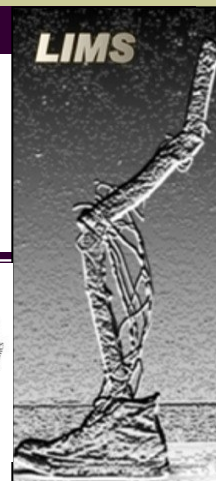


# La Crosse Institute For Movement Science (LIMS)

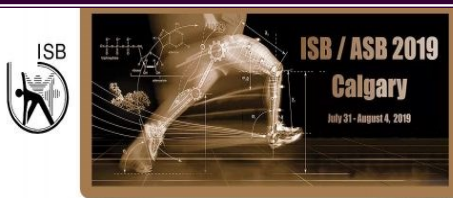
Thomas Kernozek, PhD, FACSM, Director



The Institute was created in 2005 at the University of Wisconsin—La Crosse in the Department of Health Professions, Physical Therapy Program. LIMS brings together scientists and clinicians from various disciplines seeking applied knowledge related to human movement, factors related to injury, and in the foundations of therapeutic exercise used in the treatment and rehabilitation of injury.

Each year over 40 students from graduate and undergraduate programs from the UW-L campus are involved in laboratory research including Physical Therapy, Exercise and Sport Science, Physics, and Biology. High-technology funding from the State of Wisconsin supports 8 Physics Biomedical student internships in the laboratory.

Due to the many publications from the clinical biomechanics laboratory, LIMS has developed a national/international reputation.



Tom Kernozek, PhD, Drew Rutherford, MS, and Naghmeh Gheidi, PhD, represented LIMS at the International Society of Biomechanics/American Society of Biomechanics Meeting in Calgary, Alberta. Two platform presentations were presented by Kernozek, one by Gheidi and a poster by Rutherford.

**Effects of added load on patellofemoral joint stress in running,**  
Kujawa, M, Goerlitz, A. Rutherford, D, Kernozek, T.

**Effect of Running Velocity on Patellofemoral Joint Stress,** Gheidi, N., Kernozek, T, Guhl, M, Ertman, B.

**ACL tension during training activities for return to sport,** Willson J, Meardon, S, Rutherford, D, Kernozek, T.

**Patellofemoral joint loading during forward and backward lunges,** Schiller, M, Goulette, D, Durall, C, Kernozek, T, Rutherford, D.

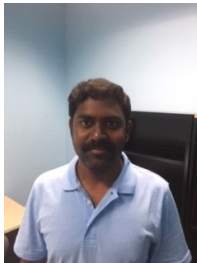
Co-authors: Molly Kujawa, Aleyna Goerlitz, Michael Schiller, Jeremie Schiedermayer, and Jess Onsager were recent graduates of the UWL Physical Therapy Program. Bryce Ertman, Maria Lee, Brett McCutchin, Jackie Cleereman and Danielle Goulette are current UWL Physical Therapy graduate students. Chris Durall is with the UWL Student Health Center. John Willson and Stacey Meardon are collaborators from East Carolina University Physical Therapy Program.

## Two new faculty join LIMS

Thomas "Gus" Almonroeder, PT, DPT, PhD and Kanikkai Steni Balan Sackiriyas, PT, DSc have joined the Physical Therapy faculty and LIMS. Dr. Almonroeder's background is in biomechanics and motor control. His research has focused on common acute and overuse lower extremity sports injuries (e.g. ACL tears, patellofemoral pain). He has specifically focused on how the cognitive demands of sports and the cognitive attributes of athletes (e.g. reaction times), influence movement control and how this may contribute to injury risk. Dr. Almonroeder will continue this work with LIMS and will also focus on developing novel approaches to more effectively re-train athletes to adopt safer movement patterns. These efforts will include both uninjured athletes and athletes who are rehabilitating following injury.



Kanikkai "Steni" Balan Sackiriyas, PT, DSc, background is in Physical Therapy, Orthopaedics, and Geriatrics. Dr. Sackiriyas is an Associate Member of the Federation of State Boards of Physical Therapy (FSBPT). His research has focused on musculoskeletal injuries (running injuries) and increasing circulation in healthy individuals and people with diabetes. Dr. Sackiriyas will focus on developing novel approaches to decrease or predict risk for falls, improve safer movement patterns and interventions in athletes in minimizing sports-related musculoskeletal injuries.



**Interested in being a participant or working with LIMS?**

Contact Drew Rutherford, MS, [drutherford@uwlax.edu](mailto:drutherford@uwlax.edu) or Tom Kernozek, PhD [tkernozek@uwlax.edu](mailto:tkernozek@uwlax.edu) for details



## LIMS Scientists

**Thomas "Gus" Almonroeder**, DPT, PhD Motor Control/Biomechanics (Health Professions),

**Chris Durall**, DPT, ATC, MSPT Clinical Researcher, (UW-La Crosse Health Center),

**John Greany**, PT, PhD, Exercise Physiologist, (Health Professions),

**Thomas Greiner**, PhD, Biological Anthropologist, (Health Professions),

**Naghmeh Gheidi**, PhD, Biomechanist, (Assistant Professor, Exercise & Sport Science),

**Becky Heinert**, MSPT, SCS, (Gundersen Sports Medicine),

**Tom Kernozek**, PhD, FACSM, Biomechanist, (Health Professions),

**Patrick Grabowski**, PT, PhD, OCS, CSCS, Motor Control/Biomechanics, (Health Professions),

**Drew Rutherford**, MS, Laboratory Manager/Engineer (Health Professions),

**Nate Vannatta**, DPT, SCS, (Gundersen Sports Medicine),

**Robert Ragan**, PhD, Computational Physicist (Physics),

**Kanikkai "Steni" Sackiriyas**, PT, DSc, Clinical Biomechanics (Health Professions)





## Sports Medicine active in clinical research at UW-La Crosse



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HEALTH SYSTEM®

Female athletes have a 2-8 times greater incidence of anterior cruciate ligament (ACL) injury. LIMS innovative portable force platform system is being used to screen and train high school and college athletes to prevent knee injury. We have traveled to schools and universities in our region to evaluate and train female athletic teams.

Due to our partnership with Becky Heinert, MS, PT, SCS from Gundersen Health System we have screened and trained over 200 high school and collegiate athletes during landing activities. Our approach utilized LIMS developed technology coupled with motor learning principles that use immediate post-trial feedback of performance to augment training. The LIMS system is completely portable so that we can go to schools. Assessment and training takes approximately 20 minutes per athlete.



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**Fast facts regarding LIMS commitment to UWL campus strategic mission of incorporating high impact practices such as capstone experiences, student writing and engaging in "field experiences".**

*Since 2005, over 80 graduate students (and some undergraduates) have been co-authors of LIMS research papers published in refereed journals in the fields of rehabilitation, sports medicine, and biomechanics.*

- Most were students in the graduate program in physical therapy

*In the last 5 years, 7 graduate students presented LIMS research at professional meetings in the fields of sports medicine, rehabilitation and biomechanics.*



May 28-June 1, 2019 • Orlando, Florida USA

Tom Kernozek, PhD, FACSM, and physical therapy graduate student Maria Lee attended the American College of Sports Medicine Meeting in Orlando, FL in May/

June. Three posters were presented at the 2019 annual meeting:

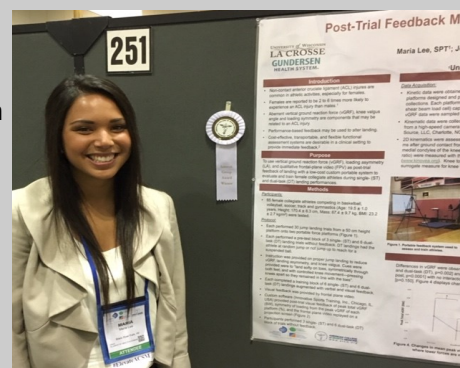
**Post-trial feedback may alter single and dual task landing performance in female collegiate athletes.** Lee, M, Onsager, J, Schiedermayer, J, Heinert, B, Rutherford, D, Kernozek, T.

**Post-trial feedback alters single and dual task landing performance in healthy and ACL reconstructed athletes.** Mc Cutchin, Lee, M, Cleereman, J, Heinert, B, Rutherford, D, Kernozek, T.

**Achilles tendon stress and backward running.** Gheidi, N., Kernozek, T.

Maria Lee was awarded a Biomechanics Interest Group (BIG) Travel Award based on scientific merit. Congratulations to Maria! This was a BIG deal!

Becky Heinert is a clinical collaborator with Gundersen Health System. Maria Lee, Jackie Cleereman, Brett McCutchin are graduate students in Physical Therapy Program. Jessica Onsager and Jeremie Schiedermayer are graduates of the UWL Physical Therapy Program.



**New PACER Lab**

**What does PACER stand for? Performance Analysis for Clinical Exercise and Running**

**What are the plans for the PACER lab?** The PACER lab houses a split belt instrumented treadmill. This is no ordinary treadmill which weighs approximately

1,800 lbs! The treadmill has two force plates embedded below the belt that can measure impact forces during a prolonged run. We also have a motion capture system in the PACER lab used to measure body and joint positions. These data together can be used to estimate joint and/or soft tissue loading. The display monitor in front of the treadmill will be used to deliver performance based feedback to alter the runner's biomechanics during training to attempt to prevent injury.



The treadmill arrived in late March where it was carefully moved into the new PACER lab in the basement (43 HSC). Research projects in this new lab will begin Fall 2019.



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**LIMS and the Gundersen Sports Medicine Residency Programs**

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**GUNDERSEN**  
HEALTH SYSTEM.

Sports Physical Therapy Residents, Michael Rodriguez and Sarah Menhennett, presented a platform presentation at the American Physical Therapy associations Combined Sections Meeting in Washington, DC (February, 2019):

- Rodriguez M, Menhennett S, Vannatta CN, Kernozek TW, & Rutherford D. Relationship Between Maximum Hip Isometric Strength, Peak Gluteal Muscle Force Values and Hip Kinematics During Running. *The Journal of Orthopedic and Sports Physical Therapy*. 2019;49(1):CSM30-62.

Family Medicine Resident, Laura Jacobson, presented a poster at the American Medical Society for Sports Medicine's Annual Conference in Houston, TX (April 2019):

- Jacobson L, Vannatta CN, Kernozek TW, Schuman C. Sex Differences in Patellofemoral Joint Stress During Running

Sports Physical Therapy Resident, Vien Vu, completed a study with local high schools examining the effects of completing multiple tasks on the ability to anticipate event timing as a possible indicator of injury risk:

- Vu V, Kovacs A, Wughalter E, Vannatta CN, Kernozek T. Effects of Ankle Sprains and Single versus Dual Task Paradigms on Coincidence Anticipation Performance in Female High School Basketball Players. Findings were presented at Gundersen's Academic Day and the WPTA's West Central District Meeting. An abstract has been submitted for consideration as a platform presentation at the 2020 APTA Combined Sections Meeting.

Sports Physical Therapy Resident, Danny Larson, completed a study examining muscle forces and joint kinetics between healthy controls and ACL reconstructed individuals during common return to sport tests:

- Larson D, Vannatta CN, Rutherford D, Kernozek T. Kinematic and Kinetic Alterations in Hop Tests Persist 1-3 Years Post ACLR in Females. Findings were presented at Gundersen's Academic Day and the WPTA's West Central District Meeting. An abstract has been submitted for consideration as a platform presentation at the 2020 APTA Combined Sections Meeting.

Sports Physical Therapist, Nathan Vannatta, is continuing a longitudinal study investigating biomechanical aspects of running gait and field tests which may differ between injured and uninjured runners. This project is in its fourth year of data collection and is beginning preliminary analyses. LIMS, in collaboration with Gundersen Health Systems' Sports Medicine Department has also begun work in the new PACER laboratory space where biomechanical aspects of running and exercise can be measured and provide state-of-the-art analysis and real time feedback to begin to study the most effective ways to deliver sport specific treatments for runners.



**Recently Published or In Press Research (2018-2019)**

Nutrient Intake Prior to Exercise Is Necessary for Increased Osteogenic Marker Response in Diabetic Postmenopausal Women. Borer KT, Zheng Q, Jafari A, Javadi S, Kernozek T. *Nutrients*. 2019 Jun 30;11(7). pii: E1494. doi: 10.3390/nu11071494.

Patellar tendon stress between two variations of the forward step lunge. Zellmer M, Kernozek TW, Gheidi N, Hove J, Torry M.J *Sport Health Sci*. 2019 May;8(3):235-241. doi: 10.1016/j.jshs.2016.12.005.

Sex differences in gluteal muscle forces during running. Vannatta CN, Kernozek TW. *Sports Biomech*. 2018 Dec 11:1-11. doi: 10.1080/14763141.2018.1548641. [Epub ahead of print]

The effects of habitual foot strike patterns on Achilles tendon loading in female runners. Kernozek TW, Knaus A, Rademaker T, Almonroeder TG. *Gait Posture*. 2018 Oct;66:283-287. doi: 10.1016/j.gaitpost.2018.09.016.

INFLUENCE OF ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION ON DYNAMIC POSTURAL CONTROL. Heinert B, Willett K, Kernozek TW. *Int J Sports Phys Ther*. 2018 Jun;13(3):432-440.

Achilles tendon loading during weight bearing exercises. Gheidi N, Kernozek TW, Willson JD, Revak A, Diers K. *Phys Ther Sport*. 2018 Jul;32:260-268. doi: 10.1016/j.ptsp.2018.05.007.

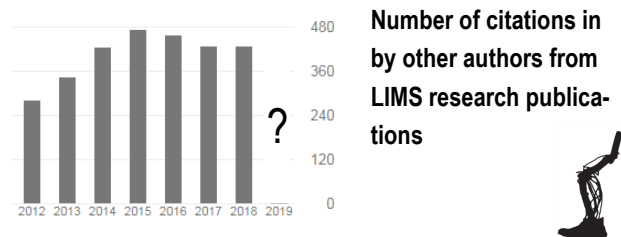
Impact kinetics associated with four common bilateral plyometric exercises. Stewart E, Kernozek T, Peng HT, Wallace B. *J Sports Med Phys Fitness*. 2019 Apr;59(4):575-580. doi: 10.23736/S0022-4707.18.08359-7.

Cognitive Demands Influence Lower Extremity Mechanics During a Drop Vertical Jump Task in Female Athletes. Almonroeder TG, Kernozek T, Cobb S, Slavens B, Wang J, Huddleston W. *J Orthop Sports Phys Ther*. 2018 May;48(5):381-387. doi: 10.2519/jospt.2018.7739.

Divided attention during cutting influences lower extremity mechanics in female athletes. Almonroeder TG, Kernozek T, Cobb S, Slavens B, Wang J, Huddleston W. *Sports Biomech*. 2019 Jun;18(3):264-276. doi: 10.1080/14763141.2017.1391327.

Effect of Posttrial Visual Feedback and Fatigue During Drop Landings on Patellofemoral Joint Stress in Healthy Female Adults. Olbrantz C, Bergelin J, Asmus J, Kernozek T, Rutherford D, Gheidi N. *J Appl Biomech*. 2018 Feb 1;34(1):82-87. doi: 10.1123/jab.2017-0074. Epub 2018 Feb 7.

Effects of Anterior Knee Displacement During Squatting on Patellofemoral Joint Stress. Kernozek TW, Gheidi N, Zellmer M, Hove J, Heinert BL, Torry MR. *J Sport Rehabil*. 2018 May 1;27(3):237-243. doi: 10.1123/jsr.2016-0197.



LIMS research continues to have national and international impact. The figure above shows the growth in the number of citations from other authors in acknowledging our work in their research.

Department of Health Professions, Physical Therapy Program

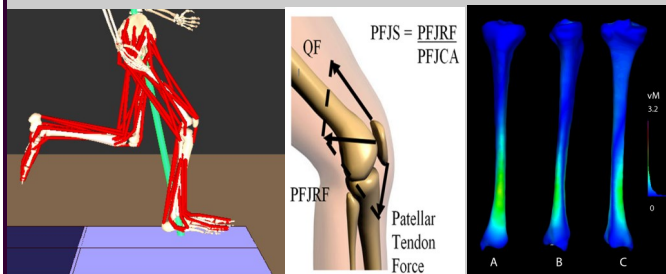
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LA CROSSE

**We measure movement performance!**

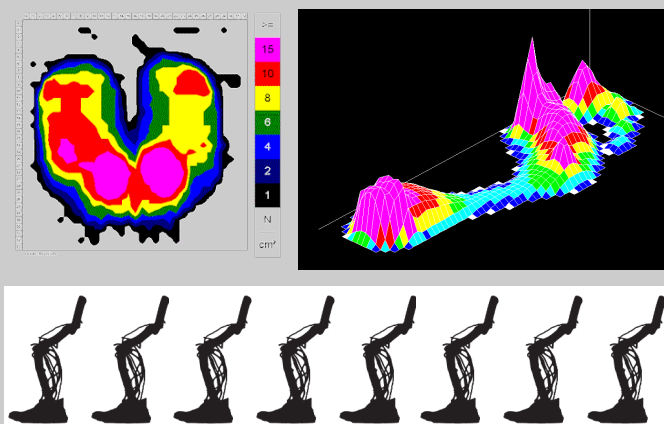
Our laboratories have sophisticated equipment that measure motion, impact forces, pressures on the feet or in seating, muscle activation, energy cost and heart rate, or for the imaging of tendons or soft tissue.

These data can be used to determine the loading on joints and muscles to give insight to how and why injuries may occur or for the improvement of performance to keep you active.

Musculoskeletal models are used to determine loading on bone, joints, ligaments, and tendons.



Pressure distribution measures show us the pressure points in seating or on your foot during walking or running.

**For more information contact:**

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**Check out  
LIMS on your  
smartphone!**