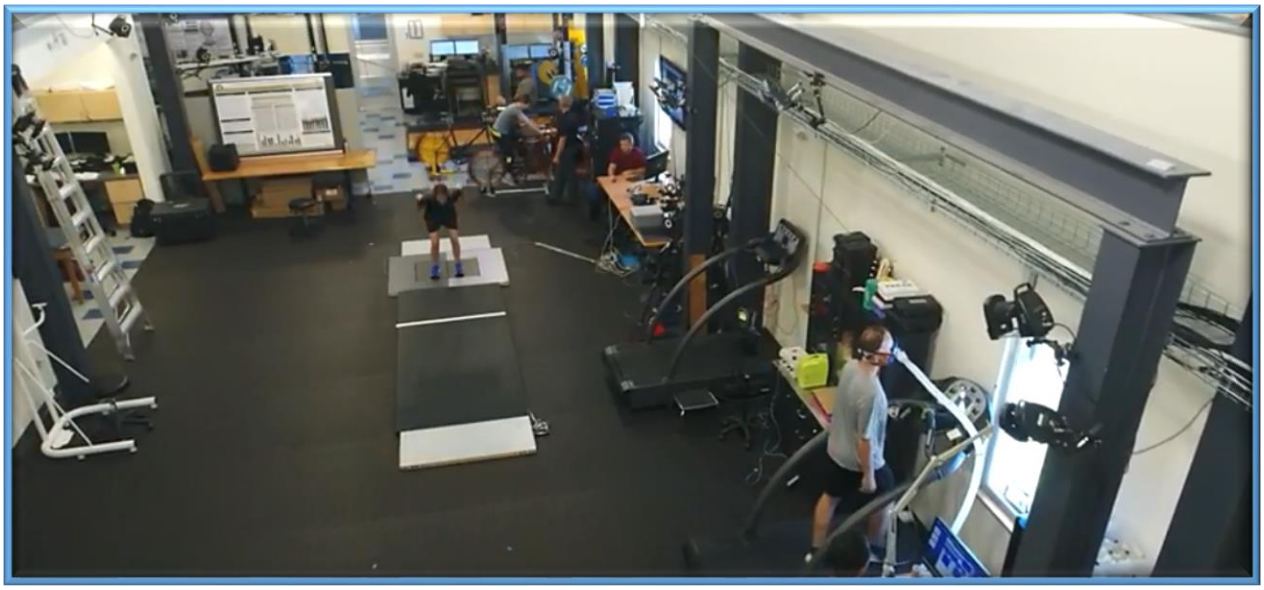
University of Pittsburgh's Neuromuscular Research Laboratory 2017 ANNUAL REPORT

Neuromuscular Research Laboratory



The Neuromuscular Research Laboratory (NMRL), is the applied research facility of the University of Pittsburgh's Department of Sports Medicine and Nutrition, housed within the School of Health and Rehabilitation Sciences. The NMRL is staffed by an interdisciplinary team of athletic trainers, exercise physiologists, registered dietitians, physicians, biomechanists, sport scientists, and epidemiologists. Pictured above, the lab space contains a wide range of equipment for the assessment of musculoskeletal, biomechanical, neural/cognitive, physiological, and biological aspects of human movement, including:

- 22-Camera Vicon Motion Analysis system, XSense Camera-less Motion Analysis system
- Kistler Piezo-electric Force Plates
- Noraxon 8-channel, Zerowire 8-channel, Delsys 12-channel EMG Systems
- Magstim Transcranial Magnetic Stimulation system
- Sonosite Diagnostic Ultrasound system
- Neurocom Equitest Balance Manager
- Isokinetic Dynamometer and Hand-held Dynamometers
- DEXA, Bodpod and Body Metrix systems
- Complete Wet Lab for Analysis of Biological Specimens
- Parvo Metabolic Carts, Cosmed $K_4 B_2$ systems
- Equivital Monitoring Systems, Polar Heart Belts, Actigraphs, Lactate Meters
- SwimEx Swimming Flume
- Woodway Treadmills, Velotron Cycle Ergometers, Lode Excalibur Cycle Ergometer
- Olympic Weightlifting Rack/Platform and Smith Machine with Complete Weight Sets

NMRL Director's Note

The University of Pittsburgh's Neuromuscular Research Laboratory/Warrior Human Performance Research Center (NMRL/WHPRC) has a rich research legacy of studying musculoskeletal injury prevention and human performance optimization. Established in 1987 as a collaborative effort between Dr. Scott Lephart and Dr. Freddie Fu to primarily study joint proprioception, neuromuscular control, and functional joint stability in sport-centric injuries, the NMRL/WHPRC evolved to also study military-centric musculoskeletal injuries and human performance optimization in 2005. Over the last 13 years, the University of Pittsburgh NMRL/WHPRC has been one of the preeminent academic institutions studying military human performance optimization and injury prevention (HPO/IP). We remain committed to our **VISION:** *To be internationally recognized as a premier academic research center and its faculty as thought leaders in musculoskeletal injury prevention and human performance optimization and* **MISSION**: *To mitigate musculoskeletal injuries and optimize human performance by conducting innovative, multi-disciplinary, basic and applied research providing evidence and translating scientific knowledge; enhancing clinical decisions and education. This research will lead to improved quality of life and resiliency in athletic, military, and active populations.*

In 2017, we have received funding for involvement 4 major studies: a US DoD study entitled "Characterization of Psychological Resilience and Readiness: Cross Validation of Cognitive and Behavioral Metrics During Acute Military Operational Stress" (Nindl and Germaine, Co-PIs), a United Kingdom Ministry of Defence study entitled "Solider Performance and Readiness as Tactical Athletes (SPARTA) training study (Nindl and Connaboy, Co-PIs) , a NASA study entitled "NSCOR for Evaluating Risk Factors and Biomarkers for Adaptation and Resilience to Spaceflight: Emotional Valence and Social Processes in ICC/ICE Environments (Dinges, UPENN, PI), and an NIH study entitled "Molecular Transducers of Physical Activity (MoTrPAC) in Humans (Dr. John Jakicic, PI). Another key highlight for 2017 was the NMRL/WHPRC sponsored a special supplement in the *Journal of Science and Medicine in Sport* entitled "Military Human Performance and Optimization/Injury Prevention in conjunction with the 4th International Congress of Soldiers' Physical Performance in Melbourne, Australia in which NMRL/WHPC were authors on 9 manuscripts.

Highlights from 2017

2017 continued to be both a productive year for the NMRL/WHPRC. The annual report for 2017 will highlight some of our faculty and graduate students' scholarly accomplishments. For more information about our laboratory visit the website: http://www.nmrl.pitt.edu/warrior-human-performance-research-center.

NMRL Faculty and Students Were Active at ACSM's MARC

From Nov. 3-4, 2017, Harrisburg, PA hosted the 40th Annual Meeting of the Mid-Atlantic Regional Chapter of the American College of Sports Medicine. Dr.'s Mita Lovalekar, Christopher Connaboy and Kim Beals led a symposium titled "Advances in Military Medicine and Performance". They discussed novel data and ideas related to the care of military personnel, and specifically focused on musculoskeletal injury prevention and human performance optimization. Drs. Flanagan and Dunn-Lewis presented on neuromodulation and bilateral vs. unilateral strength training. Doctoral Students, Shawn Eagle, Caleb Johnson, Anne Beethe, Kellen Krajewski, Aaron Sinnott, Meaghan Beckner, and Alice LaGoy presented podium or poster presentations on topics including: ACL injury treatment, perception-action coupling, new functional jump screenings, swimming performance, and sodium loss interventions. Finally, Master's Students, Jordan Lane, Regina Stump, and Meghan Schmidt presented podium or poster presentations on topics including: fatigue and load carriage and swimming performance.

NMRL Faculty and Students Travel Around the World to Present on Human Performance Optimization and Injury Prevention Research

NMRL Director, Dr. Bradley Nindl, presented a NATO Special Operations Research Workshop on Human Performance in Stuttgart, Germany on Jan. 26th, 2017. Dr. Nindl's presentation was titled "Human Performance Metrics for Optimization of Warrior Physical Readiness". The workshop (right) was attended by more than 100 senior medical military personnel from across the NATO alliance working toward implementing Human Performance programs. Dr. Nindl was also a keynote speaker (left) presenting "Optimizing Military Physical Performance: Science and Strategies" during the 11th Seminar on Military Sports Medicine: Military Physiology and Performance at the 20th Maccabiah International Conference of Sports Medicine and Sport Sciences held at The Academic College at Wingate on June 29th, 2017 in Netanya, Israel.

NMRL Faculty and Students were active at the 4th International Congress on Soldiers' Physical Performance in Melbourne, Australia (Nov. 28th – Dec. 1st, 2017). Dr. Nindl, Associate Lab Director Dr. Kim Beals, and doctoral students Shawn R. Eagle and Anne Z. Beethe presented at the conference. Dr. Nindl served on the organizing committee of the conference, and presented on the "Role of Insulin-Like Growth Factor-I in Stress Fracture Risk" while also moderating a roundtable of experts discussing physiological and psychological resilience. Dr. Beals presented "The Association of Physical Training with Musculoskeletal Injuries in US Special Operations Forces", "The association of prospective upper extremity musculoskeletal injuries with body composition and physiological measures in Special Operation Forces" and "Heart Rate Variability changes in Reserve SEAL Operators during close quarters combat training". Finally, Shawn Eagle and Anne Beethe were selected as ICSPP Travel Grant Recipients and presented "Asymmetrical Landing Patterns Combined with Heavier Body Mass Increases Lower Extremity Injury Risk in Special Operations Forces" and "Comparing Lower Extremity Strength with Aerobic and Anaerobic Capacity to Predict Novice Combat Swimmer 500-m Time Trial Performance", respectively.

Doctoral Students Win National and International Awards

Third-year doctoral students Shawn Eagle and Anne Beethe (left) were awarded Student Travel Grants to participate in the International Congress on Soldiers' Physical Performance in Melbourne, Australia from November 28-December 1st, 2017. Additionally, Anne Beethe, was one of 2 recipients, nationally to receive the National Swimming Pool Foundation® Board Fellowship for her work in Military Aquatic Research.

Fourth-year doctoral student Caleb Johnson (right) won the Regional President's Cup award for his presentation at the MARC Doctoral Investigator Awards titled, "The use of an experimental, topical foam to enhance skin cooling and sodium retention". Additionally, Caleb was selected for an SHRS Research Development Grant for his project "Reliability of the Action Capabilities Assessment Task: A Novel Test of Action Capabilities".

NMRL Receives Funding for Innovative Project

The NMRL received funding from the Department of Defense to study cognitive resilience in Soldiers during simulated military operational stress. Dr. Bradley Nindl is co-principal investigator on the study with Dr. Anne Germain, of the Military Sleep Tactics and Resilience Research Program in the University of Pittsburgh School of Medicine. The testing protocol will follow Soldiers over a comprehensive 5-day testing protocol that includes physiological, neurocognitive, psychomotor, sensorimotor, tactical and sleep testing. Internal co-investigators from the NMRL (group pictured on right) include Dr.'s Chris Connaboy, Shawn Flanagan, Mita Lovalekar, Qi Mi, and Brian Martin. Dr.'s Nindl and Germain have partnered with several external collaborators, as well: Dr. Peter Roma of the National Aeronautics and Space Administration (NASA), Dr. Michael Dretsch of the U.S. Army Training and Doctrine Command, Dr. Amy Haufler of Johns Hopkins University, Dr. Matthew Tenan of the U.S. Army Research Laboratory, Dr.'s. Caroline Davis and Caroline Mahoney of the Natick Soldier Research Development and Engineering Center, Harris Lieberman of the U.S. Army Research Institute of Environmental Medicine, Carl Castro of the University of Southern California and Jacque Reifman of the U.S. Army Medical Research and Materiel Command.

Making an Impact: Disseminating Research and Advising on National Policy

Dr. Kim Beals, Assistant Professor and Associate Director of the NMRL, has been a member of the Coordinating Committee for the National Physical Activity Plan Alliance (NPAPA) since 2009, whose mission is to maintain and expand the impact of the National Physical Activity Plan, a comprehensive strategic plan for increasing physical activity in all segments of the US population. Dr. Beals attended the annual NPAPA meeting (right) in Washington DC on July 12, 2017. In addition, she is a member of the Research Advisory Board for the 2014 and 2016 US Report Cards on Physical Activity for Children in Youth. In November 2017, this group met at Pennington Biomedical Research Center to discuss the 2018 update.

On May 5, 2017, Dr. Shawn Flanagan, Assistant Professor, presented at the Frontiers of Brain Health Lunch Lecture Series at the University of Texas Center for Brain Health in Dallas, TX. Dr. Flanagan's presentation was entitled *Emerging Ideas and Approaches at the Intersection of Exercise and Brain Health.* His talk highlighted current knowledge on the beneficial effects of exercise for brain health and cognitive function, in addition to newly discovered neurobiological pathways that may play an important role in communicating signals produced by exercise to the brain.

Dr. Matthew Darnell (left), Assistant Professor and Director of Graduate Studies in Wellness and Human Performance, presented for the Neurosurgical Residents of UPMC at the Neurosurgical Residents Wellness Seminar Series (Sep. 20, 2017). His presentation, titled "Full Plate: Nutrition for Managing Busy Lifestyles and Stress", focused on the positive influences food and eating behavior can have on controlling stress and inflammation.

The NMRL Welcomes Visitors

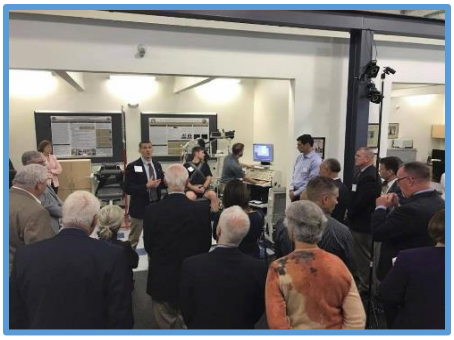
The NMRL hosted many groups over the past year, starting with members of the University of Pittsburgh's senior leadership team (left) on June 21st and July 26th, 2017, including: Heather Lyke - Deputy Athletic Director, Christian Spears - External Affairs, , Marcus Bowman - Senior Associate Athletic Director for Sport Administration, Patricia Beeson - Provost and Senior Vice Chancellor, Nathan Urban - Vice Provost for Graduate Studies and Strategic Initiatives, and Rob Rutenbar - Senior Vice Chancellor for Research. Senior leaders visited the lab, viewed demonstrations of laboratory testing, and discussed how the NMRL could promote injury prevention and human performance optimization for the University of Pittsburgh.

In September, 2017, the NMRL hosted the Navy's Deputy Chief for Readiness and Health, RADM Bruce Gillingham (right). Discussions were held on opportunities for increased research collaboration.

In December, 2017, the NMRL hosted US Army Officers and Scientists (right-below) to discuss potential collaborations in the area of traumatic brain injury and joint clinical education programs. US Army Officers included: COL Matt Garber, COL Jamie Grimes, Tracie Lattimore, MAJ(P) Sharon Rosser, MAJ Tyson Baynes, MAJ Travis Robbins, and Gary McKinney.

Finally, the NMRL hosted a group of Pitt alumni on the Chancellor's Weekend (right-next page), providing an overview of the NMRL's

research priorities followed by an interactive laboratory tour. Alumni from the School of Health and Rehabilitation Sciences included Joseph David (BS ’88, MS ’88) and John Childs (MS’02, PhD ’03).



NMRL Director Assumes Command

Col Bradley Nindl received the guidon from Major General Mary Link (right), the Commanding General of the Army Reserve Medical Command, as he assumed command of the Southeast Medical Area Readiness Support Group (SE-MARSG) in Nashville, TN from the outgoing Commander, COL(P) Scott Lynn on Aug. 26 2017. The SE-MARSG has 2000 Soldiers and provides support, command, and control for 24 direct reporting units that include medical backfill battalions, medical support units, troop medical clinics, veterinary and blood detachments throughout the southeastern United States including Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee. The Change of Command ceremony symbolizes the continuation of leadership and unit identity despite the change of individual authority. It also represents the transfer of power from one leader to another; passing the ceremonial flag from outgoing to incoming commander is a physical representation of that transfer.

Special Edition of the Journal of Science and Medicine in Sport

A special issue of the Journal of Science and Medicine and Sport (right), dedicated to the topic of Military Human Performance Optimization/Injury Prevention, was published November 2017. Dr. Nindl served as a guest editor for this special issue, which contains 18 manuscripts from five organizations dedicated towards studying biomedical research solutions to benefit military physical performance and readiness: the Neuromuscular Research Laboratory/Warrior Human Performance Research Center (NMRL/WHPRC) at the University of Pittsburgh, the Military Performance Division at the U.S. Army Research Institute of Environmental Medicine (USARIEM), the Injury Prevention Division of the U.S. Army Public Health Center (APHC), the Division of Applied Physiology, Army Personnel Research Capability (APRC), British Ministry of Defence, and the Land Division, Australian Defence Science and Technology (DST) Group. The manuscripts include development of military physical employment standard assessments, military injury epidemiology and risk factors, and physiological, neuromuscular, and hormonal adaptations to physical training and load carriage. Overall, this special issue demonstrates a synergistic effort of scientists, medical staff, physical training personnel, and military operational leaders and stakeholders to examine injury mitigation and performance optimization in order to reduce preventable musculoskeletal injuries and improve combat readiness.

The Naval Special Warfare Injury Prevention and Performance Optimization Initiative Study Wraps Up

The Naval Special Warfare (NSW) Injury Prevention and Performance Optimization Initiative was a 10-year research project funded by the United States Department of Defense under the auspices of the Office of Naval Research. Researchers at the NMRL used a Human Performance Research Model to study injury prevention and performance optimization in order to minimize the number and severity of injuries, maximize performance and readiness, and enhance career longevity and quality of life following service in Naval Special Warfare Students and Operators. This research initiative met the collective desire of Naval Special Warfare to strategically maximize human capital, sharpen battlefield performance, and extend the operational service life of the Operator. The Naval Special Warfare Tactical Athlete Program Human Performance and Injury Prevention Initiative Final Report was submitted to the Office of Naval Research Dec 27, 2017 as is available for public release.

Highlighted Key Findings Include:

- NSW Operators and Students have unique injury profiles that include a greater risk of injury compared to general-purpose forces.
- The majority of musculoskeletal injuries (MSI) occur during physical training and the majority of these injuries are preventable.
- Weight lifting was a common cause of MSI among NSW Operators. A significant proportion of these MSI were classified as overuse MSI and as potentially preventable, by implementation of a program designed to prevent MSI and optimize performance.
- There was a significant association between prospective lower extremity MSI and ankle inversion strength, ankle eversion/inversion strength ratio, hamstring flexibility (least and most flexible), gastrocnemius-soleus flexibility (less flexible), dynamic balance asymmetry, vestibular and preference ratios and aerobic capacity.
- Knee strength, fat-free mass, and hamstring flexibility were important risk factors identified in the machine-learning algorithm that accurately classified SEAL Operators with LE MSKI. Alternative high prediction models also can be created using this modeling framework on different variable sets.

Four Young Scientists Successfully Defend their Dissertations and Enter the Work Force

In the past year, NMRL Doctoral Students (left to right) Heather Bansbach, Paul Whitehead, Erin Pletcher, and Mallory Faherty all successfully defended their dissertation work, and moved on to academic careers. Dr. Heather Bansbach is now at the University of Virginia as a Licensing Analyst, responsible for evaluating the patentability and marketability of assets created at UVA. Dr. Paul Whitehead is now an Assistant Professor of Kinesiology at the University of Alabama Huntsville, teaching several classes and initiating a research agenda focused on ice hockey performance and injury prevention. Dr. Erin Pletcher is an Assistant Professor of Athletic Training at Rowan University, teaching and developing her independent research focus. Dr.

Mallory Faherty is now a Research Analyst at Duke University, working in the Michael W. Krzyzewski Human Performance Laboratory on research related to the preservation of long-term joint health.

NMRL Faculty: Ongoing Research Initiatives

Bradley Nindl, PhD, **FACSM,** is Director of the Neuromuscular Research Laboratory/Warrior Human Performance Research Center and Professor in the Department of Sports Medicine in the School of Health and Rehabilitation Sciences at the University of Pittsburgh. His research interests span human performance optimization/injury prevention domains with a focus on adaptations of the neuromuscular and endocrine systems (growth hormone/insulin-like growth factor-I axis) to both exercise and military operational stress. He is an associate editor for Medicine and Science in Sports and Exercise and the Journal of Strength and Conditioning Research and a Fellow in the American College of Sports Medicine.

Kim Beals, PhD, RD, CSSD, is Associate Director of the NMRL, and an Assistant Professor in the Department of Sports Medicine and Nutrition. Dr. Beals' current initiatives are focused around nutrition and exercise strategies to modify body composition and to enhance physical performance. Future initiatives are focused around the microbiome. Foods and nutrients in the diet may affect health by altering the composition of gut microbiota and perhaps more importantly by serving as substrates for microbial metabolism. Research is needed to determine which foods and nutrients specifically promote growth and functionality of beneficial bacteria as part of a healthy microbiome. This research will help to fill a gap in the scientific literature and increase our understanding of how the habitual diet affects the gut microbiome.

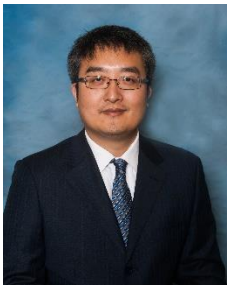
Kevin Conley, PhD, ATC, is an Associate Professor and Chair of the Department of Sports Medicine and Nutrition in the School of Health and Rehabilitation Sciences. He has over 20 years of clinical and academic experience, having spent the previous 17 years as the director of the Athletic Training Education Program. Dr. Conley also serves as Associate Dean for Undergraduate Studies at SHRS, where his responsibilities include providing support and oversight related to common policies and procedures for the six undergraduate programs in the school.

Christopher Connaboy, PhD is an Assistant Professor in the Department of Sports Medicine and Nutrition. Dr. Connaboy received his PhD in Biomechanics and Motor Control from the University of Edinburgh. His research interests center around understanding the processes of human performance optimization with regards to movement, coordination and the perceptuo-motor processes involved in performing skilled actions. He is currently serving as a co-investigator on NASA and government funded projects, and recently completed a study as a primary investigator funded by the DOD.

Katelyn Allison, PhD, ACSM EP-C, is an Assistant Professor within the Department of Sports Medicine and Nutrition and Director of the MS Program in Sports Medicine. She serves as the Principal Investigator for the following projects: *Expanding the Role of Women in the Marine Corps: Injury Prevention and Human Performance* and *Effect of Crossfit exercise training on health and performance.* Dr. Allison is leading future research initiatives around University of Pittsburgh Veteran's Health and Wellness Initiative as well as evaluating and identifying risk factors for lower extremity stress syndrome and fractures in active adults.

Matt Darnell, PhD, RD, CSSD, SCCC, is an Assistant Professor within the Department of Sports Medicine and Nutrition. He is currently involved in two research projects evaluating the effectiveness of a topical foam for improving sodium retention during exercise and reducing inflammation following an injury. Future research initiatives will focus on individual variations and contributing factors to nutrient metabolism and metabolic response in athletic populations.

Mita Lovalekar, MBBS, PhD, MPH, is an Assistant Professor of Sports Medicine and Nutrition and is an associate-investigator with the Department of Defense and MNRL research projects, and is involved with study design, data processing, analysis, and interpretation, with our externally funded and academic research projects. Her research interests include injury epidemiology and surveillance, injury prevention, and chronic disease epidemiology.



Qi Mi, PhD, is an Assistant Professor in the Department of Sports Medicine and Nutrition and a member of the Center for inflammation and Regenerative Modeling within the McGowan Institute for Regenerative Medicine. Dr. Mi is currently working on applying data mining and machine learning approaches to uncover patterns and develop predictive model of musculoskeletal injury and other biological disease.

Elizabeth Nagle, PhD, FACSM, is an Assistant Professor in the Department of Health and Physical Activity (HPA) within the School of Education with a secondary appointment with the School of Health and Rehabilitative Sciences at the University of Pittsburgh, and is also the undergraduate HPA program coordinator. Dr. Nagle completed her Ph.D. at the University of Pittsburgh, and is a certified ACSM Exercise Physiologist and Level 2 USA Swimming Coach. Her research interests include Development and Validation of aquatic protocols of Aerobic and Anaerobic Capacity for shallow water running, swimming, and military performance.

Mary Murray, EdD, ATC, is a faculty member in the Department of Sports Medicine and Nutrition at the University of Pittsburgh and is the Clinical Coordinator for the Graduate Assistant Athletic Trainers. She completed her doctoral studies in the Department of Educational Leadership, Management and Policy at Seton Hall University. She earned a Master's degree in Physical Education, Exercise, & Sports Science at the University of North Carolina and a Bachelor of Science degree with a concentration in Athletic Training at the University of Pittsburgh. Her research interests are in clinical education and student success in health science programs.

Shawn Flanagan, PhD, is an Assistant Professor in the Department of Sports Medicine and Nutrition at the University of Pittsburgh. His background is in systems neuroscience and physiology with specialized training in brain stimulation, imaging, and biochemistry. At the University of Pittsburgh, Dr. Flanagan's research is focused on the neurobiological basis of injury prevention and human performance optimization. Current areas of interest include the influence of the brain/cognition on injury, effects of biomarkers on injury and performance adaptations, psychological resilience, and novel clinical rehabilitation techniques for return to duty/play from musculoskeletal and head injuries.

Courtenay Dunn-Lewis, PhD, is a Visiting Assistant Professor in the Department of Sports Medicine and Nutrition and the Department of Health and Physical Activity at the University of Pittsburgh. Prior to joining the faculty at the University of Pittsburgh, Dr. Dunn-Lewis was an Assistant Professor at Merrimack College. Dr. Dunn-Lewis' teaching interests include research methods, exercise physiology, exercise program design, strength and conditioning, and performance testing and evaluation. Her current research interest is the physiology of resistance exercise adaptations, especially to muscle, bone, performance, and for aging.

NMRL Post-doctoral Fellows

Brian Martin, PhD, recently joined the NMRL as a Post-doctoral Research Fellow. His current research initiatives include manuscript preparation from the analysis of molecular weight variants of IGF-I in men and women following acute resistance exercise, and analysis of IGF-I bioactivity in men and women with lumbar spinal stenosis following three separate forms of clinical rehabilitation. Future research initiatives include establishing basic infrastructure for biochemical analysis, and to begin using biochemical analysis to assess the effects of physiological stress from nutrition and exercise training on biomarkers indicative of physiological resilience, injury and adaptation.

NMRL Staff

Susan Casino is an Administrator of the NMRL within the University of Pittsburgh's School of Health and Rehabilitation Science. She has been with the University of Pittsburgh since 2003 and the NMRL since 2008.

Robert Kornosky, MPA, is the Financial Manager for the Department of Sports Medicine and Nutrition at the University of Pittsburgh. He completed his Master's Degree in Public Administration and Bachelor's Degree in Business Administration from the University of Pittsburgh. Rob has experience in grants management, accounting, and human resource administration. Prior to joining the Department of Sports Medicine and Nutrition, Rob worked for the University's School of Medicine as an Accountant.

NMRL Doctoral Students

Anne Beethe, MA, ATC, CSCS, Prior to starting in the NMRL, Anne worked as an athletic trainer at Belmont Abbey College. She worked with the school's Division II Men's Soccer, Women's Basketball, and Baseball team. She earned her undergraduate degree in Exercise Science at Creighton University. She then went to earn her Master's degree at the University of Nebraska Omaha in Athletic Training. Her research interests include upper extremities, specifically the glenohumeral joint in overhead athletes. Other interests include proprioception, injury prevention, the biomechanics of the lower extremities as they might affect the upper extremity through the kinetic chain, and weight programs to decrease the incidence of injury.

Shawn Eagle, MAT, LAT, ATC, CSCS, is a doctoral student at the NMRL. Prior to returning to school, Shawn worked as a remote laboratory faculty member for the NMRL at the Naval Amphibious Base in Coronado, CA and Camp LeJeune-Stone Bay in Sneads Ferry, NC. He has previously earned a Masters of Athletic Training degree from Texas Tech University and a B.A. in Athletic Training from Denison University. Shawn's research interests include enhancing human performance and application of strength training programs to prevent injuries to athletes and military personnel.

Caleb Johnson, MS, is a doctoral student in Rehabilitation Science within the Department of Sports Medicine and Nutrition at the University of Pittsburgh. He received a bachelor's degree in Science in Kinesiology at Penn State University and a Master of Science degree in Health, Physical Activity, and Chronic Disease at the University of Pittsburgh. Caleb also worked in research at Pitt's Health and Physical Activity Department and held an internship with the NMRL. Caleb is interested in proprioception and core stability as they pertain to lower-body injury prevention and more specifically, injury prevention programs for young to adolescent athletes.

Alice LaGoy, MS, is a doctoral student in Rehabilitation Science within the Department of Sports Medicine and Nutrition at the University of Pittsburgh She received her undergraduate degree in human physiology from Gonzaga University. After completing her undergraduate degree, Alice worked as a research assistant at the Washington State University Sleep and Performance Research Center. She is currently working as a member of the Military Sleep Tactics and Resilience Research Team at the University of Pittsburgh. Her research interests include perception-action coupling related to athletic and military performance, the role of sleep in recovery and the physiology underlying these relationships.

Meaghan Beckner, MS, is a doctoral student in the Rehabilitation Science program within the School of Health and Rehabilitation Sciences at the University of Pittsburgh. She received her Bachelor's degree in Exercise Science at the University of Pittsburgh and worked as a clinical research coordinator for several years. Meaghan returned to the University of Pittsburgh's Department of Health and Physical Activity as a Graduate Assistant and received her Master's degree in Health and Physical Activity. Her research interests include performance optimization and injury prevention, primarily within special operations forces.

Kellen Krajewski, MS, is a doctoral student in the Sports Medicine program within the School of Health and Rehabilitation Sciences at the University of Pittsburgh. Prior to enrolling in the doctoral program, he received his master's degree in Sports Medicine from Armstrong State University. There, he served as a Graduate Student Researcher for the Biodynamics and Human Performance Center. In addition, Kellen has served as an instructor of biomechanics at the University of Scranton and oversaw biomechanics research conducted in their Human Motion and Ergonomics Laboratory. Kellen's research interests include performance optimization and injury prevention in tactical populations, spine biomechanics with external loads, and biomechanical performance assessments.

Aaron Sinnott, MS, ATC, is a doctoral student in the Sports Medicine program within the School of Health and Rehabilitation Sciences at the University of Pittsburgh. Prior to enrolling in the doctoral program, he was a site coordinator for the NCAA-DoD C.A.R.E. Consortium Project at California State University-Humboldt. Aaron also held a lecturer position in the Kinesiology and Recreation Administration department. He received his master's degree in Exercise Science from Humboldt State University (2015) while employed as a graduate assistant athletic trainer for men's soccer and basketball. His thesis work focused on cumulative head impacts in football and soccer. Aaron completed his undergraduate education in Athletic Training from California State University-Sacramento (2013). Research interests encompass concussion injuries – mechanisms for optimal recovery, and influences on functional impairment.

Select Peer-reviewed Publications by NMRL Faculty, Students, and Staff

Allison KF, **Keenan KA**, Wohleber MF, Perlsweig KA, Pletcher ER, **Lovalekar M**, **Beals K**, Coleman LC, **Nindl BC**. Greater ankle strength, anaerobic and aerobic capacity, and agility predict Ground Combat Military Occupational School graduation in female Marines. JSAMS; 20(4), S85-90.

Anderson MK, Grier T, Canham-Chervak M, Bushman TT, **Nindl BC**, Jones BH. Effect of Mandatory Unit and Individual Physical Training on Fitness in Military Men and Women. American Journal of Health Promotion. 2017 Sep;31(5):378-87.

Beals, K., **Allison, KF**, Darnell, ME, **Lovalekar, M**, Nieman, DC, Vodovotz, Y and Lephart, SM. The effect of tart cherry juice blend on reducing eccentric exercise-induced muscle soreness. Isokinetics & Exercise Science, 2017 vol. 25, no. 1, pp. 53-63.6.

Eagle SR, **Nagai T**, Morgan P, Hendershot R, Sell TC. Naval Special Warfare (NSW) Crewmen Demonstrate Diminished Cervical Strength and Range of Motion Compared to NSW Students. WORK 2017 58(2).

Drain JR, Groeller H, Burley SD, **Nindl BC**. Hormonal response patterns are differentially influenced by physical conditioning programs during basic military training. Journal of science and medicine in sport. 2017 Nov 1;20:S98-103.

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Johnson, CD, Whitehead, PN, Pletcher, ER, **Faherty, MS**, **Lovalekar, MT**, **Eagle, SR**, **Keenan, KA**. The relationship of core strength and activation and performance on three functional movement screens. Journal of Strength and Conditioning Research; 2017; Epub Ahead of Print

Johnson, CD, Simonson, AJ, **Darnell, ME**, DeLany, JP, Wohleber, MF, **Connaboy, C.** Energy expenditure and intake during Special Operations Forces field training in a jungle and glacial environment. Journal of Applied Physiology, Nutrition, and Metabolism; 2017; Epub Ahead of Print

Keenan, KA., Wohleber, MF., Perlsweig, KA., Baldwin, TM., Caviston, M., **Lovalekar, M.**, **Connaboy, C.**, **Nindl, BC.**, **Beals, K.** Association of prospective lower extremity musculoskeletal injury and musculoskeletal, balance, and physiological characteristics in Special Operations Forces. Journal of Science and Medicine in Sport 20 (2017) S34-39.

Koskinen SO, Kyröläinen H, Flink R, Selänne HP, Gagnon SS, Ahtiainen JP, **Nindl BC**, Lehti M. Human skeletal muscle type 1 fibre distribution and response of stress-sensing proteins along the titin molecule after submaximal exhaustive exercise. Histochemistry and cell biology. 2017 Nov 1;148(5):545-55.

Kraemer WJ, Ratamess NA, **Flanagan SD**, Shurley JP, Todd JS, Todd TC. Understanding the Science of Resistance Training: An Evolutionary Perspective. Sports Med. 2017 Dec;47(12):2415-2435.

Kraemer WJ, Kennett MJ, Mastro AM, McCarter RJ, Rogers CJ, DuPont WH, **Flanagan SD**, Turbitt WJ, Fragala MS, Post EM, Hymer WC. Bioactive growth hormone in older men and women: It's relationship to immune markers and healthspan. Growth Horm IGF Res. 2017 Jun; 34:45-54.

Kraemer WJ, Ratamess NA, **Nindl BC**. Recovery responses of testosterone, growth hormone, and IGF-1 after resistance exercise. Journal of Applied Physiology. 2017 Mar 1;122(3):549-58.

Lovalekar M, Abt JP, Sell TC, Lephart SM, Pletcher E, **Beals K**. Accuracy of recall of musculoskeletal injuries in elite military personnel: a cross-sectional study. BMJ Open. 2017 Dec 14;7(12):e017434.

Lovalekar M, Perlsweig KA, **Keenan KA**, Baldwin TM, Caviston M, McCarthy AE, Parr JJ**, Nindl BC**, **Beals K.** Epidemiology of musculoskeletal injuries sustained by Naval Special Forces Operators and students. J Sci Med Sport. 2017 Nov;20 Suppl 4: S51-S56.

Lovalekar M, **Keenan KA**, Chang YF, Wirt MD**, Nindl BC**, **Beals K**, **Nagai T**. Using the capture-recapture method to estimate the incidence of musculoskeletal injuries among U.S. Army soldiers. J Sci Med Sport. 2017 Nov;20 Suppl 4: S23-S27.

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Nindl BC, Alemany JA, Rarick KR, **Eagle SR**, **Darnell ME**, **Allison KF**, Harman EA. Differential Basal and Exercise Induced IGF-I System Responses to Resistance vs. Calisthenic Based Military Readiness Training Programs. Growth Hormone and IGF-I Research 2017 Feb;32: 33-40.

Nindl BC, **Eagle SR**, Frykman PN, Palmer C, Lammi E, Reynolds K**, Allison K**, Harman E. Functional Physical Training Improves Women's Military Occupational Performance. Journal of Science and Medicine in Sport. 2017 Nov 20 Suppl 4: S91-S97. doi: 10.1016/j.jsams.2017.07.012.

Nindl BC, **Beals K**, Witchalls J, Friedl KE. Military human performance optimization and injury prevention: strategies for the 21st century warfighter. Journal of science and medicine in sport. 2017 Nov 1;20: S1-2.

Oparaji JA, Rose F, Okafor D, Howard A, Turner RL, Orabi AI, Byersdorfer C, **Mi Q**, Ritchey K, Lowe ME, Husain SZ. Risk Factors for Asparaginase-associated Pancreatitis: A Systematic Review, Journal of Clinical Gastroenterology, 2017 Nov/Dec;51(10):907-913

Pierce JR, DeGroot DW, Grier TL, Hauret KG, **Nindl BC**, East WB, McGurk MS, Jones BH. Body mass index predicts selected physical fitness attributes but is not associated with performance on military relevant tasks in US Army Soldiers. Journal of science and medicine in sport. 2017 Nov 1;20:S79-84.

Rawcliffe, AJ, Simpson, RJ, Graham, SM, Psycharakis, SG, Moir, GL and **Connaboy, C.** Reliability of the Kinetics of British Army Foot-Drill in Untrained Personnel. Journal of Strength and Conditioning Research, 2017, 31(2), 435- 444.

Shafer, A.B., Rickman, A.D. Goss, F.L., **Nagle, E.F.** Psychosocial Determinants of Physical Activity in Undergraduate College Students. J. Public Health Issues & Practices. 2017: 1:104.

Simpson, RJ, Graham, SM, **Connaboy, C**, Clement, R, Pollonini, L, and Florida-James, GD. Blood lactate thresholds and walking/running economy are determinants of backpack-running performance in elite British soldiers. Applied Ergonomics, 2017, 58, 566-572.

Vodovotz Y, Simmons RL, Gandhi CR, Barclay D, Jefferson BS, Huang C, Namas R, El-Dehaibi F, **Mi Q**, Billiar TR, Zamora R. "Thinking" vs. "Talking": Differential Autocrine Inflammatory Networks in Isolated Primary Hepatic Stellate Cells and Hepatocytes under Hypoxic Stress, Frontiers in Physiology, 2017 Dec 22;8:1104

Select Conference Presentations by NMRL Faculty, Students, and Staff

Alfano, CA, Bower, J, Simpson, RJ, **Connaboy, C**, Laughlin, M, and Deng, Z. (2017). Psychological Risk, Overlap with Physical Health, and Associated Performance in the Human Exploration Research Analogue (HERA) NASA Human Research Program Investigators Workshop, January 23rd-26th, Galveston, TX, USA.

Allison KF, Keenan KA, Mi Q, Lovalekar MT, Beals K, Coleman LC, **Nindl BC**. Body Composition and Physical Determinants of Physiological and Musculoskeletal Readiness in Marines. American College of Sports Medicine, Denver, CO, May 31, 2017.

Beals, K, Keenan, KA, Lovalekar, M, Perslweig, KA, Wohleber, MF, Simonson, A**, Connaboy, C**, and **Nindl, BC**. (2017). The association of prospective upper extremity musculoskeletal injuries with body composition and physiological measures in Special Operation Forces, 4th International Congress on Soldiers' Physical Performance. Melbourne, Australia, 28th Nov-1st Dec, 2017.

Beals K, Darnell ME, Lovalekar M, Haubenstricker JE, **Nindl BC**. Evaluating Diet Quality in SEAL Qualification Training Students. American College of Sports Medicine Annual Meeting; May 30 - June 3, 2017; Denver, CO

Beckner, ME, Nagle, EZ, Beethe, AZ, Nagai, T, Schmidt, MM, **Connaboy, C,** Abt, JP, Lephart, SM**, Nindl, BC**. (2017). Relationship Between Land-Based Performance Assessments and Swimming Force During Combat Swim Flutterkick, Mid-Atlantic Regional Chapter ACSM meeting, Nov 3rd-4th, Harrisburg, PA

Beethe AZ, Dunn-Lewis C, Connaboy C, Flanagan SD. Intermittent Theta Burst Stimulation Doesn't Improve Reaction Speeds in Females with Anterior Cruciate Ligament Injuries. Mid-Atlantic Regional Chapter of the American College of Sports Medicine Annual Meeting, Harrisburg, PA, November, 2017.

Beethe, A.Z, Nagle, E.F, Lovalekar, M, Nagai, T, Connaboy, C. Acute Effects of a 500 Meter Combat Swimming Time-Trial on Balance, Ankle Range of Motion, Strength, Pain and Exertion in Novice Performers. 4th International Congress on Soldiers' Physical Performance Meeting; November 28th-December 1st, 2017; Melbourne, Australia

Beethe, A.Z, Nagle, E.F, Connaboy, C, Lovalekar, M, Abt, J, Nagai, T. Lephart, S.M. Comparing Lower Extremity Strength with Aerobic and Anaerobic Capacity to Predict Novice Combat Swimmer 500m Time

Trial Performance. 4th International Congress on Soldiers' Physical Performance Meeting; November 28th-December 1st, 2017; Melbourne, Australia

Beethe, AZ, Nagle, EF, Connaboy, C, Abt, JP, Lephart, SM, Lovalekar, MT, Nagai, T. (2017). Land Based Laboratory Associations with Freestyle Swimming Performance: A Comparison between males and Females. ACSM's 64th Annual Meeting, May 30- June 3, Denver, CO.

Dunn-Lewis C, Flanagan SD, Onate JA, Volek JS, Maresh CM, Kraemer WK. Injury-Related Reductions in Skilled Visuomotor Learning Revealed by Single Trial Analysis and Response Time Variability. American College of Sports Medicine Annual Meeting, Denver, CO, May, 2017.

Eagle, SR, Connaboy, C, Mi, Q, Lovalekar, M, Wohleber, MF, Simonson, A**, Nindl, BC**. (2017). Asymmetrical landing patterns combined with heavier body mass increases lower extremity injury risk in special operations forces, 4th International Congress on Soldiers' Physical Performance. Melbourne, Australia, 28th Nov-1st Dec, 2017.

Eagle, SR, Nindl, BC, Johnson, CD, Kontos, AP and **Connaboy, C**. (2017). Action Boundary Perception, Depression and Visuomotor Symptoms Differentiate Healthy Controls from Athletes with Recent Concussion, Mid-Atlantic Regional Chapter ACSM meeting, Nov 3rd-4th, Harrisburg, PA

Eagle SR, Nindl BC, Connaboy C, Allison KF. Significantly Increased Odds of Reporting Previous Shoulder Injury in Female Marines Based on Larger Magnitude Shoulder Rotator Side-to-Side Strength Differences. National Athletic Training Association Annual Conference; June 29, 2017; Houston, Texas.

Eagle SR, Nindl BC, Johnson CD, Kontos AP, **Connaboy C**. Action Boundary Perception Movement Time, Depression and Visuomotor Symptoms Differentiate Healthy Controls from College-Aged Athletes. Mid-Atlantic Regional American College of Sports Medicine Annual Conference; November 4, 2017; Harrisburg, PA.

Eagle SR. Application of a Novel Action Boundary Perception Task: A Potential Concussion Biomarker? Australian Skill Acquisition Network Conference & 10th Australian Skill Acquisition Research Group Meeting; November 25th, 2017; Brisbane, Australia.

"Evaluating Diet Quality in SEAL Qualification Training Students", American College of Sports Medicine Annual Meeting, Denver CO, June 2, 2017.

Faherty MS, Csonka J, Salesi K, Varnell M, **Connaboy C, Nagai T, Lovalekar M**. (2017). Changes in Static Balance and Dynamic Postural Stability Are Associated with History of Ankle Sprain in Male and Female Intercollegiate Soccer Athletes. International Ankle Symposium; September 15-17, 2017; Chapel Hill, NC.

Faunce A, Moriarty R, Sciavolino B, Sridhar S**, Flanagan SD**. Transcranial Magnetic Stimulation Reveals Long-Term Reductions in Strength of Sensorimotor Circuits Governing Injured Leg After Anterior Cruciate Ligament Rupture. University of Pittsburgh First Experiences in Research Celebration of Research; Pittsburgh, PA April 2017.

Flanagan SD, Dunn-Lewis C, Onate JA, Volek JS, Maresh CM, Kraemer WJ. Is Seeing Believing? Validity of Modern Sham Coil as a Placebo in Neuromodulation Studies. Mid-Atlantic Regional Chapter of the American College of Sports Medicine Annual Meeting, Harrisburg, PA, November, 2017.

Flanagan SD, Dunn-Lewis C, Onate JA, Volek JS, Maresh CM, Kraemer WK. Leg-Specific Functional Activation in M1 Using Action Imagery During a Modified Attention Switching Task. Experimental Biology, Chicago, IL, April, 2017.

Flanagan SD, Dunn-Lewis C, Onate JA, Volek JS, Maresh CM, Kraemer WK. Unique Leg-specific Executive And Motor BOLD Activity With Visually-guided Imagery Following ACL Injury. American College of Sports Medicine Annual Meeting, Denver, CO, May, 2017.

Graham, SM, Grace, F, Sculthorpe, N, **Connaboy, C**, Baker, J and Baird, MF. (2017). Validation of a 6-s Cycle Ergometry Sprint to Measure Peak Power in Recreationally Active Females, ACSM's 64th Annual Meeting, May 30- June 3, Denver, CO.

Huang, HC, **Nagai, T**, Sell, TC, **Lovalekar, M, Nindl, BC, Connaboy, C**. (2017). Physical Fitness Predictors of a Proposed Combat Readiness Test. ACSM's 64th Annual Meeting, May 30- June 3, Denver, CO.

Johnson CD, Whitehead, PN, Pletcher, ER, Faherty, MS, **Lovalekar, MT, Eagle, SR, Keenan, KA**. Core Strength as a Predictor of Performance During Three Functional Movement Screens. ACSM National Conference, Denver, CO, May 30-Jun 3, 2017.

Johnson CD, Darnell ME, Nindl BC, Mares AV, Sakr MJ. The Use of an Experimental, Topical Foam to Enhance Skin Cooling and Sodium Retention. American College of Sports Medicine Mid-Atlantic Regional Chapter Meeting. November 3-4, 2017. Harrisburg, PA

Keenan, KA, Wohleber, MF, Perslweig, KA, Simonson, A, **Connaboy, C, Nindl, BC and Beals, K**. (2017). Musculoskeletal, balance, biomechanical, and physiological predictors of shoulder injury in Special Forces Operators, 4th International Congress on Soldiers' Physical Performance. Melbourne, Australia, 28th Nov-1st Dec, 2017.

Krajewski, KT, McCabe, C Brown, S, **Connaboy, C**. (2017). Inter-Segmental Coordination Strategies and Kinematics Utilized During a Single Leg 180° Jump, Mid-Atlantic Regional Chapter ACSM meeting, Nov 3rd-4th, Harrisburg, PA

LaGoy, AD, Johnson, CD, Allison, KF, Flanagan, SD, Lovalekar, MT, Nagai, T, Connaboy, C. (2017). Effect of Increasing Military-Related Load Carriage Magnitude on Dynamic Postural Stability in Men and Women, Mid-Atlantic Regional Chapter ACSM meeting, Nov 3rd-4th, Harrisburg, PA

Lane, JS, Bansbach, HM, **Connaboy, C, Darnell, ME, Keenan, K, Lovalekar, MT, Nagai, T, Allison, KF**. (2017). The Effects of Loaded Fatigue on Loaded Postural Stability, Mid-Atlantic Regional Chapter ACSM meeting, Nov 3rd-4th, Harrisburg, PA

Liu D, Namas RA, Abdul-Malak O, Guardado, J, Zuckerbraun B, Sperry J, Rosengart M, Vodovotz Y, **Mi, Q**, Billiar T, Implementation of Multiple Organ Dysfunction Score Parameter to Identify Outcome-based Phenotypes for Trauma Clinical Trials, American Surgical Association's 127th Annual Meeting, Philadelphia, PA, April 20-22, 2017

Lovalekar M, Keenan K, Perlsweig K, **Beals K**. Descriptive Epidemiology of Musculoskeletal Injuries and Associated Healthcare Utilization among Crewman Qualification Training Students. American Public Health Association 2017 Annual Meeting & Expo. Atlanta, GA; Nov. 4 - Nov. 8, 2017.

Moir, GL, Snyder, BW, **Connaboy, C**, Lamont, HS and Davis, SE. (2017). The Influence of the Number of Jumps on Eccentric and Concentric Force-Velocity Characteristics, ACSM's 64th Annual Meeting, May 30- June 3, Denver, CO.

Nagai, T, Beethe, AZ, Connaboy, C, Lovalekar, MT, Abt, JP, Lephart, SM, **Nagle, EF**. (2017). Gender Differences on Water-Based Aerobic Capacity During Incremental Free-Style Swimming to Exhaustion. ACSM's 64th Annual Meeting, May 30- June 3, Denver, CO.

Nagle, EF, Nagai, T, Beethe, AZ, Lovalekar, MT, Nagle, JA, **Connaboy, C**, Abt, JP, Robertson, RJ, Lephart, SM. (2017). Reliability and Validity of a Maximal Aerobic Power Swimming Pool Protocol Using Healthy Adult Males and Females ACSM's 64th Annual Meeting, May 30- June 3, Denver, CO.

Nagle, JA, **Nagle, EF, Nagai, T, Lovalekar, MT, Connaboy, C**, Abt, JP, Robertson, RJ, Lephart, SM. (2017). Differences in Mean and Peak Swimming Force and their Association to Swimming Performance and Land-based Anaerobic Performance: Comparing Males and Females ACSM's 64th Annual Meeting, May 30- June 3, Denver, CO.

Perlsweig KA, **Mi Q, Lovalekar M, Beals K**. Heart Rate Variability Changes in Reserve SEAL Operators during close quarters combat training, 4th International Congress on Soldiers' Physical Performance, Melbourne, Australia ,Nov 28 Dec 1, 2017

Rawcliffe, A, Simpson, R, Graham, S, Psycharakis, S, Bansbach, H, and **Connaboy, C**. (2017). Changes in ankle proprioception and neuromuscular function following an acute bout of British Army foot drill: Implications of lower-limb musculoskeletal injury risk, 4th International Congress on Soldiers' Physical Performance. Melbourne, Australia, 28th Nov-1st Dec, 2017.

Rawcliffe, A, Morrison, A, Graham, SM, Simpson, R, Psycharakis, S and **Connaboy, C**. (2017). A 3-dimensional biomechanical analysis of British Army foot-drill in untrained personnel: Implications for lower-extremity injury risk, 4th International Congress on Soldiers' Physical Performance. Melbourne, Australia, 28th Nov-1st Dec, 2017.

Schmidt, MM, Nagle, EZ, Nagai, T, Beethe, AZ, Lovalekar, MT, Connaboy, C, Abt, JP, Lephart, SM, **Nindl, BC.** (2017). Association of Body Composition to Aerobic Capacity and Swimming Performance in Adult Fitness Swimmers, Mid-Atlantic Regional Chapter ACSM meeting, Nov 3rd-4th, Harrisburg, PA

Schmitz JL, Whitehead PN, **Darnell ME**, Akins JS, **Lovalekar MT**, Conley KM, **Nagai T**. Comparison and correlation of dynamic postural stability indices obtained during different dynamic landing tasks and footwear conditions. The 12th Annual Atlantic Coast Conference (ACC) Meeting of the Minds Conference, Duke University; March 31 thru April 2, 2017; Durham, NC.

Sinnott, AM, Lovalekar, MT, Nagle, EZ, Beethe, AZ, Nagai, T, Nindl, BC, Connaboy, C. (2017). Does Fatiguing Exercise Influence Performance on an Affordance-Based Action Boundary Task? Mid-Atlantic Regional Chapter ACSM meeting, Nov 3rd-4th, Harrisburg, PA

Snyder, BW, Moir, GL, **Connaboy, C**, Lamont, HS and Davis, SE. (2017). A Comparison of Different Methods for Assessing Plyometric Ability during Jumps, ACSM's 64th Annual Meeting, May 30- June 3, Denver, CO.

Snyder, J, **Beethe, AZ, Nagai, T, Nagle, EZ, Schmidt, MM, Connaboy, C, Lovalekar, M**, Abt, JP, Lephart, SM, **Nindl, BC**. (2017). Association Between Aerobic Combat Swimming Performance and Anaerobic Kicking Power in Adult Fitness Swimmers, Mid-Atlantic Regional Chapter ACSM meeting, Nov 3rd-4th, Harrisburg, PA

Stump, RK, Pletcher, E, **Connaboy, C, Allison, KF, Lovalekar, M, Darnell, ME, Nagai, T**. (2017). Effects of Fatigue Induced by Intermittent Running on Muscular Strength, Power, and Glycogen Content, Mid-Atlantic Regional Chapter ACSM meeting, Nov 3rd-4th, Harrisburg, PA

Winterton, M Martindale, RJJ and **Connaboy, C**. (2017). UK military veterans: social identities and barriers to inclusion, British Sociological Association Annual Conference, April 4th- 6th, Manchester, UK, 2017

Wohleber, MF, **Keenan, KA**, Perslweig, KA, Simonson, A, **Connaboy, C, Nindl, BC and Beals, K**. (2017). Musculoskeletal, physiological, and balance characteristics associated with prospective lower extremity injury type in Special Operations Forces, 4th International Congress on Soldiers' Physical Performance. Melbourne, Australia, 28th Nov-1st Dec, 2017.

Wohleber, M, Simonson, A, **Lovalekar, ML**, Rafferty, D, Sell, T, Reinert, A, **Connaboy, C**. (2017). Knee isokinetic strength and fat free mass correlate to anaerobic output among Air Force Operators, ACSM's 64th Annual Meeting, May 30- June 3, Denver, CO.

Youell JD, Simonson SR, **Darnell ME**, Conger SA. The Effects of Carbohydrate Mouth Rinse Concentration on Cycling Time Trial Performance. American College of Sports Medicine Annual Meeting; May 30 - June 3, 2017; Denver, CO

Invited Speaking Engagements

Katelyn Allison

Title: Body Composition and Anthropometric Variables are Associated with Better Physiological and Musculoskeletal Performance in Female Marines
Event: Military Women's Health Research Interest Group Quarterly Call, Jan. 12

Chris Connaboy

Title: Perception of Action Boundaries and Return-to-Play and (Re)injury Risk: A New Test Battery
Event: Grand Rounds, UPMC Sports Medicine Concussion Program, March 16, Pittsburgh, PA

Title: Optimizing the Physical Performance of Women in Ground Close Combat Roles
Event: USARIEM Meeting, Oct. 12, Natick, MA

Title: Understanding performance optimization and injury risk mitigation through the accumulation of marginal gains and the aggregations of marginal losses
Event: Mid-Atlantic Regional Chapter ACSM Meeting, Nov. 4-5, Harrisburg, PA

Title: Training interventions for women in ground close combat roles
Event: 711th Human Performance Wing of U.S. Air Force, Nov. 8, Pittsburgh, PA

Title: Characterization of Psychological Resilience and Readiness: Cross-Validation of Cognitive and Behavioral Metrics During Acute Military Operational Stress
Event: 711th Human Performance Wing of U.S. Air Force, Nov. 8, Pittsburgh, PA

Matt Darnell

Title: Full Plate: Nutrition for Managing Busy Lifestyles and Stress
Event: UPMC Neurosurgical Residents Wellness Seminar Series, Sep. 20, Pittsburgh, PA

Shawn Flanagan

Title: Emerging Ideas and Approaches at the Intersection of Exercise and Brain Health
Event: Frontiers in Brain Health Lunch Lecture Series at the University of Texas Dallas, May 5

Mita Lovalekar

Title: Advances in Military Medicine and Performance
Event: Mid-Atlantic Regional Chapter ACSM Meeting, Nov. 4-5, Harrisburg, PA

Bradley Nindl

Title: Human Performance Metrics for Optimization of Warrior Physical Readiness
Event: NATO Special Operations Research Workshop on Human Performance, Jan. 26, Stuttgart, Germany

Title: How the University of Pittsburgh's Neuromuscular Research Laboratory/Warrior Human Performance Research Center Contributes Scientific Knowledge to Bolster U.S. National Security
Event: University of Pittsburgh Office of Health Sciences Alumni Relations Baltimore Alumni Reception, April 20, Baltimore, MD

Title: Optimizing Military Performance: Science and Strategies
Event: 20th Maccabiah International Conference of Medicine and Sport Sciences, June 29, Netanya, Israel

Title: Characterization of Psychological Resilience and Readiness: Cross-validation of Cognitive and Behvaioral Metrics During Acute Military Operational Stress
Event: NATO SOF Medicine Research Workshop, Lisbon, Portugal, 5 October 2017.

Title: Role on Insulin-like growth factor-I in stress fracture risk
Event: 4th International Congress of Soldiers' Physical Performance entitled Sex-Specific considerations in stress fracture risk of military personnel, Melbourne, Australia, 1 Dec 2017.

Title: Recommendations for improving Military Physical Performance and Fitness
Event: Invited talk to the Australian Physical Training Instructor Cadre at the 4th International Congress of Soldiers' Physical Performance Melbourne, Australia, 29 Nov 2017.

Title: International Military Physiology Roundtable on Military Resilience (Moderator)

Event: 4th International Congress of Soldiers' Physical Performance Melbourne, Australia, 1 Dec 2017.

Title: University of Pittsburgh Neuromuscular Research Laboratory/Warrior Human Performance Research Center
Event: University of Canberra Research Institute for Sport and Exercise, Canberra, Australis, 4 Dec 2017.

Title: Optimizing Military Physical Performance: Science and Strategies
Event: Russell Army HQ, Canberra, Australia, 5 Dec 2017.

Awards and Recognition

Meaghan Beckner

Award/Recognition: Most Outstanding Master's Student
Awarding Body: University of Pittsburgh, Department of Health and Physical Activity

Anne Beethe

Award/Recognition: ICSPP-CISM Student Travel Grant
Awarding Body: 4th International Congress of Soldiers Physical Performance

Award/Recognition: Research Fellowship Board Grant
Awarding Body: National Swimming Pool Foundation

Courtenay Dunn-Lewis

Award/Recognition: 2017 Summer Fellowship
Awarding Body: Retirement Research Foundation

Shawn Eagle

Award/Recognition: ICSPP-CISM Student Travel Grant
Awarding Body: 4th International Congress of Soldiers Physical Performance

Caleb Johnson

Award/Recognition: SHRS Research Development Award
Awarding Body: University of Pittsburgh, School of Health and Rehabilitation Sciences

Award/Recognition: ACSM President's Cup Regional Winner
Awarding Body: Mid-Atlantic Regional Chapter of ACSM

Elizabeth Nagle

Award/Recognition: Invited Committee Member for Task Force on Pool Safety, Aquatic Fitness and Exercise
Awarding Body: American College of Sports Medicine

Award/Recognition: President's Award
Awarding Body: Mt. Lebanon Aqua Club

Additional Information

For additional information about the NMRL, please contact:

Bradley C. Nindl, PhD, FACSM
Director
Neuromuscular Research Laboratory
bnindl@pitt.edu
412-246-0460

Neuromuscular Research Laboratory
Warrior Human Performance Research Center
School of Health and Rehabilitation Sciences
University of Pittsburgh

Strategy Map

Vision: To be internationally recognized as a premier academic research center and its faculty as thought leaders in musculoskeletal injury prevention and human performance optimization

Mission: To mitigate musculoskeletal injuries and optimize human performance by conducting innovative, multidisciplinary basic and applied research; providing evidence and translating scientific knowledge; and enhancing clinical decisions and education. This research will lead to improved quality of life and resiliency in athletic, military, and active populations.

Core Values: **Integrity ~ Innovation ~ Professionalism ~ Adaptability ~ Collaboration ~ Mentorship ~ Impact ~ Diligence ~Perseverance**

INNOVATION

Strategic Themes:

Grantsmanship
Plan, develop, implement, and execute proactive and aggressive funding/grant-seeking strategies by two major approaches: 1) continued pursuit of legacy DoD funding; and 2) diversification of our research funding portfolio by pursuit from non-DoD funding (NIH, VA, industry, etc.). Cultivate an enduring team approach that leverages our human capital to foster success.

Scholarship
Maximize our scientific impact, influence, and acumen by frequently publishing in the top journals in sports medicine, rehabilitation sciences, injury prevention, athletic training, biomechanics and exercise physiology. Develop thought leaders in the field who are highly sought for invited talks, research collaborations, consultation and expertise. Full and visible participation with professional organizations/societies, editorial boards, and national/international scientific meetings.

Partnership
Establishing collaborative relationships regionally, nationally, and internationally of mutual benefit that synchronize efforts, enhance, complement , and optimize our grantsmanship and scholarly results.

Mentorship
Instill, cultivate, and foster an altruistic, mentor-based culture to benefit and develop students and faculty to be future global thought-leaders. A supportive environment manifested by visible and transparent lines of communication that nurtures scholarship, teaching, and service bands of excellence.

Customer/ Stakeholder
- CS 1.0 Increase Customer Base
- CS 2.0 Increase Customer Satisfaction
- CS 3.0 Maximize F/S/F Satisfaction

Funding/ Stewardship
- FS 1.0 Maximize Financial Resources

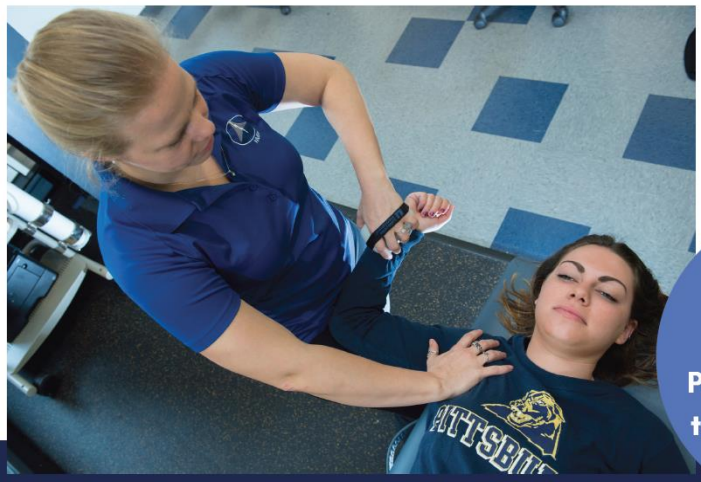
Internal Processes
- IP 1.0 Increase Scholarly Productivity
- IP 2.0 Balance Standardization with Innovation
- IP 3.0 Cultivate Partnership
- IP 4.0 Increase Visibility of Research

People and Tools
- PT 1.0 Optimize Human Capital
- PT 2.0 Improve Communications & Teamwork
- PT 3.0 Leverage Technology

Feedback May Adjust Resourcing

University of Pittsburgh

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



ACADEMIC PROGRAMS

- Nutrition and Dietetics (MS)
- Sports Medicine (MS)
- Wellness and Human Performance (MS)
- Rehabilitation Science with a concentration in Sports Medicine (PhD)

Participate in lab testing with elite athletes

State-of-the-art lab facilities

Small class sizes

NEUROMUSCULAR RESEARCH LABORATORY (NMRL)

Students may have exposure to the Neuromuscular Research Laboratory (NMRL) - the Department's applied research facility. The 11,600 square foot lab utilizes cutting-edge and innovative research capabilities with a multi-disciplinary, team-centric approach to **optimizing human performance and mitigating musculoskeletal injuries to improve both the quality of life and resiliency in athletic, military and active populations.**

Lab information: www.nmrl.pitt.edu

We provide superior education, research and practical experiences to prepare students to be innovative and knowledgeable professionals in the field of sports medicine and nutrition.

Our programs create leaders who work in community, private, clinical, educational and research settings.

Program information: www.shrs.pitt.edu/smn