

DEPARTMENT OF DEFENSE RESEARCH PROJECTS



NEUROMUSCULAR RESEARCH LABORATORY UNIVERSITY OF PITTSBURGH



Department of Sports Medicine and Nutrition
School of Health and Rehabilitation Sciences
Department of Orthopaedic Surgery



"I'm excited about what the University of Pittsburgh is doing for us. They're in the second year of a long-term study to collect just that kind of injury and performance data we need, both before the rotation and once the soldier returns, and providing the soldier the tools he needs to work on when he is deployed."

*~ General Peter W. Chiarelli,
Vice Chief of Staff of the
U.S. Army*

March 11, 2009

*Committee on Appropriations –
Subcommittee on Defense*

Department of Defense Injury Prevention and Performance Optimization Research

On March 10, 2009, Dr. Scott Lephart, the principal investigator of the U.S. Army 101st Airborne (Air Assault) Injury Prevention and Performance Optimization Research Initiative, briefed the Assistant Surgeon General, Brigadier General Timothy K. Adams, and the Vice Chief of Staff of the U.S. Army, General Peter W.

Chiarelli, regarding our research activities at Fort Campbell, specifically, our research examining the effects of load on the biomechanics and physiological responses of the individual soldier. General Chiarelli testified at a hearing before the Committee on Appropriations Subcommittee on defense. The Hearing, titled "Soldier Equipment, Ergo-

nomics and Injuries," was requested in order to review and investigate the effects of soldier's equipment on injuries. During questioning, General Chiarelli outlined the significance and importance of the University of Pittsburgh's research at Fort Campbell regarding this issue.

Eagle Tactical Athlete Program

Division implementation of the **Eagle Tactical Athlete Program (ETAP)** will be phase-conducted over the next 18 months. Phase I was an efficacy trial intervention of the ETAP. The ETAP is a validated injury prevention and performance optimization training program based on 20 months of biomechanical, musculoskeletal, physiological, and nutritional data collected from soldiers of the 101st, task and demand analyses, and previously identified risk factors for injury. Phase IIA will include formal enrollment of soldiers into the Instructor Certification School (ICS). The ICS is a 4-day physical training instructor certification school specifically designed to educate Non-Commissioned Officers (NCOs) on the principles of

training and to be able to deliver the ETAP to their units. Phase IIB will include ETAP Division implementation to Physical Training (PT). Division implementation will occur upon completion of each weekly class, and the corresponding NCOs will implement the learned ETAP into their respective units as part of the daily PT. Enrollment in the ICS and Division implementation of the ETAP will be phased according to Brigade and deployment schedules. A similar process will follow for all Brigades with NCO enrollment in ICS and implementation of the ETAP, yet total duration of each will be adjusted as necessary to account for deployment.

Phase I: ETAP Efficacy Trial
Based on the results of the

validation trial, an efficacy trial was recently conducted to further test our hypotheses in soldiers during a reset period. The experimental group performed the ETAP, including a selected training modality each day of the week that **(See ETAP Page 2)**



Eagle Tactical Athlete Program

"Like professional football players and Olympic gymnasts, the elite soldiers of the 101st Airborne Division are driven individuals who are required to perform intense tactical maneuvers at high speed and velocity such as running, jumping, landing and cutting – often with impaired vision and at night during both training and active duty. The risk and incidence of lower extremity injury is high."

*~ Lt. Col. Rusty Rowe,
Command Surgeon of Special
Operations Command Europe and
former Division Surgeon of the Army
101st Airborne*



(Continued from Page 1)

meets the objectives for performance optimization and was progressed on a bi-weekly basis to induce specific adaptations of training. The exercise progression increased exercise sets, repetitions, time to perform an exercise, or volume of exercise. Soldiers in the control group performed their regular physical training led by the same NCO assigned for the eight weeks of the trial. Soldiers in the experimental and control groups were tested pre- and post-efficacy trial ETAP intervention for strength, APFT, flexibility, balance, field performance tests, and physiological variables. Post-test results indicated that knee and torso strength were greater in the experimental group than the control group. Components of the APFT, including push-ups, sit-ups and the 2-mile run were each higher in the experimental group. Overall, the experimental group had greater improvements in flexibility and balance with eyes open and eyes closed conditions. Physiological tests of jumping, agility, and anaerobic running power improved. Peak and mean power as well as RPM during cycle testing were also significantly higher in the experimental group.

Phase IIA:

Instructor Certification School

The objective of Phase II is to enroll Division NCOs into the ICS and phase-implement the ETAP into Division PT. In Phase IIA, the NCOs will learn the theory and implementation of the updated PT program (ETAP) and at the completion of the course be certified as Eagle Tactical Athlete Training Leaders. Each NCO will perform the ETAP and receive lectures and practical education designed to promote train-

ing program design and implementation, exercise techniques and selection, basic exercise physiology, and nutrition. Training modalities are divided by weekday and include separate sessions to improve anaerobic power/capacity, agility, muscular strength/endurance, aerobic capacity, muscular power/explosiveness, and foot-march endurance. At the completion of the weekly ICS, platoon NCOs will return to their units with all of the necessary information to instruct the ETAP based on the concepts learned at the school. The certified NCOs will receive planning materials and exercise descriptions to assist

in the delivery of the program.

Phase IIB:

Division Implementation

Upon completion of each weekly class, the certified NCOs will implement the learned ETAP into their respective units as part of the daily PT. The program will contain the same principals by which the eight week model was developed, but the progression will be modified to account for the longer duration (deployment schedule-dependent). The weekly training format will remain the same with individual days dedicated to a single training principle, yet allowances will be built into the program to account for combat focus training. The Human Perform-

ance Research Center personnel will ensure proper delivery of the ETAP by the NCOs to their respective units by answering questions related to the implementation and assessing correct performance of the exercises by the soldiers at the unit level. As part of the Division implementation, random soldiers will be tested for laboratory, field, and APFT

"Physical conditioning, and, what we're finding through the University of Pittsburgh's study that's being conducted, nutrition are key elements in helping soldiers when they have to carry loads in avoiding the kind of musculoskeletal issues we are seeing today."

*~ General Peter W. Chiarelli,
Vice Chief of Staff of the
U.S. Army*

improvements at three month intervals to confirm proper progression of the ETAP and compliance by the soldiers. It is intended that the quality control checks will identify potential limitations in program administration or progression. The

overall objective is to reduce the risk of injuries by implementing an injury prevention and performance optimization program. This program is designed to modify potential risk factors to injury and improve physical performance. Injury surveillance of unintentional musculoskeletal injuries will occur for comparison to previous injury rates.

This work was supported by the US Army Medical Research and Materiel Command under Award No. (Research grant USAMRMC/TATRC #W81XWH-06-2-0070/W81XWH-09-2-0095). Opinions, interpretations, conclusions and recommendations are those of the author and are not necessarily endorsed by the U.S. Army.

Presentations and Publications

- Abt JP, Sell TC, Nagai T, Deluzio JB, Keenan K, Rowe R, McGrail MA, Cardin S, Lephart SM, FACSM. Relationship between the Army Physical Fitness Test and Laboratory-Based Physiological and Musculoskeletal Assessments. *2009 American College of Sports Medicine Annual Meeting*. Seattle, WA (May 27-30).
- Chu Y, Sell TC, Abt JP, Huang G, Nagai T, Deluzio J, McGrail MA, Rowe R, Lephart SM. Knee Biomechanics in Air Assault Soldiers Performing Two-Legged Drop Landings with and without Visual Input. *2009 American College of Sports Medicine Annual Meeting*. Seattle WA (May 27-30).
- Crawford K, Abt JP, Sell TC, Nagai T, Deluzio JB, Rowe R, McGrail M, Lephart SM, FACSM. Lower Body Fat Improves Physical And Physiological Performance In Army Soldiers. *2009 American College of Sports Medicine Annual Meeting*. Seattle, WA (May 27-30).
- Abt JP, Lephart SM, Sell TC, Nagai T, Rowe R, McGrail M. Kinematic adaptations with interceptor body armor in Soldiers of the Army 101st. *Journal of Athletic Training*. 43(3):S-96, 2008.
- Huang HC, Nagai T, Deluzio J, Benjaminse A, House A.J, Chu YC, Abt JP, Sell TC, Lephart SM. The Relationship among Body Composition, Anaerobic Power, Lactate Threshold and Maximal Oxygen Consumption in Male Soldiers. *2008 National Athletic Trainers' Association Annual Meeting*. St. Louis, MO (June 17 - 21).

Who's Who: Department of Defense Research Personnel

Dr. Scott M. Lephart, PhD, ATC

Neuromuscular Research Laboratory

University of Pittsburgh
Pittsburgh, PA



Dr. Lephart serves as the principal investigator of the U.S. Army 101st Airborne (Air Assault) and Naval Special Warfare Injury Prevention and Performance Optimization Research Initiatives. Dr. Lephart is the director of the Neuromuscular Research Laboratory as well as Department Chair and Associate Professor of Sports Medicine and Nutrition and Associate Professor within the Department of Orthopaedic Surgery at the University of Pittsburgh. He completed his undergraduate degree at Marietta College (Marietta, OH) and both his Master's and Doctoral degrees in Sports Medicine at the University of Virginia (Charlottesville, VA) in 1988. His research interests include musculoskeletal sports and female ACL injury prevention, neuromechanical contributions to upper extremity function, and injury prevention in golfers.

performance Optimization Research Initiatives. Dr. Lephart is the director of the Neuromuscular Research Laboratory as well as Department Chair and Associate Professor of Sports Medicine and Nutrition and Associate Professor within the Department of Orthopaedic Surgery at the University of Pittsburgh. He completed his undergraduate degree at Marietta College (Marietta, OH) and both his Master's and Doctoral degrees in Sports Medicine at the University of Virginia (Charlottesville, VA) in 1988. His research interests include musculoskeletal sports and female ACL injury prevention, neuromechanical contributions to upper extremity function, and injury prevention in golfers.

"This is an extraordinary opportunity to match our passion for the care of athletes with our military's need." ~ Dr. Scott Lephart

Takashi Nagai, MS, ATC, CSCS

Human Performance Research Center

US Army 101st
Fort Campbell, KY



Takashi Nagai is the research coordinator at the Human Performance Research Center (HPRC) at Fort Campbell, KY, and has a faculty appointment at the

Department of Sports Medicine and Nutrition at the University of Pittsburgh. He has completed his Bachelor of Science in Athletic Training from the University of Charleston, WV, and his Master of Science in Exercise Physiology from the University of Utah, and is currently completing his PhD in Rehabilitation Science at the University of Pittsburgh. Since the opening of the HPRC in May 2007, he has coordinated various research projects including physical fitness tests, field fitness tests, training program design, development, and implementation, and clinical trials. His research interest is to evaluate neuromuscular adaptations to physical training and its influence on unintentional musculoskeletal injury prevention.

"Modern soldiers need modern physical training backed by solid research."

~ Takashi Nagai

Greg Hovey, MS, CSCS

Human Performance Research Center

Navy Special Warfare
Little Creek, VA



Greg Hovey is a Research Associate Faculty assigned to the Neuromuscular Research Center Department of Defense Laboratory at the Naval Amphibious Base Little

Creek, Norfolk, VA. Prior to this appointment, Greg completed his Masters degree in Exercise Science at Central Washington University. As a former Marine, Greg has a special interest in working with the military's elite Special Forces Units. His research interests include the multifaceted factors contributing to preventable musculoskeletal injuries. Research at the HPRC in Little Creek aims to reduce the incidence of preventable musculoskeletal injuries during training, combat and recreation, enhance force readiness by maximizing the effects of training to reduce fatigue and optimize performance, and prolong the operational life as well as enhance quality of life after service.

"This is our way of giving back and serving those individuals who serve us every day."

~ Greg Hovey

Naval Special Warfare—Group TWO

"As with an elite athletic team, musculoskeletal injuries significantly limit the war-fighting capability and readiness of the Naval Special Warfare combatant force. Optimal physical training and conditioning are the cornerstones of the maintenance of the weapons platform of the Navy SEAL Operator,"

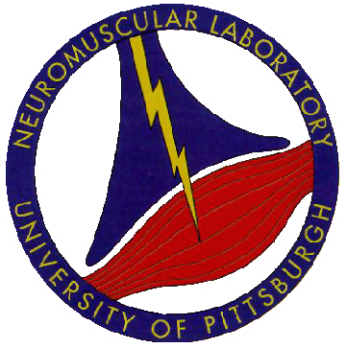
*~ Dr. Scott Lephart, PhD, ATC
Principal Investigator,
University of Pittsburgh*



"The SEAL himself is the primary weapons platform of Naval Special Warfare," said Captain Chaz Heron, commander of Naval Special Warfare Group TWO. "There is an imperative need to extend the operational life and maximize the battlefield performance of the Operator." Development of a task-and-demand analysis-based, empirically supported, and strategic injury prevention and human performance initiative will be the benchmark for all current and future components of the Naval Special Warfare. The laboratory tests are designed specifically for the Operators of the Naval Special Warfare and replicate the demands of their tactical operations. Funding for the Navy project is managed by the Office of Naval Research, Grant ONR-N00014-08-1-0412.



Department of Defense Research Laboratories



Neuromuscular Research Laboratory (NMRL), University of Pittsburgh, Pittsburgh, PA

The Neuromuscular Research Laboratory (NMRL) is a 5,200 sq/ft applied research facility of the University of Pittsburgh's Department of Sports Medicine and Nutrition within the School of Health and Rehabilitation Sciences. The NMRL collaborates with the Department of Orthopaedic Surgery and the University of Pittsburgh Medical Center as the primary clinical research division.

Human Performance Research Center, US Army 101st Fort Campbell, KY

The University of Pittsburgh Human Performance Research Center is a 10,000 sq/ft of research space for current testing activities, validation, efficacy, and implementation of the Eagle Tactical Athlete Training Program, and education of Non-Commissioned Officers for training of the Division upon implementation of the evidence-based program.

Human Performance Research Center, Navel Special Warfare Group TWO, Little Creek, VA

A 2,200 sq/ft human performance research laboratory was opened at Little Creek, VA in April 2008 to work directly with the Navel Special Warfare Group TWO operators.

Neuromuscular Research Laboratory

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The **NMRL** and **Human Performance Research Centers** at both Fort Campbell and Little Creek are outfitted with instrumentation that is designed to measure upper extremity, lower extremity, and torso bio-mechanical performance during functional tasks, musculoskeletal strength, balance, flexibility, body composition, cardiorespiratory endurance, and anaerobic power.

