
2003- Member, American College of Sports Medicine
2003- *Ad Hoc* Review for ~15 of the highest ranked journals in Rehabilitation, Sports Science, Orthopedics, Medicine, Clinical Neurology, and Engineering

Honors

1992 The President's Award (top graduate in major), The King's College
2000 New Horizon Award, Sports Physical Therapy Section, APTA
2002 O'Donoghue Sports Injury Research Award, American Orthopaedic Society for Sports Medicine
2002 University of Delaware Competitive Graduate Fellowship
2003 Best Scientific Poster (Sports Medicine), American Academy of Orthopaedic Surgeons
2003 Young Scientist Award, American Society of Biomechanics
2004 Hughston Award, American Orthopaedic Society for Sports Medicine
2006 Advisor, L.B. Sims Distinguished Thesis Award, University of Iowa
2008 Clinical Research Award, Iowa Physical Therapy Association
2008-12 CORRT K12 Scholar/Trainee, NIH funded

C. Contributions to Science

1. My early research and corresponding papers focus on injury epidemiology, developing practical, valid clinical outcomes measurement tools, and measuring clinical outcomes after musculoskeletal injury. Pioneering work at the United States Military Academy at West Point (USMA) led to new knowledge on: 1) factors that predispose people to ACL injuries, 2) the incidence and outcomes of ankle sprains, and 3) clinical outcomes measurement in people with shoulder pathology. Our research team evaluated an entire USMA cadet class for factors that may contribute to non-contact ACL injuries and followed the cadets throughout their tenure at West Point. We successfully identified factors that predisposed males (narrow notch width, i.e., small ACL size) and females (narrow notch width, hyperflexibility, high BMI) to non-contact ACL tear. The resulting paper, which I "penned", won the AOSSM's O'Donoghue Sports Injury Research Award and the Hughston Award as well. We also studied the epidemiology of ankle sprains in this period and published another important paper on persistent disability after ankle sprains. This paper highlighted the prevalence of persistent disability after ankle sprains and showed that disability is common regardless of the severity of the initial injury. This paper also presented new insights on syndesmosis ankle sprains and their prognosis. In addition, we developed and validated a series of practical clinical outcomes measurement tools for the knee, shoulder, and ankle. My work on global ratings (i.e., the SANE rating) in people with ACL injuries, shoulder instability, or ankle sprains was particularly well received. The validity of the SANE rating has been verified by several other research groups. This measure is now being used in NIH-funded research and is one of the American Academy of Orthopaedic Surgeon's recommended outcome measures. According to Google Scholar, the three papers below have been cited over 1200 times, supporting the high impact of this work.

- a. Gerber JP, **Williams GN**, Scoville CR, Arciero RA, and Taylor DC: Persistent Disability Associated with Ankle Sprains: A Prospective Examination of an Athletic Population. *Foot & Ankle International*, 1998, 19(10):653-60. PMID: 9801078
- b. **Williams GN**, Gangel TJ, Arciero RA, Uhorchak JM, and Taylor DC: Comparison of the Single Assessment Numeric Evaluation Method and Two Shoulder Rating Scales: Outcome Measures After Shoulder Surgery. *American Journal of Sports Medicine*, 1999, 27(2):214-221. PMID:10102104
- c. Uhorchak JM, Scoville CR, **Williams GN**, Arciero RA, St. Pierre P, Taylor DC: Risk Factors Associated with Non-Contact Injury of the ACL Ligament: A Prospective four-year Evaluation of 859 West Point Cadets. (*O'Donoghue Sports Injury Award Paper*). *American Journal of Sports Medicine*, 2003, 31(6):831-842. PMID: 14623646.

2. Neuromuscular plasticity after ACL injury and related treatment is a primary research focus for me. The quadriceps muscles are preferentially affected by ACL injury. Significant atrophy, altered quadriceps muscle control, and abnormal movement biomechanics are experienced by most people who experience an ACL tear. My research has given scientists and clinicians important insight on the amount of and distribution of thigh and leg muscle atrophy after an ACL injury. I have also provided insight on how quadriceps muscle control changes with ACL injury and the association of these changes in control with muscle atrophy after injury. Prior to my work, the predominant thinking was that rehabilitation should focus on hamstrings muscle strength and control because the hamstrings muscles act restraints to the increased anterior knee translation associated with ACL injuries. My research showed that poor quadriceps control is a larger issue than hamstrings control. People who are able to cope with an ACL injury are unique in that they display little quadriceps atrophy and maintain their quadriceps control. Conversely, those who cannot cope with an ACL injury usually have significant quadriceps atrophy and poor quadriceps muscle control. These insights are important in designing and advancing ACL rehabilitation programs. In another harvested for ACL reconstruction. The semitendinosus and/or gracilis tendons regrow in about 50% of people who undergo ACL reconstruction with hamstrings autografts. When the tendon regrowth stalls, the semimembranosus and biceps femoris muscles typically hypertrophy to compensate for donor site morbidity. It's unclear if this compensatory hypertrophy impacts long-term knee health. More recently I've performed groundbreaking work on adaptations in the thigh muscles during the first 6-weeks after ACL surgery. I also piloted a treatment approach directed at minimizing quadriceps atrophy after ACL injury and surgery. These are significant developments. Papers from this more recent work are just beginning to emerge.

- a. Krishnan C, **Williams GN**: Factors explaining Chronic Knee Extensor Strength Deficits after ACL Reconstruction. *Journal of Orthopaedic Research*, 2011, 29(5):633-40. PMID: 21246615. PMCID: PMC4527967.
- b. **Williams GN**, Chmielewski T, Rudolph KS, Buchanan TS, Snyder-Mackler L: Dynamic Knee Stability: Current Theory and Implications for Clinicians and Scientists. *Journal of Orthopaedic & Sports Physical Therapy*, 2001, 31(10):546-566. PMID: 11665743
- c. **Williams GN**, Snyder-Mackler L, Barrance PB, Axe MJ, Buchanan TS: Quadriceps Weakness, Atrophy, and Activation Failure in Predicted Noncopers after Anterior Cruciate Ligament Injury. *American Journal of Sports Medicine*, 2005, 33(3):402-407. PMID: 15716256
- d. **Williams GN**, Snyder-Mackler L, Barrance PB, Buchanan TS: Quadriceps Femoris Muscle Morphology and Function after ACL Injury: a differential response in copers versus non-copers. *Journal of Biomechanics*, 2005, 38(4):685-693. PMID: 15713288
- e. **Williams GN**, Snyder-Mackler L, Barrance PB, Axe MJ, Buchanan TS: Muscle and Tendon Morphology after Reconstruction of the anterior cruciate ligament with Autologous Semitendinosus-Gracilis Graft. *Journal of Bone & Joint Surgery*, 2004, 86-A (9):1936-1946. PMID:15342756

3. I've made significant contributions to science in the area of ACL rehabilitation. My careful study of ACL injury epidemiology and neuromuscular plasticity after ACL injury, expertise as a sports physical therapist and athletic trainer, knowledge of biomechanics, and experience treating several hundred people with ACL injuries has enabled me to be a leader in ACL rehabilitation. I worked with a team of researchers in the Multi-center Orthopaedic Outcomes Network (MOON Group) to critically review the literature and examine the basis for ACL rehabilitation. We used this systematic research to develop evidence-based ACL rehabilitation guidelines; I "penned" the guidelines. These ACL rehabilitation guidelines have been used in two MOON NIH RO1 studies with over 5,000 patients enrolled. The MOON ACL rehabilitation guidelines and associated systematic reviews are published and readily available. A quick internet search will show the prominence of these guidelines and the impact of the MOON Group's work. These guidelines are considered the gold standard by many clinicians.

- a. Wright RW, Haas AK, Anderson J, Calabrese G, Cavanaugh J, Hewett TE, Loring D, McKenzie C, Preston E, **Williams GN**, and the MOON Group. Anterior Cruciate Ligament Reconstruction Rehabilitation: MOON Guidelines. *Sports Health*. 2015, 7(3):239-243. PMID: 26131301.
- b. Wright RW, Preston E, Fleming BC, Amendola A, Andrich J, Bergfeld J, Dunn WR, Kaeding C, Kuhn JE, Marx RG, McCarty EC, Parker RC, Spindler KP, Wolcott M, Wolf, BR, **Williams GN**: A Systematic Review: of anterior cruciate ligament reconstruction rehabilitation: Part I: continuous passive motion, early weight bearing, postoperative bracing, and home-based rehabilitation. *Journal of Knee Surgery*, 2008, 21(3):217-224. PMID: 18686484. PMCID: PMC3692363.

- c. Wright RW, Preston E, Fleming BC, Amendola A, Andrish J, Bergfeld J, Dunn WR, Kaeding C, Kuhn JE, Marx RG, McCarty EC, Parker RC, Spindler KP, Wolcott M, Wolf, BR, **Williams GN**: A Systematic Review of anterior cruciate ligament reconstruction rehabilitation: Part II, open versus closed kinetic chain exercises, neuromuscular electrical stimulation, accelerated rehabilitation, and miscellaneous topics. *Journal Knee Surgery*, 2008, 21(3):225-234, PMID:18686485. PMCID: PMC3692368.

List of Published Work in MyBibliography

<https://www.ncbi.nlm.nih.gov/sites/myncbi/1XQoel-Ujck/bibliography/40037348/public/?sort=date&direction=descending>

D. Additional Information: Research Support and/or Scholastic Performance

Completed Research Support

K12 HD055931 (NIH/NCMRR-NICHD) 2008-2012

Novel Assessment & Treatment of Quadriceps Atrophy after Knee Injury

Role: Scholar/Trainee

This is a competitive career development award through the *Comprehensive Opportunities in Rehabilitation Research* K12 program (PI: Mueller, M; Wash. U.–St. Louis), which provides similar funding to a KO1 award. My research plan is directed at studying the adaptations in quadriceps muscle after knee joint trauma using MRI, muscle physiology tests, neurophysiological testing. The project is aimed at obtaining preliminary data from interventions aimed at minimizing quadriceps atrophy, weakness, & neuromuscular control deficits. Salary support through this mechanism ended in 2010, but protected time continued for 5 years.

P50 AR055533 (NIH/NIAMS) 2007-2012

New Approaches to Assess and Forestall Osteoarthritis in Injured Joints

Role: Co-investigator (PI: Joseph A. Buckwalter)

This project tests the validity of novel MRI imaging sequences (T1 ρ , T2, dGEMRIC) thought to be imaging biomarkers of early cartilage degeneration using prospective evaluation of people with acute ACL injuries. The project also includes a novel clinical trial investigating the effects that weightbearing early after ACL injury and reconstruction have on cartilage and muscle health using advanced imaging and tests of muscle physiology.

Quadriceps Muscle Activation Failure after ACL injury & Reconstruction 2009-2011

Role: Principal Investigator

NFL Charities Medical Research Grants

The aim of this project is to establish the relationship between quadriceps activation impairment and quadriceps muscle atrophy, weakness, and neuromuscular control deficits. We are also defining the relationship between quadriceps activation impairment, pain, and the volume of knee joint effusion present in the early period after ACL injury/reconstruction. Finally, we are testing the effect of early intervention on quadriceps activation impairment in the ACL injury/reconstruction model. Publication, presentations, and follow-on grant applications from this work are now in process.

High Intensity Exercise & NMES after Arthroscopic Partial Meniscectomy 2009-2015

Role: Principal Investigator

DJO, Inc.

This project is a prospective randomized clinical trial investigating the early high intensity voluntary exercise combined with neuromuscular electrical stimulation as a method of minimizing quadriceps muscle atrophy and related dysfunction after arthroscopic partial meniscectomy. In addition to the interventions, the association between the volume of knee joint effusion and pain in the early period after surgery are being evaluated with respect to the magnitude of quadriceps muscle atrophy, weakness, and control deficits.