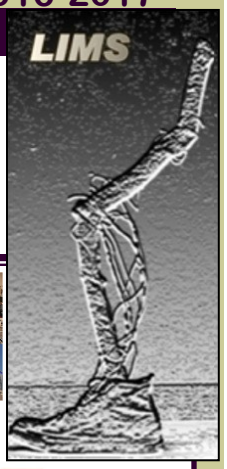
UNIVERSITY of WISCONSIN
LA CROSSE

2016-2017

La Crosse Institute For Movement Science (LIMS)

Thomas Kernozek, PhD, FACSM, Director

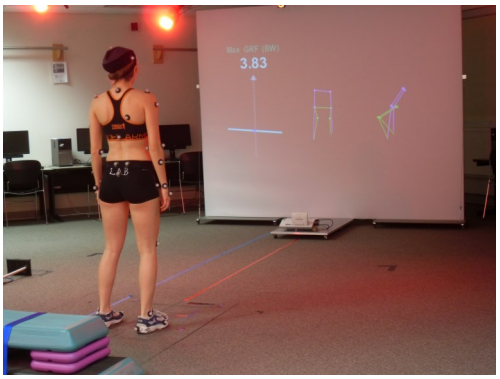


The Institute was created in 2005 at the University of Wisconsin—La Crosse in the Department of Health Professions, Physical Therapy Program. LIMS brings together scientists and clinicians from various disciplines seeking applied knowledge related to human movement, factors related to injury, and in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

LIMS continues to assess the use of performance based feedback for movement training



Motion capture and force platform data used on a visual display to examine the effectiveness of movement based training. Currently, the laboratory has several on-going studies on this topic where the performer used this data to alter their movement performance.

Interested in being a participant in a LIMS study?

Current research projects

Achilles Tendon loading in habitual forefoot and rearfoot runners

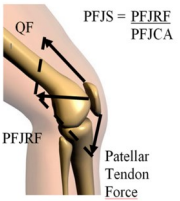
Validation of a new clinical instrument to assess landing mechanics and performance based feedback

Use of performance based feedback in reducing risky landing mechanics

Validation of a portable inshoe loading measurement system for running assessment

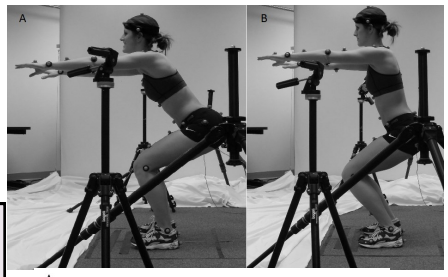
Please contact Drew Rutherford, MS, drutherford@uwlax.edu or Tom Kernozek, PhD tkernozek@uwlax.edu for details

Tom Kernozek, Naghmeh Gheidi, and Jordan Hove presented a paper titled "Patellofemoral joint stress during bodyweight squats with alterations in anterior knee displacement". This paper modeled the patellofemoral joint of the knee to calculate patellofemoral joint stress (PFJS). This is the load between the patella and femur as show in figure right. The model determines the patellofemoral joint reaction force (PFJRF) from estimates of quadriceps force (QF) derived from the performer's movement captured in the lab. Patellofemoral joint contact area (PFJCA) is based on how the patellar contact area changes with knee position from other studies. PFJS was calculated with a computer model based on these movement performances of our participants with two different squat techniques. One squat technique was performed with the participant keeping their knees behind their toes (SBT). The second squat technique allowed their knees to move forward past their toes (SPT). Cords between tripods were used as tactile feedback for body position as shown in the figure below.



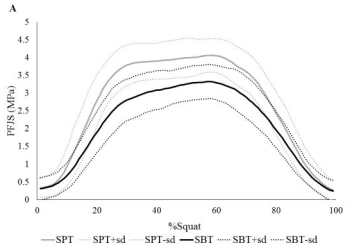
Two squat techniques performed.

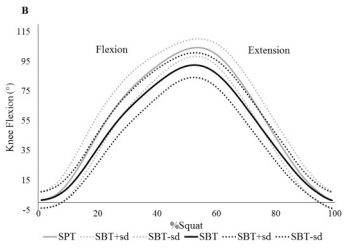
Figure A, Knees only allowed to move behind the toes (SBT). Figure B, Knees were allowed to move forward past the toes (SPT).



Patellofemoral Joint Stress was nearly 24% greater when the knees were allowed to move forward past the toes!

Figure A (right) shows the higher patellofemoral joint stress when the knees were allowed to move past the toes (SPT). When the knees stay behind the toes (SBT) this stress is much lower. The solid lines are the mean values and the dashed lines show the standard deviations. The higher amount of knee motion (Figure B right) during the SPT technique coupled with the greater amount of quadriceps force required to perform the movement produces this. If one has patellofemoral pain, it may be wise to perform squats using the SBT technique.





LIMS Scientists

Chris Durall, DPT, ATC, MSPT (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)

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)

Robert Ragan, PhD, Computational Physicist (Physics)

Recently Published or In Press Research

Utilization of ImPact Testing to Measure Injury Risk in Alpine Ski and Snowboard Athletes. Faltus J, Huntimer B, Kernozek T, Cole J. Int J Sports Phys Ther. 2016 Aug;11(4):498-506.

Influence of Injury on Dynamic Postural Control in Runners. Meardon S, Klusendorf A, Kernozek T. Int J Sports Phys Ther. 2016 Jun;11(3):366-77.

Effects of Foot Strike and Step Frequency on Achilles Tendon Stress During Running. Lyght M, Nockerts M, Kernozek TW, Ragan R. J Appl Biomech. 2016 Aug;32 (4):365-72. doi: 10.1123/jab.2015-0183. Epub 2016 Mar 8.

Plantar loading changes with alterations in foot strike patterns during a single session in habitual rear foot strike female runners. Kernozek TW, Vannatta CN, Gheidi N, Kraus S, Aminaka N. Phys Ther Sport. 2016 Mar;18:32-7.

Bone stress in runners with tibial stress fracture. Meardon SA, Willson JD, Gries SR, Kernozek TW, Derrick TR. Clin Biomech (Bristol, Avon). 2015 Nov;30(9):895-902

Comparison of two methods of determining patellofemoral joint stress during dynamic activities. Kernozek TW, Vannatta CN, van den Bogert AJ. Gait Posture. 2015 Jul;42(2):218-22.

Biomechanical Analysis of a Change-of-Direction Task in Collegiate Soccer Players. Condello G, Kernozek TW, Tessitore A, Foster C. Int J Sports Physiol Perform. 2016 Jan;11(1):96-101.

Influences of Patellofemoral Pain and Fatigue in Female Dancers during Ballet Jump-Landing. Peng HT, Chen WC, Kernozek TW, Kim K, Song CY. Int J Sports Med. 2015 Aug;36(9):747-53.

Plantar loading and foot-strike pattern changes with speed during barefoot running in those with a natural rearfoot strike pattern while shod. Cooper DM, Leissring SK, Kernozek TW.Foot (Edinb). 2015 Jun;25(2):89-96.

Plantar loading characteristics during walking in females with and without patellofemoral pain. Willson JD, Ellis ED, Kernozek TW.J Am Podiatr Med Assoc. 2015 Jan-Feb;105(1):1-7.

Two- and Three-Dimensional Relationships Between Knee and Hip Kinematic Motion Analysis: Single-Leg Drop-Jump Landings. Sorenson B, Kernozek TW, Willson JD, Ragan R, Hove J. J Sport Rehabil. 2015 Nov;24 (4):363-72.

Patellofemoral joint stress during running with alterations in foot strike pattern. Vannatta CN, Kernozek TW. Med Sci Sports Exerc. 2015 May;47(5):1001-8

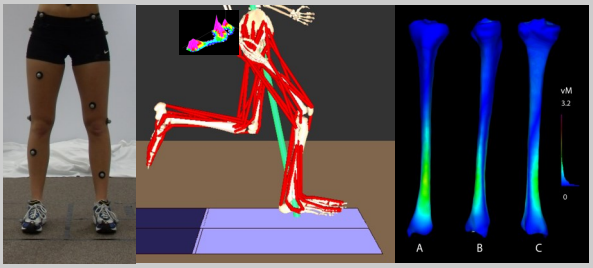
UNIVERSITY of WISCONSIN LA CROSSE

We measure your movement performance!

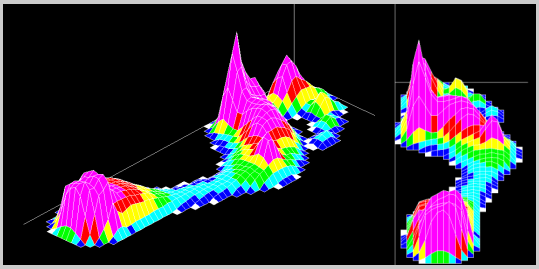
Our laboratories have sophisticated equipment to measure motion, impact forces, pressures on the feet or in seating, muscle activation, energy cost and heart rate, or for the imaging of tendons or soft tissue.

These data can be used to determine the loading on joints and muscles to give insight to how and why injuries occur or in the improvement of performance to keep you active. Below are some examples from current projects that highlight our capabilities.

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



Pressure distribution measures show how you are loading different areas of your foot.



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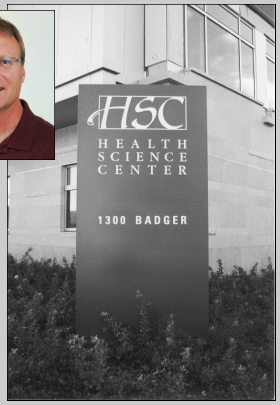

Check out our lab on your smartphone!