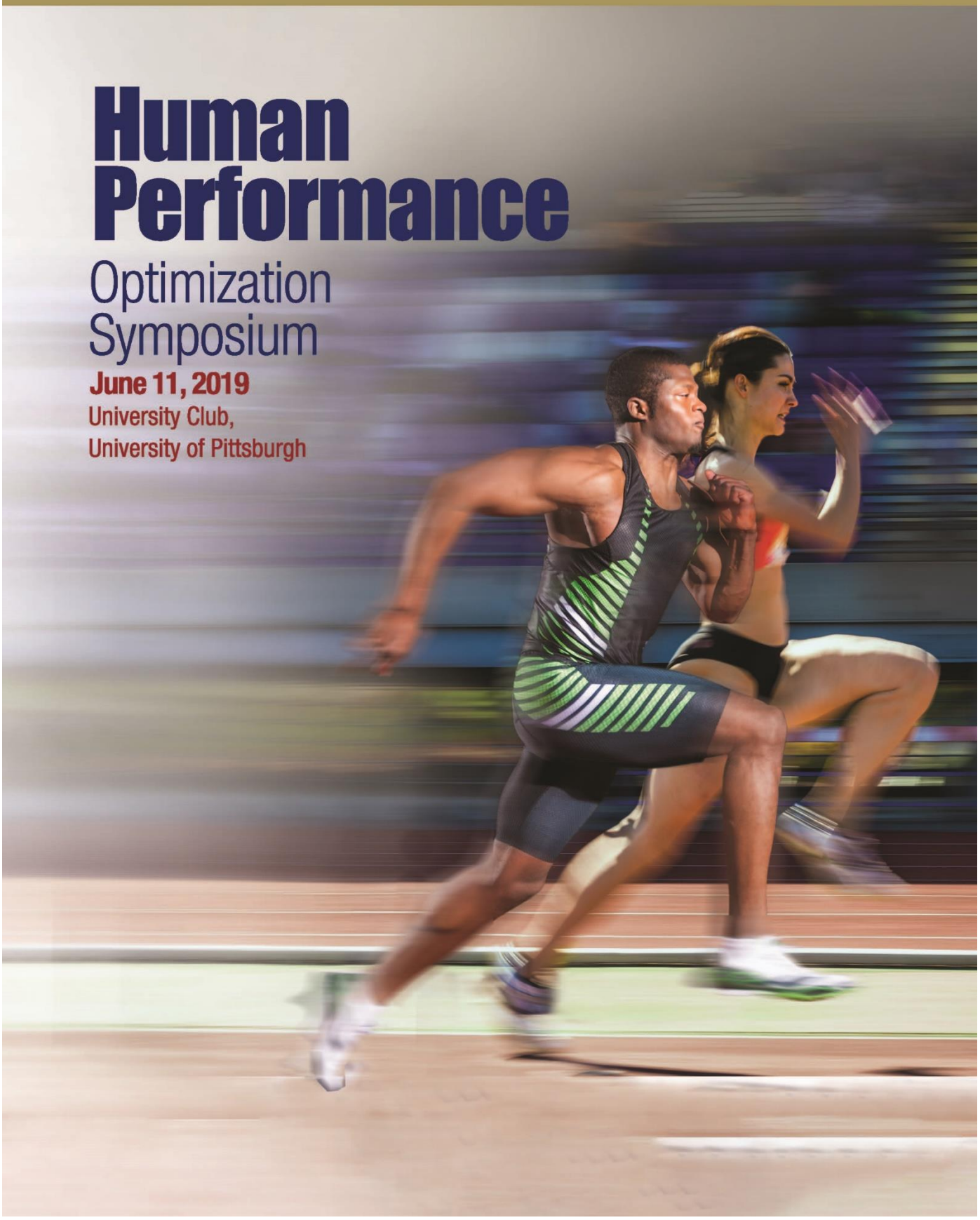
University of Pittsburgh

Human Performance

Optimization Symposium

June 11, 2019

University Club,
University of Pittsburgh



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Symposium Planning Committee:

Chair: Bradley Nindl, PhD, FACSM
Director of the Neuromuscular Research Laboratory (NMRL)
And Warrior Human Performance Research Center

Freddie H. Fu, MD
Professor and Chair, Orthopaedic Surgery

Nathan Urban, PhD
Vice Provost for Graduate Studies and Strategic Initiatives
Professor and Vice Chair, Neurobiology

Cynthia Sweet, MS
Associate Vice Chancellor, Office of Economic Partnerships

Kim Beals, PhD, RD, CSSD, LDN
Associate Professor, Department of Sports Medicine and Nutrition
Associate Director, Neuromuscular Research Laboratory

Jennifer Brown, MS, CTA
Senior Associate Athletic Director for Sports Medicine
Head training for Men's Basketball Program

Patrick Cantini
Strategy and Business Development Officer, McGowan Institute for Regenerative Medicine

Kevin M. Conley, PhD, ATC
Associate Professor and Chair, Department of Sports Medicine and Nutrition

Evan Facher, PhD, MBA
Vice Chancellor for Innovation and Entrepreneurship
Director of the Innovation Institute

Ann Gleeson, MS
Managing Director, Center for Military Medicine Research

Tara Ridge-Hankin, PT, MS
Vice Chair and Director, Post Professional Education
Assistant Professor, Department of Physical Therapy

Chris Hoppe, JD
Executive Associate Athletic Director, Sports Administration and Student-Athletic Support Services

James Irrgang, PT, PhD, FAPTA
Chair and Professor of Physical Therapy

John M. Jakicic, PhD
Distinguished Professor and Chair, Department of Health and Physical Activity

Ron Poropatich, MD
Director, Center for Military Medicine Research

Symposium Organizers:

The McGowan Institute for Regenerative Medicine

The McGowan Institute for Regenerative Medicine is a partnership between the University of Pittsburgh and UPMC and serves as a base for scientists and clinical faculty working in tissue engineering and biomaterials, cellular therapies, and medical devices and artificial organs. McGowan's mission is the development of innovation clinical protocols and the commercial transfer of new technologies.

www.mcgowan.pitt.edu

Neuromuscular Research Laboratory / Warrior Human Performance Research Center

The Neuromuscular Research Laboratory/Warrior Human Performance Research Center (NMRL) is the applied research facility of the University of Pittsburgh's Department of Sports Medicine and Nutrition, within the School of Health and Rehabilitation Sciences.

Since 1990, the NMRL has initiated research in the areas of proprioception and neuromuscular control, in an attempt to answer many of the questions regarding the role of capsuloligamentous structures in the pathoetiology of joint injury. The objectives of our research has been to study comprehensive profiles of an individual's function by evaluating both the sensory and motor characteristics specific to musculoskeletal injury and pathology. Biomechanical and neuromuscular assessments under sports-simulated environments are used to determine specific variables including investigating the influence of weight distribution, muscle function, balance, flexibility, proprioception, gender, aging, and fatigue, as well as the effects of injury, surgery, and rehabilitation on joint stability. Deficiencies in body mechanics and muscle function are used to develop programs, not only to improve performance, but also minimize potential for injury.

We have also applied the sports injury prevention and performance enhancement model to the United States military in our Department of Defense (DoD) research. The NMRL, particularly the Warrior Human Performance Research Center, provides administrative and technical oversight of DoD research. Technical responsibilities include data processing and management; database entry of laboratory, injury, and nutrition data; analysis of food records; development of testing protocols; piloting of new testing protocols; and collection of athletic model data.

The NMRL is staffed by multidisciplinary research faculty and graduate students including athletic trainers, physical therapists, exercise physiologists, bioengineers, biomechanists, registered dietitians, medical doctors and epidemiologists.

http://www.nmrl.pitt.edu/about

Symposium Sponsors:

The Center for the Neural Basis of Cognition (CNBC) is a joint venture of the the University of Pittsburgh and Carnegie Mellon University. The center leverages Pitt's strengths in basic and clinical neuroscience and those of Carnegie Mellon in cognitive and computational neuroscience to support a coordinated cross-university research and educational program of international stature. In the CNBC, more than 200 world-class faculty and trainees investigate the cognitive and neural mechanisms that give rise to biological intelligence and behavior. Research topics include affective, cognitive, linguistic, perceptual, motor, and social systems in both normal and disordered populations, as well as computational neuroscience. The CNBC also promotes the translation of findings from basic research into applications for medicine, education, robotics, and artificial intelligence.
http://www.braininstitute.pitt.edu/center-neural-basis-cognition

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Established in 1969 as a health sciences school of the University of Pittsburgh, SHRS stands on its solid reputation as an international leader in rehabilitation and disabilities education, research and community service, improving the lives and independence of all people with a focus on people at risk for or having chronic conditions or disabilities and those who have traditionally been underserved and underrepresented.

Our Vision
To be a catalyst for a world free of barriers and disparities that allows all people, regardless of health, to have opportunities to participate in life to the fullest; to be accomplished through education, research and service.

Our Mission
To advance health, rehabilitation and reintegration service delivery through teaching, research and professional service.

We advance our Mission and pursue our Vision by:

Providing an unparalleled environment for education and training
Supporting an inter-professional approach to research to address challenges of people with acute and chronic conditions and disabilities
Collaborating with local, national and international partners to address and improve integration of rehabilitation services in health care delivery systems, community engagement and models of care.

www.shrs.pitt.edu

Department of Orthopaedic Surgery

Founded in 1909 as a Division of General Surgery and subsequently named a separate department of the University of Pittsburgh School of Medicine in 1953, this surgical specialty flourished initially under the direction of Drs. David Silver, Paul Steele, Albert Ferguson, and James Herndon. In 1998, Freddie H. Fu, MD was appointed chairman and awarded the David Silver Chair in orthopaedics. Through the years, the department has attained a national and international reputation for teaching and developing recognized leaders in orthopaedics. Many important contributions to advanced understanding of orthopaedic diseases have emanated from the department. The department's research budget has grown steadily, covering diverse but interrelated areas such as arthritis; cartilage metabolism; the bio-mechanics of soft tissue, implants, joint, and bones; gene therapy; robotics and computer-assisted surgery; and spinal deformity.

Today, under the leadership of Dr. Fu, a talented staff of established clinicians and scientists is furthering the department's international standing. The faculty is committed to providing excellence in clinical care, a focused education in various subspecialties, and cooperative participation in innovative research. Part-time faculty take a dynamic interest in teaching and providing clinical guidance in all orthopaedic areas and, in many instance, complement full-time faculty expertise in subspecialty areas. Continued expansion of the basic science faculty and development of a large facility for studying biomechanical and development aspects of musculoskeletal diseases have made this one of the premier programs in the country.

https://www.orthonet.pitt.edu/about

Established in 2013, The University of Pittsburgh Innovation Institute is the University's hub for innovation and entrepreneurship.

The Innovation Institute provides a comprehensive suite of services for Pitt Innovators, from protecting intellectual property to the commercialization of new discoveries through licensing and/or new enterprise development. The Institute also provides a wealth of educational programming, mentoring and networking for Pitt faculty, students and partners.

The Innovation Institute strengthens the culture of innovation and entrepreneurship at Pitt and is eager to facilitate and support entrepreneurial initiatives across the university and beyond. It is also invites alumni, entrepreneurs and industry partners to collaborate with our faculty and students to help achieve societal impact through commercialization.

Through the affiliated Institute for Entrepreneurial Excellence, the Innovation Institute also assists entrepreneurs throughout Western Pennsylvania in starting, growing or transitioning their businesses.

The Innovation Institute is led by the Vice Chancellor for Innovation and Entrepreneurship and Director, Evan Facher, PhD, MBA, and is under the purview of Senior Vice Chancellor for Research, Rob A. Rutenbar.

https://www.innovation.pitt.edu/about/

The Center for Military Medicine Research (CMMR) at the University of Pittsburgh was established in 2012 to support the medical research interests of the Department of Defense and Veterans Affairs. Over the last six years, CMMR has built a series of multi-disciplinary research programs between academia, industry and military researchers. The Center's work is national in scope and we have close connections across the US Armed Forces community.

The Center for Military Medicine Research (CMMR) "represents a formal mechanism through which the challenges and opportunities of casualty care and wound healing can be examined at an advanced research level," announced Arthur S. Levine, Pitt's senior vice chancellor for the health sciences and dean of the School of Medicine.

CMMR has lived up to Dr. Levine's pledge that the center would "identify a network of successful partnerships and collaborations between scientists, clinicians, industry, and the U.S. Departments of Defense and Veterans Affairs to foster the most promising research technologies and therapeutic strategies."

https://www.cmmr.pitt.edu/

To realize the vast potential of tissue engineering and other techniques aimed at repairing damaged or diseased tissues and organs, the University of Pittsburgh School of Medicine and University of Pittsburgh Medical Center established the McGowan Institute for Regenerative Medicine. The McGowan Institute serves as a single base of

operations for the university's leading scientists and clinical faculty working in the areas of tissue engineering, cellular therapies, and artificial and biohybrid organ devices.

The Institute's mission includes the development of innovative clinical protocols as well as the pursuit of rapid commercial transfer of its technologies related to regenerative medicine. Also critical to the mission is the education and training of the next generation of scientists, clinicians and engineers who will be carrying the field forward toward the ultimate goal of patient benefit.

The McGowan Institute Director is William R. Wagner, PhD, who is a professor in the Department of Surgery at the University of Pittsburgh, with joint appointments in the Departments of Bioengineering and Chemical Engineering. He is an active researcher in the biomaterials field and leads a research group focused on developing technology to address cardiovascular disease.

The Institute takes its name from the McGowan Center for Artificial Organ Development, which has been incorporated into the McGowan Institute. Through the McGowan Institute's expanded role and mission, other university faculty have joined forces to address promising opportunities in tissue engineering, adult-derived stem cell research and wound healing.

https://mirm-pitt.net/

DARI MOTION
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"Scientific Analytics is the insight engine of human movement. Our patented and FDA-Cleared DARI Motion capture technology uses computer vision and cloud-based physics processing to generate instant, actionable human movement insights to empower people to move better and live better, avoid injury, and perform their best. Scientific Analytics is committed to using this groundbreaking technology and our database of 425+ billion human movement data points to improve motion health the world over."

www.Scientificanalytics.com www.DARImotion.com

READY
NUTRITION

Ready Nutrition was founded by 2-Time Pitt Basketball Captain, Pat Cavanaugh, with one simple mission – Develop Clean, Powerful Sports Nutrition Products.
All products are All-Natural or Organic and contain no Sugar Alcohols and or Artificial Ingredients.
Ready Water was designed as a functional sports drink to provide clean, powerful hydration that is NSF Certified Gluten-Free using fruits and veggies for color. Over 100 Division 1 Teams nationwide use Ready Water in their recovery and hydration programs.

Ready Water Flavor Development – The average time for Ready to bring a new flavor to market is 6-9 months with Pat Cavanaugh himself signing off on each and every flavor.

Unique and On-Trend Flavors –
Cotton Candy Grape – Ready is a big fan of Cotton Candy Grapes (The Green Grapes are available seasonally and taste like Cotton Candy). They wanted to offer a cotton candy grape flavor and took over 9 months to perfect this sweet & refreshing addition to the Ready Water lineup .

Black Cherry – This "sleeper" flavor has become a top seller within the entire roster of Ready Water. Smooth, light and refreshing, this continues to be a favorite with Ready customers.

Lemon Ice – This is Pat Cavanaugh's favorite flavor and one that also took over 6 months to develop. Not to too sweet with just a hint of lemon just as Pat likes in his daily gallon of water. The) goal was to accomplish a flavor that tasted just like regular water with a squeeze of lemon in it, and we nailed it!
www.comeready.com

Exhibitors:

Hosted by:

University of Pittsburgh

Founded in 1787, the University of Pittsburgh is one of the oldest institutions of higher education in the United States. Pitt people have defeated polio, unlocked the secrets of DNA, lead the world in organ transplantation, and pioneered TV and heavier-than-air flight, among numerous other accomplishments.

From research achievements to the quality of its academic programs, the University of Pittsburgh ranks among the best in higher education.

Faculty members have expanded knowledge in the humanities and sciences, earning such prestigious honors as the National Medal of Science, the MacArthur Foundation's "genius" grant, the Lasker-DeBakey Clinical Medical Research Award, and election to the National Academy of Sciences and the Institute of Medicine.

Pitt students have earned Rhodes, Goldwater, Marshall, and Truman Scholarships, among other highly competitive national and international scholarships.

Alumni have pioneered MRI and TV, won Nobels and Pulitzers, led corporations and universities, served in government and the military, conquered Hollywood and The New York Times bestsellers list, and won Super Bowls and NBA championships.

Symposium Overview:

The symposium will address human performance optimization and will appeal to an audience of scientists, engineers, clinicians (Orthopaedics, neurology, physical medicine, genetics etc.), sports conditioning professionals, physical and occupational therapists, coaches, team trainers, athletic directors and personnel as well as others involved in the conditioning and rehabilitation of athletes.

Objectives:

To fully optimize physical readiness and performance, a fully-rounded approach to training and conditioning, nutrition, recovery, monitoring, longevity and health must be taken. The symposium on Human Performance Optimization has an educational focus and commitment to bringing the most up-to-date scientific information in the above areas of health and performance enhancement to the professionals in the field. The event will foster an environment for sports performance specialists, Military performance specialists, nutritionists, functional medicine and rehabilitation specialists to learn the most effective strategies for enhancement of training adaptations and improvements to optimize sports performance. Our presenters bring a wealth of experience in clinical analytics, nutrition, strength and conditioning, rehabilitation/recovery and applied sports science. Our collective goal is to collaborate, build, and learn while educating our industry to develop resiliency for life and performance.

Individual presentation objectives provided within the speaker's bio, if provided.

Continuing Education Credit

The American College of Sports Medicine's Professional Education Committee certifies that "University of Pittsburgh (Human Performance Optimization Symposium)" meets the criteria for official ACSM Approved Provider status from June 2019 to December 2022. Approved Providers and their content reflect the concepts of their respective organizations and do not necessarily represent the positions or policies of ACSM. Providership # 846338

Course approved for 6 contact hours = 6 CEC's

Please contact Katy Wharton at whartonkm@upmc.edu for certificate.

Pennsylvania Physical Therapy Professionals

The University of Pittsburgh, School of Health and Rehabilitation Sciences, Department of Physical Therapy has accredited this activity for 7 general CEU* credits.

*Continuing Education Units (CEU), traditional classroom-based format, was once the only activity available to help PT licensees maintain their professional competence. It is now only one of a growing number of activities, such as specialty exams, residencies, and membership in a professional organization that many PT Boards now recognize under the title of continuing competence units.

Nutrition Educational Credits

The overall session objectives are:

- Describe current evidence-based guidelines and strategies to optimize nutrition for exercise training and recovery.
- Discuss the use of a personalized nutrition approach to improve training adaptations, athlete performance and recovery
- Apply evidence-based guidelines to help collegiate and professional athletes maximize training and recovery.
- Provide a forum for discussion of contemporary issues related to nutrition and exercise science

Type of Activity: Lecture/Discussion CPE hours = up to 6 hours for the entire day

Activity Contact: Dr. Kim Beals, beals.kim@pitt.edu 412-246-0477

Human Performance Optimization State of the Science Symposium

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7:00 am - 3:30pm	Meeting registration open	Location: Second floor
7:30 am - 8:00 am	Continental Breakfast	Foyer of Ballroom B
8:00 am - 8:15 am	Opening Remarks	Ballroom B
8:15 am - 9:45 am	**Session #1 – Sports Analytics and Wearables** *Moderator – **Chris Connaboy, PhD**, Assistant Professor, University of Pittsburgh* Plenary Speaker: **Yaser Sheikh, PhD,** Associate Professor, Robotics Institute, Carnegie Mellon Institute *Presentation title: Social Perception for Machines* **Qi Mi, PhD,** Assistant Professor, University of Pittsburgh *Presentation title: Data Visualization and Analytics in Human Performance* **Gelsy Torres-Oviedo, PhD,** Assistant Professor, University of Pittsburgh *Presentation title: Sensorimotor Adaptation Studies Towards Improving Gait Rehabilitation* **Eni Halilaj, PhD,** Assistant Professor, Carnegie Mellon University *Presentation title: Turning Data from Wearables and Images Into Meaningful Biomechanical Outcomes* **Roundtable Discussion**	Ballroom B
9:45 am - 10:00 am	Refreshment Break	Ballroom B
10:00 am - 11:30 am	**Session #2 – Sports Medicine & Injury Prevention** *Moderator – Jennifer Brown, Senior Associate Athletic Director for Sports Medicine, University of Pittsburgh* Plenary Speaker: **Freddie H. Fu, MD,** Professor and Chair, Orthopaedic Surgery , University of Pittsburgh *Presentation title: Is the Latest, Always the Greatest in Sports Medicine* **Mark Paterno, PT, PhD,** Professor, Cincinnati Children's Hospital Medical Center *Presentation title: Injury Prevention in Rehabilitation*	Ballroom B

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10:00 am - 11:30am	**Session #2 – Sports Medicine & Injury Prevention (continued)** **Volker Musahl, MD,** Professor, University of Pittsburgh Presentation title: *UPMC Sports Performance-Experience with Pitt Football* **James Irrgang,** PT PhD, FAPTA, Professor, University of Pittsburgh Presentation title: *Rehabilitation Concepts for Sports-Related Injuries to Optimize Human Performance* **Roundtable Discussion**	Location: Ballroom B
11:30 am - 12:00pm	Poster oral presentations by: **William R. Conkright**, MS, RD, CSSD, CSCS, University of Pittsburgh Presentation title: *Energy Expenditure and Load Carriage Exceeded Military Recommendations in Special Operations Forces Deployed in Afghanistan* **Felix Proessl**, MS, University of Pittsburgh Presentation title: *Altered Brain Morphology in Women with History of ACL Rupture: A Structural MRI Study* **Alexis A. Pihoker,** MA, CSCS, University of Pittsburgh Presentation title: *Markers of Bone Formation Are Augmented Following Three Months of Ballistic Training* **Jordon Weaver,** BS, University of Pittsburgh Presentation title: *A Kinetic Model to Predict Human Muscle Growth*	Ballroom B
12:00 pm - 1:30 pm	Lunch and Poster Session	Ballroom A
1:30 pm - 3:00 pm	**Session #3 – Strength and Conditioning for the 21st Century** *Moderator – Brad Nindl, PhD, Professor, University of Pittsburgh* Plenary Speaker: **William Kraemer**, PhD, Professor, Human Services, Ohio State University Presentation Title: *Strength and Conditioning for the 21st Century* Panelists: **Dave Andrews,** Head Strength and Conditioning Coach, Men's Football, University of Pittsburgh	Ballroom B

1:30 pm - 3:00 pm	**Session #3 – Strength and Conditioning for the 21st Century (continued)** Panelists: (continued) **Tyler Carpenter,** Head Strength and Conditioning Coach, Men's Soccer, Women's Soccer and Men's Wrestling, University of Pittsburgh **Riley Ross,** Sports Science Performance Coach, Men's Wrestling, Ohio State University **Rhen Vail,** Strength and Conditioning Coach, Women's Basketball, University of Pittsburgh **Roundtable Discussion**	Location: Ballroom B
3:00 pm - 3:15 pm	Refreshment Break	Foyer of Ballroom B
3:15 pm - 4:45 pm	**Session #4 – Nutrition** *Moderator – Kim Beals, PhD, RD, CSSD, LDN, University of Pittsburgh* Plenary Speaker: **Nanci Guest, PhD, RD, CSCS**, University of Toronto *Presentation title: Sport Nutrigenomics: Personalized Nutrition to Improve Athletic Performance* **Matt Darnell, PhD, SCCC, CSSD**, University of Pittsburgh *Presentation title: Personalized Nutrition for Elite and Professional Athletes* **Auburn Weisensale, MS, RD, CSSD, LDN**, University of Pittsburgh *Presentation title: PITT nutrition* **Roundtable Discussion**	Ballroom B
4:45 pm - 5:00 pm	Closing Remarks	Ballroom B

Faculty Disclosures:

All individuals in a position to control the content of this education activity are required to disclose all relevant financial relationships with any proprietary entity producing, marketing, re-selling, or distributing health care goods or services, used on, or consumed by, patients.

No relevant financial relationships with commercial entities were disclosed by:
Dave Andrews
Kim Beals, PhD
Jennifer Brown
Tyler Carpenter
Kevin Conley, PhD
William Conkright
Matt Darnell, PhD, SCCS, CSSD
Eni Halilaj, PhD
James Irrgang, PT, PhD, FAPTA
William J. Kraemer, PhD
Qi Mi, PhD
Volker Musahl, PhD
Bradley Nindl, PhD
Mark Paterno, PT, PhD
Alexis Pihoker
Felix Proessl
Riley Ross
Yaser Sheikh, PhD
Gelsy Torres-Oviedo, PhD
Rhen Vail
Jordan Weaver
Auburn Weisensale

The following information was disclosed:

Chris Connaboy, PhD

- Grant/Research Support: NASA

Nanci Guest, PhD, RD, CSCS

- Grant/Research Support: Nutrigenomix Inc. (Industry partner through Mitacs)
- Stockholder: Hocoma; Flint Rehabilitation Devices

Disclaimer Statement
The information presented at this program represents the views and opinions of the individual presenters, and does not constitute the opinion or endorsement of, or promotion by, UPMC / University of Pittsburgh Medical Center or Affiliates and University of Pittsburgh School of Medicine. Reasonable efforts have been taken intending for educational subject matter to be presented in a balanced, unbiased fashion and in compliance with regulatory requirements. However, each program attendee must always use his/her own personal and professional judgment when considering further application of this information, particularly as it may relate to patient diagnostic or treatment decisions including, without limitation, FDA approved uses and any off-label uses.

Symposium Moderator, Session Chairs and Speaker bio's:

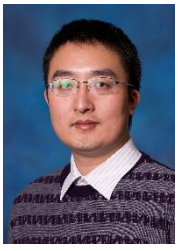
Session 1: Sports Analytics and Wearables:

Session organizer and moderator: **Chris Connaboy, PhD**, Assistant Professor, Sports Medicine and Nutrition, University of Pittsburgh

Dr. Chris Connaboy is an Assistant Professor in the Department of Sport Medicine and Nutrition, working within the Neuromuscular Research Laboratory and Warrior Human Performance Research Center. Dr Connaboy completed his PhD in Biomechanics and Motor Control and his MSc in Biomechanics at the University of Edinburgh. Prior to coming to the University of Pittsburgh, Dr. Connaboy worked at the University of Houston, TX and Edinburgh Napier University. Prior to undertaking his academic career Dr Connaboy was a soldier in the Black Watch, Royal Highland Regiment in the UK Armed Forces. As a researcher, he has expertise in human performance optimization with a specific focus on movement, coordination and the perceptuo-motor processes involved in performing skilled actions in elite soldiers and athletes. He currently serves as Co-Principal investigator on two studies (1) a study funded by the U.K. Ministry of Defence, to examining the Optimization of Training and Physical Performance for Women in Ground Close Combat Roles (WGCC 5.5.6: Task 0107), and (2) A NASA funded study (80JSC017N0001-HHCHFBP) examining the effects of a validated exercise regimen with guided imagery on behavioral health, fatigue, cognitive, sensorimotor, and immune system function in the Human Exploration Research Analog located at NASA's Johnson Space Center in Houston. He is currently a Co-investigator on a Congressionally Directed Medical Research Program award (W81XWH-16- PHTBIRP-CR3A): Characterization of Psychological Resilience and Readiness: Cross-Validation of Cognitive and Behavioral Metrics During Acute Military Operational Stress. He has also served as a co-investigator on a previous NASA funded study (NNX15AC13G) examining the Interrelationships Between Physical Health, Psychological Risk and Performance When Operating In Isolated, Confined And Extreme Environments. Also, he recently completed a project serving as PI on a study for the Air-Force the Special Operations Command (FA8650-12-2-6271): Injury Prevention and Human Performance Research Initiative.

Plenary Speaker: **Yaser Sheikh, PhD**, Associate Professor, Robotics Institute, Carnegie Mellon University

Yaser Sheikh is an Associate Professor at the Robotics Institute, Carnegie Mellon University. He also directs the Facebook Reality Lab in Pittsburgh, which is devoted to achieving photorealistic social interactions in AR and VR. His research broadly focuses on machine perception and rendering of social behavior, spanning sub-disciplines in computer vision, computer graphics, and machine learning. With colleagues and students, he has won the Honda Initiation Award (2010), Popular Science's "Best of What's New" Award, best student paper award at CVPR (2018), best paper awards at WACV (2012), SAP (2012), SCA (2010), ICCV THEMIS (2009), best demo award at ECCV (2016), and he received the Hillman Fellowship for Excellence in Computer Science Research (2004). Yaser has served as a senior committee member at leading conferences in computer vision, computer graphics, and robotics including SIGGRAPH (2013, 2014), CVPR (2014, 2015, 2018), ICRA (2014, 2016), ICCP (2011), and served as an Associate Editor of CVIU. His research has been featured by various media outlets including The New York Times, BBC, MSNBC, Popular Science, and in technology media such as WIRED, The Verge, and New Scientist.



Qi Mi, PhD, Assistant Professor, Sports Medicine and Nutrition, University of Pittsburgh

Qi Mi is an assistant professor in the Department of Sports Medicine and Nutrition within the School of Health and Rehabilitation Sciences. He completed his PhD in Mathematics at the University of Pittsburgh (Pittsburgh, PA).

Research Interests:

- Systems Biology, Applied Data Mining and Machine Learning in Sports Medicine and inflammation-related diseases.
- Knowledge discovery and predictive analytics in human performance and injury prevention
- Research tools development --- A framework for the multi-scale biomedical agent-based modeling (SPARK) and s software platform for visualization of multi-dimensional data (SPADE)

Gelsy Torres-Oviedo, PhD, Assistant Professor, Bioengineering, University of Pittsburgh

Gelsy Torres-Oviedo was a Ph.D. student of Prof. Lena Ting at The Georgia Institute of Technology and Emory University, where she developed analytical tools for understanding the neural control of balance and the functional consequences of changes in muscle activity. She was a post-doc in the laboratory of Prof. Amy J. Bastian at Johns Hopkins University and The Kennedy Krieger Institute, where she investigated factors that enhance motor learning and generalization of locomotor adaptation, which could improve the gait rehabilitation of patients beyond the clinical setting.

Eni Halilaj, PhD, Assistant Professor, Mechanical and Biomedical Engineering, Carnegie Mellon University

Eni Halilaj is an assistant professor of mechanical engineering at Carnegie Mellon University, where she directs the Musculoskeletal Biomechanics Lab. Her work focuses on musculoskeletal biomechanics in the context of injury and disease. She uses medical imaging, motion capture in laboratory settings and natural environments, computational modeling, and machine/statistical learning to elucidate the implication of movement mechanics in orthopaedic pathologies. Her ultimate goal is to integrate insights from her experimental and computational work in the development of effective rehabilitation strategies aimed at restoring and preserving pain-free mobility throughout the lifespan.

Prior to joining Carnegie Mellon in Fall 2018, Eni was a distinguished postdoctoral fellow at Stanford University and a member of the Mobilize Center—a National Institutes of Health Big Data to Knowledge Center of Excellence on Mobility Big Data. She completed her undergraduate and graduate studies at Brown University, where she was part of the Orthopaedic Bioengineering Lab in Biomedical Engineering and the Visualization Research Lab in Computer Science.

Session 2: Sports Medicine and Injury Prevention:

Session organizer: (with Dr. Irrgang listed below) **Tara Ridge-Hankin, PT, MS,** Vice Chair and Director, Post Professional Education, Assistant Professor, Department of Physical Therapy

Tara Ridge-Hankin is vice chair for Post-Professional Education, Department of Physical Therapy. She is responsible for surveying the post-professional education landscape and developing and implementing a plan to expand these offerings to meet the needs of local, regional, national and international PT audiences. Ridge-Hankin develops educational offerings to support residency and fellowship training and preparation of physical therapists for specialty certification in orthopaedics, orthopaedic manual therapy, sports, neurological, geriatric and women's health physical therapy. Previously, Ridge-Hankin worked for the UPMC Centers for Rehab Services where she held several management positions. She has also been an active member of the Program Services Council of the American Board of Physical Therapist Residency and Fellowship Education (ABPTRFE), serving as chair and director on the board.

Session moderator: **Jennifer Brown, MS, CTA,** Senior Associate Athletic Director for Sports Medicine, Head training for Men's Basketball Program

"At Pitt, student-athletes' health and well-being is at the core of what we do and this position will lead our efforts in this critical area," Lyke said. "We are confident Jennifer brings the right leadership qualities and breadth of experiences as an athletic trainer and administrator to spearhead this effort. She impresses us on many levels, including her focus on the student-athlete experience, progressive ideas and experiences."

Brown will oversee and set the direction for all aspects related to the Sports Medicine Team and the University of Pittsburgh's 19 sports.

Brown will also be responsible for the direct daily athletic training responsibilities of the men's basketball program. Additionally, she will also oversee and manage the department's student-athlete drug testing policy and insurance program. She will serve as the day-to-day liaison to the University of Pittsburgh Medical Center, the University Counseling Center, the Western Psychiatric Institute and Clinic and the School of Health and Rehabilitation Sciences Program.

Brown comes to Pitt after spending the last three years as head athletic trainer at Eastern Michigan University where she held the role of NCAA Athletic Health Care Administrator and was responsible for the daily sports medicine operation of the Eagles' 21 varsity sports programs. She managed the relationship with University of Michigan Health System physicians, supervised four assistant athletic trainers, numerous graduate and student athletic trainers, a mental health counselor, a dietician and held primary responsibilities and oversight of their football team.

During her three years in Ypsilanti, Brown's accomplishments included substantive improvements to the baseline testing and concussion management protocol, implementation of a mental health screening tool and development of the mental health treatment program, transitioning to EMU's first electronic medical records system and a complete re-design of the department's secondary insurance business model.

Prior to EMU, Brown spent 11 years at Northwestern University where she most recently served as the associate athletic trainer. At Northwestern, she worked directly with the Wildcats' football team. While in Evanston, Brown was a member of the University's Alcohol and Other Drug Collaborative Team and Biennial Review Committee as well as being a key stakeholder in the AOD policy revision. She has been active in professional organizations at the state, district and national levels, most recently serving as the Planning Committee Chair for the Great Lakes Athletic Trainers' Association Annual Meeting and Symposium. Brown has also presented at numerous sports medicine conferences.

Prior to NU, Brown served as an athletic trainer at Northern Illinois University (2003-04), University of Nebraska at Omaha (2001-03) and University of Colorado (2000-01).

A native of Machesney Park, Ill., Brown graduated from Northwestern in 1999 with a bachelor's degree in human development and psychological services before going on to earn her master's degree in fitness and wellness management from the University of Nebraska at Omaha in 2003.

She is a NATABOC Certified Athletic Trainer, licensed athletic trainer in Illinois, Michigan and Nebraska, and is an American Heart Association Healthcare Provider.

Plenary Speaker: **Freddie H. Fu, MD,** Professor and Chair, Orthopaedic Surgery, University of Pittsburgh

Freddie H. Fu, MD, has been the chairman of the Department of Orthopaedic Surgery at the University of Pittsburgh School of Medicine and the University of Pittsburgh Medical Center (UPMC) since 1998, where he is the David Silver Professor of Orthopaedic Surgery. He has been the head team physician for the University of Pittsburgh Department of Athletics since 1986.

Dr. Fu is known worldwide for his pioneering surgical techniques to treat sports-related injuries to the knee and shoulder and his extensive scientific and clinical research in the biomechanics of such injuries. Because of his reputation, Dr. Fu attracts both athletic and non-athletic patients from all over the globe.
He also was instrumental in the establishment of the Sports and Preventive Medicine Institute in 1985. Under Dr. Fu's medical directorship, the facility - now called the UPMC Rooney Sports Complex - has grown into one of the world's largest, most comprehensive and highly regarded sports medicine clinical and research centers. In 2000, this world-class center moved to its new home within the expansive, state-of-the-art UPMC Sports Performance Complex. The complex, partly designed by Dr. Fu, also houses the indoor and outdoor training facilities of the University of Pittsburgh Panthers and the Pittsburgh Steelers.

Dr. Fu holds secondary appointments at the university as professor of physical therapy and health physical and recreational education at the University of Pittsburgh School of Health and Rehabilitation Sciences. He also holds an

honorary doctorate of science degree from Point Park University and an honorary doctorate of public service from Chatham College.

He also established the University of Pittsburgh's Sports Medicine Fellowship Program, which attracts physicians from all over the world to learn surgical techniques and conduct research with Dr. Fu and his colleagues in the department of orthopaedic surgery.

Dr. Fu received undergraduate and post-graduate degrees at Dartmouth College and Dartmouth Medical School before earning his medical degree at the University of Pittsburgh in 1977. Continuing his training at Pitt, he then completed a residency in orthopaedic surgery and a fellowship in orthopaedic research. Dr. Fu also fulfilled an internship in general surgery at Brown University and an international fellowship at the Hanover Trauma Center in Germany.

He joined the University of Pittsburgh School of Medicine faculty in 1982 as an assistant professor of orthopaedic surgery and director of sports medicine. He become clinical vice chairman of the department of orthopaedic surgery in 1990 and executive vice chairman in 1994. Dr. Fu is an author of more than 600 peer-reviewed articles and has made over 1,200 national and international presentations, co-authored 173 books chapters, and edited 30 major orthopaedic textbooks. Former president of the Pennsylvania Orthopaedic Society, he has been a member of 55 other professional and academic medical organizations.

More than 90 professional awards and numerous major research grants garnered by Dr. Fu are the result of his efforts in clinical, basic scientific and biomechanical research concerning sports medicine and orthopaedic surgery. In 1996, the National Athletic Trainers Association (NATA) honored Dr. Fu with the President's Challenge Award for his tutelage in advancing the quality of health care related to sports medicine. In 2002, Dr. Fu became the sponsor of the annual NATA New Investigator Award, and he was named as one of three University of Pittsburgh Distinguished Alumni Fellows because of his “inspiration to countless students, athletes, colleagues and the broader community.”

Because of Dr. Fu's medical achievements and their impact locally as well as world-wide and his many contributions to enrich the Pittsburgh community, at the end of 1999, Pittsburgh Magazine named him one of the 100 most influential Pittsburghers of the 20th century. He is consistently listed in the magazine's annual "Best Doctors" issue. Also in 1999, the Allegheny Cycling Association gave Dr. Fu its award for Outstanding Service to the Cycling Community in recognition of Dr. Fu's sponsorship of many local cyclists and his constant support of many local cycling events. In May 2002, the YMCA of Pittsburgh honored Dr. Fu with its 28th Annual Person of the Year award. And, in 2004, Dr. Fu was named Vector’s Pittsburgh Man of the Year for Community Service.

A brief look at Dr. Fu's extensive community involvement includes service as co-chairman of the Pittsburgh Local Organizing Committee of the 2005 Summer National Senior Games - The Senior Olympics; chairman of the board and executive medical director of the City of Pittsburgh Marathon Inc. from 1985 through 2003; company physician and member of the board of trustees for the Pittsburgh Ballet Theatre; and team physician for Mt. Lebanon High School. Dr. Fu is also involved in the WQED Children's Festival Chorus and honorary board member of the Parental Stress Center. He has served as honorary chairman for various functions of the Pittsburgh Employment Alliance and is an active member of the Organization of Chinese Americans.

Mark V. Paterno, PT, PhD, MBA, SCS, ATC, Professor, Occupational and Physical Therapy, Cincinnati Children’s Hospital Medical Center

Mark V. Paterno is a physical therapist and a professor within the Division of Occupational Therapy and Physical Therapy and the Division of Sports Medicine at Cincinnati Children’s Hospital Medical Center in Cincinnati, OH. Mark also serves as a coordinator of Orthopaedic and Sports Physical Therapy, scientific director within the Division of Occupational Therapy and Physical Therapy and faculty for the Sports and Orthopaedic Physical Therapy Residency programs. He graduated from Ithaca College with a Master’s Degree in Physical Therapy in 1994. Mark then went on to become a certified athletic trainer and an APTA board certified specialist in Sports Physical Therapy. Mark obtained his Masters of Business Administration from Troy State University and his PhD from Rocky

Mountain University of Health Professions as he completed his doctoral studies in Orthopaedic and Sports Science. As a clinical scientist, Mark has over 80 publications and 10 book chapters which focus on the area of outcomes after ACL reconstruction and pediatric sports medicine and he has lectured internationally on these topics. He currently serves as a manuscript reviewer for several orthopaedic and sports medicine publications, a founding member and second vice president for the Pediatric and Adolescent Research in Sports Medicine (PRISM) Society as well as a member of the ROCK group, which is an international, multi-disciplinary group, dedicated to researching juvenile osteochondritis dissecans.

Volker Musahl, MD, Professor of Orthopaedic Surgery, University of Pittsburgh

After earning his medical degree at Albert-Ludwigs-Universität Freiburg in Germany, Dr. Musahl moved to the United States, where he completed his residency at the University of Pittsburgh, and a fellowship at the Hospital for Special Surgery Sports Medicine and Shoulder in New York City. In addition to his work as a leading Orthopaedic surgeon, he is the Blue Cross of Western Pennsylvania Professor, and Chief, Sports Medicine, and the Medical Director of the UPMC Freddie Fu Sports Medicine Center, he is the Co-Head Team Physician for Pitt Football, and he is the Program Director for the Sports Medicine Fellowship Program.

Dr. Musahl's research interests include clinical outcome research, knee and shoulder biomechanics. Dr. Musahl and Dr. James Irrgang currently have several funded trials on patients with ACL injuries, multiple knee ligament injuries, and rotator cuff tears. He specializes in Sports Medicine; provides comprehensive care of injuries to the knee, shoulder, elbow, hip and ankle. Currently, Dr. Musahl is Professor of Orthopaedic Surgery, Bioengineering, and Clinical Translational Science Institute.

James Irrgang, PT, PhD, FAPTA, Chair and Professor of Physical Therapy, University of Pittsburgh

James Irrgang is professor and chair of the Department of Physical Therapy. He also has secondary appointments in the Department of Orthopaedic Surgery and the Clinical and Translational Science Institute in the School of Medicine. Currently, Irrgang serves as the Scientific Director of the American Physical Therapy Association's Physical Therapy Outcomes Registry. His research interests include development and validation of patient-reported outcome measures as well as clinical research related to the knee and shoulder. Current active studies include a: 1) multicenter randomized clinical trial to determine the effects of timing of surgery (early vs. delayed) and post-operative rehabilitation (early vs. delayed) for the treatment of multiple ligament knee injuries on time to return to pre-injury activity; 2) prospective observational study to determine the outcome and factors influencing the effects of exercise therapy for individuals with a full-thickness supraspinatus tear; 3) randomized clinical trial to examine four methods of exercise for treatment of degenerative meniscus tears. His areas of clinical expertise are related to evaluation and treatment of the knee and shoulder. Irrgang is a Catherine Worthingham Fellow of the American Physical Therapy Association. Additionally, he served as President of the Orthopaedic Section from 2007 to 2013 and was presented with the Paris Distinguished Service Award from the Section in 2015.

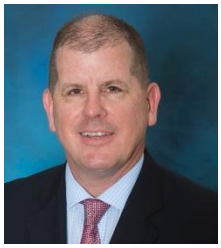
Poster Session:

Poster Session chair: **Kevin Conley, PhD, ATC***,* Associate Dean for Undergraduate Studies, SHRS, Chair and Associate Professor, Sports Medicine and Nutrition

Kevin Conley has over 20 years of clinical and academic experience in the field of athletic training. He started his career in 1993 as an athletic trainer for the Pitt football team; over the years he also worked with the baseball, swimming and diving teams. In 1998 he was named Director of the Athletic Training program and helped prepare and execute the move of the academic programs in Athletic Training and Sports Medicine to the School of Health and Rehabilitation Sciences in 2000, where they merged with the program of Clinical Dietetics and Nutrition to create the Department of Sports Medicine and Nutrition. Conley was named the Associate Dean for Undergraduate Studies in 2013, where his responsibilities include providing support and oversight related to common policies and procedures for the six undergraduate programs in SHRS.

Conley's service includes work with Special Olympics where he is a member of the management team for Special Olympics Pennsylvania/Allegheny County. He has also served as a member of the medical staff for Team USA at the Special Olympics World Summer Games in Athens, Greece in 2011 and as Medical Director for Team USA at the Special Olympics World Winter Games in PyeongChang, Republic of Korea in 2013.

Session 3: Strength and Conditioning for the 21st Century



Session organizer and moderator: **Bradley C. Nindl, PhD, FACSM,** Professor and Director, Neuromuscular Research Laboratory / Warrior Human Performance Research Center

Bradley C. Nindl, PhD, FACSM is the Director of the Neuromuscular Research Laboratory/Warrior Human Performance Research Center and Professor in the Department of Sports Medicine and Nutrition in the School of Health and Rehabilitation Sciences at the University of Pittsburgh. He also has dual appointments as the Senior Military and Scientific Advisor for the University of Pittsburgh Center for Military Medicine Research and at the McGowan Institute for Regenerative Medicine. Prior to coming to the University of Pittsburgh, Nindl worked for over 20 years as an Army Medical Department government scientist working for the US Army Research Institute of Environmental Medicine within the US Army Medical Research and Materiel Command and the Army Institute of Public Health within the US Army Public Health Command. Nindl received a BS in biology from Clarkson University in 1989, a MS in physiology of exercise from Springfield College in 1993, a PhD in physiology from the Pennsylvania State University in 1999, and a Master of Strategic Studies from the US Army War College in 2012.

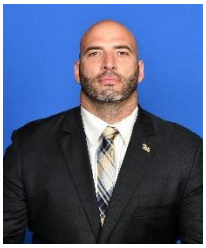
Nindl's research interests span human performance optimization /injury prevention and biomarker domains with a focus on adaptations of the neuromuscular and endocrine systems (growth hormone/insulin-like growth factor-I axis) to both exercise and military operational stress. He is internationally recognized for his work in these areas and was Co-Chair of the 3rd International Congress on Soldiers' Physical Performance in 2014 and has performed research sabbaticals at the University of Jyvaskyla in Finland (2009) and the University of Wollongong in Australia (2014) with the Finnish and Australian Defence forces, respectively. His previous awards include the American College of Sports Medicine Young Investigator Award in 2002 and the US Army's Surgeon General "9A" Proficiency Designator (the Army Medical Department's highest award for professional excellence, bestowed on less than 2% of AMEDD military officers) in 2013. 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. He has over 146 peer-reviewed publications indexed on PubMed that have been cited over 3900 times with an h-index of 35. Nindl is also an Army Reservist (COL) and Commander of the Southeast Medical Area Readiness Group in Nashville, TN having been deployed in 2004-2005 in Mosul, Iraq where he was awarded a Bronze Star and the Combat Action Badge. He and his wife Jeanne live in Gibsonia, PA have 5 children: Ashley, Lyndsey, Zachary, Joshua, and Cooper.

Plenary Speaker: **William Kraemer, PhD**, Professor of Human Services, The Ohio State University

Dr. Kraemer took his current position at The Ohio State University in 2014. During his career he has managed and directed a diverse and incredible range of research portfolios over the past 30 years in Division I research institutions including the Pennsylvania State University and University of Connecticut. His prior research as an officer in the U.S. Army gave him insights into the challenges of military service and the need for training and recovery methods to cope with stress. As a former football, wrestling and strength coach at the secondary and college levels his insights in to athletic performance has been unique in the field. His laboratory groups and their scientific collaborators have taken on various problems related to exercise training and recovery in men and women in military and athletic populations and the interventions that can enhance performance. They have examined nutritional interventions as an important tool for enhancing performance, health and recovery. From basic cellular studies examining muscular and endocrine effects of microgravity and pituitary cell function to hypertrophy from exercise training, animal models have provided basic findings for human studies. His work in sports medicine and sports science has led to him being named one of the top sport scientists in the world. A wide span of subject populations from children to

older adults have been involved with these studies with an emphasis on women's health including breast cancer. One of his primary lines of research has been directed toward the understanding of resistance exercise and training and its programming for health, fitness and high performance training. Using the latest laboratory techniques in neuroscience, neuromuscular and endocrine sciences have led to important discoveries and solutions to problems. Together the integration of systems physiology and multi-disciplinary teams have provided his long-standing approach to scientific investigation. With over 480 peer reviewed scientific publications and 12 books and over 56,000 citations on Harzing's Publish or Perish lists, his scholarly impact has been impressive. An honorary doctorate from the University of Jyväskylä in Finland in 2016 also demonstrated the worldwide influence of his research. His research has garnered millions of dollars of external funding from federal, corporate and institute funding sources.

Panelists:



Dave Andrews, Head Strength and Conditioning Coach for Men's Football Team, University of Pittsburgh

One of Pat Narduzzi's first moves at Pitt was hiring Dave Andrews as head strength and conditioning coach.

Narduzzi's decision has continuously paid dividends over the past four years, a span that has witnessed the Panthers achieve the third-winningest conference record among the 14 ACC football schools. A crucial factor behind Pitt's ACC rise has been the strength and conditioning preparation orchestrated by Andrews and his staff.

In 2014, Andrews was an assistant director of strength and conditioning at Notre Dame. Prior to Notre Dame, he spent two seasons as the associate head strength and conditioning coach at Illinois (2012-13). From 2004-11, Andrews served in various strength and conditioning capacities at the University of Cincinnati, including his final four years when he was the Bearcats' head Olympic strength and conditioning coach.

He is a certified strength and conditioning coach by the Collegiate Strength and Conditioning Coaches Association (CSCCA) and USA Weightlifting (USAW) as a level one sports performance coach.

Andrews is a 2004 graduate of Ohio State with a bachelor's degree in education. In addition to his undergraduate studies in education, Andrews also owns a master's degree in that subject from the University of Cincinnati.

Tyler Carpenter, Head Strength and Conditioning Coach, University of Pittsburgh

Tyler Carpenter has been the Head Strength and Conditioning Coach at Pitt since August 2017 following a four-year stint at The Ohio State University where he served as Assistant Strength and Conditioning Coach. Carpenter oversees all aspects of strength and conditioning for teams in the Fitzgerald Fieldhouse while working primarily with men's and women's soccer and wrestling.

While at Ohio State, Carpenter oversaw the training of men's and women's soccer, women's track and field and women's ice hockey and assisted with the training of 12 other teams at Ohio State. Carpenter was a part of the 2015 Big Ten Championship Men's Soccer team and 2015 Big Ten Women's Indoor Track and Field Championship.

Before Ohio State, Carpenter was a Graduate Assistant Strength and Conditioning Coach for the University of Tennessee Lady Vols, responsible for the training of women's soccer and assisting all other Lady Vol teams. He entered that role following a 15-week internship with the Lady Vols. During his time as a GA he received his Master of Science degree in Kinesiology with a concentration in Sport Psychology and Motor Behavior.

Carpenter received his BSBA from the Fisher College of Business at OSU. Throughout his undergrad he worked with the football team for five seasons in various capacities including a strength and conditioning internship, winning five Big Ten championships and reaching 5 BCS bowl games.

Riley Ross, Sports Science Performance Coach, Ohio State University
Experience: Sports Science Performance Coach and Professor for 15 years
Joined OSU staff as the Director of Wrestling Sports Science & Development prior to the 2018-19 season

- Responsible for integrating analytics, technology and strength and conditioning strategies
- Tasked with developing Buckeye wrestlers to their full genetic potential
- Owns unique background in performance, assessment and prescriptions, as well as analytics in the tactical and private sector
- Prior to Ohio State, he was a Tactical Strength and Conditioning Specialist with an anti-terrorism task force in Florida
- Has developed and coached World Champions in a myriad of combat sports disciplines

Rhen Vail, Strength and Conditioning Coach for Women's Basketball, University of Pittsburgh
Joined the University of Pittsburgh Department of Athletics in May 2018 as Strength and Conditioning Coach for Women's Basketball.

Prior to his arrival at Pitt, Vail served as Head Basketball Sports Performance Coach at Kent State from 2016-18. In his first season in the position, the men's basketball team won its first Mid American Conference Tournament title since 2008, while the women's team improved its win total by 13 games and captured the MAC East Division Championship. During his time with the Golden flashes, Vail was a part of 12 MAC Championships and helped train numerous All-Americans and draft picks. He has trained 13 MLB draft picks and worked in some capacity with 30 NFL draft picks.

For three years before his promotion, he was assistant strength and conditioning coach for the Golden Flashes from 2013-16, overseeing baseball, women's soccer, men's and women's track and assisting with football. He earned a master's degree in sport and recreation management from Kent State in 2013 after completion of his graduate assistantship with the department.

In 2011, Vail received his undergraduate degree from The Ohio State University in exercise science where he served as a student intern with the Buckeye football strength and conditioning staff for three seasons. Upon completion of his degree, Vail completed a six-month internship with Athletes Performance (now Exos) in Los Angeles working closely with a wide variety of world class athletes. He is certified through the Collegiate Strength and Conditioning Coaches Association (CSCCa) and USA Weightlifting (USAW).

Session 4: Nutrition

Session organizer and moderator: **Kim Beals (Crawford), PhD, RD, CSSD, LDN**, Associate Professor and Associate Director, Neuromuscular Research Laboratory (NMRL)
Kim Beals is an associate professor in the Department of Sports Medicine and Nutrition. She is also the associate director of the University of Pittsburgh Neuromuscular Research Laboratory (NMRL) and Warrior Human Performance Research Center. Beals completed her PhD in Exercise Physiology at the University of Pittsburgh and her Master of Science in Clinical Nutrition at Drexel University. She is a registered dietitian and board certified specialist in sports dietetics. Her research interests and involvement focus on: 1) the use of foods and nutrients to improve diet quality, physical performance and body composition and reduce systemic inflammation, 2) identifying body composition factors related to reducing musculoskeletal injuries and improving physical performance, 3) evaluating the impact diet has on a healthy gut microbiome and metabolome and how that affects overall health, recovery and resiliency.

Plenary Speaker: **Nanci Guest,** PhD, RD, CSCS, Department of Nutritional Sciences, University of Toronto

Dr. Guest is a registered dietitian (sport focus) and a strength and conditioning coach, and she has been working in private practice for over two decades. She completed two Bachelor of Science degrees and a Master of Science degree at the University of British Columbia, in the areas of dietetics/kinesiology and nutritional sciences. Her doctoral research from the University of Toronto focused on nutrigenomics and athletic performance and she teaches sport nutrition and nutrigenomics courses at the University level. Dr. Guest is on the Scientific Advisory Board for Nutrigenomix Inc., and currently conducts research with the company. She has published her research in top journals, and given dozens of invited talks in Canada, the USA and Europe. She is a global consultant to professional and amateur athletes and teams, and she served as the head dietitian at the Vancouver 2010 Olympics and Toronto 2015 PanAm games. She also prepared several athletes for the last four London, Sochi, Rio and PyeongChang Olympics. She has been offering genetic testing for personalized nutrition in her Toronto-based practice for over 6 years.

Presentation synopsis: As the demand for genetic testing by athletes grows, there is a need for nutritionists, coaches and physiologists working with athletes to have sufficient knowledge to understand the science behind these innovative tests, determine their benefits and limitations and learn which ones provide clinically actionable information. Research has shown that variations in certain genes can modify the activity of our enzymes, receptors, transporters and other proteins, and explain why some individuals respond differently from others to the same foods, nutrients and supplements. Identifying these genetic variations can help to determine individual dietary and supplement requirements, food intolerances and dietary patterns that aim to improve health, body composition and performance. Consumer genetic testing services for athletes are available, but their utility and validity remain controversial due to wide variability in quality and scientific robustness. This session will include an overview of nutrigenomics in athletics, and how current research can be translated into practice. This session will also include practical tips on how to begin offering genetic testing services in your practice, and what to look for when choosing a company to work with. The speaker will also present data from her PhD research: caffeine, genetics and athletic performance.

Matt Darnell, PhD, RD, CSSD, SCCC, Assistant Professor, Sports Medicine and Nutrition, University of Pittsburgh

Matthew Darnell is an assistant professor in the Department of Sports Medicine and Nutrition and director of the Master of Science Programs in Wellness and Human Performance and Sports Science. He is also a registered dietitian, board-certified specialist in Sports Dietetics, and certified strength and conditioning coach. Currently serving as the sports dietitian for the Pittsburgh Steelers, his research interests include nutrition and exercise approaches for improved athletic performance, injury prevention and rehabilitation.

Presentation synopsis: Approaches will be presented for personalizing nutrition plans to optimize performance in professional and elite athletes. Attendees will learn how to apply information from body composition, metabolic, and biochemical testing to personalize nutrition recommendations and meal plans.

Auburn Weisensale, MS, RD, CSSD, LDN, Director of Nutrition, Athletic Department, University of Pittsburgh

Auburn Weisensale manages all nutrition related needs for baseball, men's and women's basketball, men's and women's cross country, gymnastics, men's and women's soccer, softball, men's and women's swimming and diving, men's and women's track and field, volleyball, and wrestling teams. Ms. Weisensale does team nutrition education as well as one-on-one nutrition counseling. Additional services she provides to the student-athletes include grocery store tours, cooking demos, supplement education, and weekly samples at the fueling station referred to as *Taste it Tuesday*.

Before her time with Pitt, Ms. Weisensale worked as a sports nutrition assistant for the University of Florida. Ms.

Weisensale also spent time at Indiana University as a Gatorade Sports Nutrition Immersion Program Fellow. Prior to that, she spent time as an intern for Tara Gidus Nutrition Consulting with the Orlando Magic, University of Central Florida, and run Disney. She also worked as a Sports Nutrition Intern at the University of Virginia.

A 2013 graduate of James Madison University with a bachelor of science in dietetics, Ms. Weisensale was a four-year letter winner on the field hockey team. Ms. Weisensale completed her dietetic internship/residency program through the Pennsylvania State University and Penn State Milton S. Hershey Medical Center. She went on to pursue her master's degree in Applied Exercise Science with a concentration in Sports Nutrition from Concordia University Chicago. In February 2018, Ms. Weisensale became a Board Certified Specialist in Sport Dietetics.

*Freddie Fu, MD photograph *By Cdmurawski - Own work, CC BY-SA 3.0*

Poster Abstracts:

Presenter: Nizam U Ahamed
Poster Category: Sports Analytics and Wearables
Poster Number: 3

A Machine Learning Approach to Understand Intrinsic and Extrinsic Factors that Influence Running Gait Patterns

Nizam Ahamed (1, 2) Lauren Benson (1), Christian Clermont (1), Andy Pohl (1), Reed Ferber (1)
(1) Faculty of Kinesiology, University of Calgary, Calgary, AB Canada
(2) Neuromuscular Research Lab, Department of Sports Medicine and Nutrition, University of Pittsburgh, PA, USA

Running-related overuse injuries can result from a combination of various intrinsic (e.g., gait biomechanics) and extrinsic (e.g., environmental weather, running surface) risk factors. Due to the availability, utility and current advances in modern portable wearable sensors, specifically inertial measurement units (IMUs) or inertial body sensors, it is now possible to collect data at any location including real-world environment. Since large quantities of data can be collected using wearable devices, machine learning (ML) techniques are also needed to better understand the complexities of gait biomechanics and how concomitant changes in biomechanical patterns may be related to injury or performance. Our aim in this project is to understand different intrinsic (gait biomechanics) and extrinsic factors (environmental weather and changes of elevation) influence running gait patterns using machine learning algorithms to the data retrieved from wearable technology. A group of recreational runners were participated in this study. Biomechanical gait variables from each runner were recorded using a commercially available wearable IMU, consisting of a three-dimensional accelerometer, magnetometer, and gyroscope. During each run, the IMU performed on-board computation of six biomechanical variables: pelvic drop (deg), vertical oscillation (cm), ground contact time (ms), braking (m/s), pelvic rotation (deg) and cadence (steps/min). Data were recorded from uncontrolled outside of the laboratory settings, i.e. different inclination conditions (uphill, level and downhill) and during winter and spring sessions, with recorded average air temperatures of -10° C and +6° C, respectively. A robust, and non-linear machine learning classifier, called Random Forest (RF), was used to develop the subject-specific and group-based classification models, which measured the accuracy and importance of gait biomechanical variables in classifying runs of differing running factors. We believe that our Machine Learning-based method may provide a more in-depth understanding of changes in gait biomechanics in response to extrinsic injury-risk factors. Additionally, these findings also support the efficacy of wearable technology, and subsequent data science approaches for understanding the complexities of running gait patterns based on collecting data in out-of-laboratory environments.

Presenter: Meaghan Beckner
Poster Category: Nutrition
Poster Number: 1

The Effects of Two Multi-ingredient Pre-workout Supplements on Endurance Capacity and Anaerobic Cycling Performance

Meaghan Beckner, Brian Martin, Alexis Pihoker, Matthew Darnell, Alicia Kjellsen, Paul Arciero, Mita Lovalekar, Kim Beals, Shawn Flanagan, Bradley Nindl

PURPOSE: To examine the effectiveness of two multi-ingredient pre-workout supplements (MIPS), one with beta-alanine and caffeine (BAC) and one without (NBAC), vs. placebo (PLA) on anaerobic performance and endurance capacity. METHODS: Twenty-eight exercise-trained individuals (15 men, 13 women, 24.3 ± 4.9 years, 173.6 ± 9.2 cm, 74.7 ± 15.5 kg) participated in a randomized, counterbalanced, double-blind, placebo controlled cross-over study to assess anaerobic power and capacity via Wingate (WAnTAP and WAnTAC), and aerobic endurance via cycle VO2peak. On three separate occasions (≥ 7 days between trials) subjects completed vertical jump (VJ), 30-second Wingate test and VO2peak test 30 minutes after ingestion of BAC, NBAC, or PLA. WAnTAP and WAnTAC were calculated as the peak and average power relative to body mass, respectively. Following a 10-minute walking recovery, subjects completed the cycle VO2peak test. Blood lactate was collected within 5 minutes post WAnT (BLAWAnT), and VO2peak (BLAVO2). Following tests for normality, outcome variables were compared between supplements using one-way repeated measures ANOVA or Friedman test (alpha=0.05) and Bonferroni adjusted pairwise comparisons as appropriate. RESULTS: There was a significant effect of treatment on WAnTAP (p=0.016). WAnTAP was higher in BAC (10.9 ± 1.4 W/kg) and NBAC (10.8 ± 1.2 W/kg) compared to PLA (10.5 ± 1.2 W/kg) ($p = 0.018$ and $p = 0.014$, respectively). WAnTAC was significantly different across supplements (p=.043) but post hoc pairwise comparisons were not significant. BLAWAnT was higher with BAC (17.7 ± 3.5 mmol) and NBAC (17.4 ± 3.2 mmol) compared to PLA (15.3 ± 3.3 mmol) ($p = 0.028$ and $p = 0.033$, respectively). BLAVO2 was higher with BAC (12.7 ± 5.9 mmol) compared to NBAC (9.9 ± 2.4 mmol, $p < 0.001$) and PLA (9.7 ± 2.8 mmol, $p < 0.001$). No significant differences were observed in VO2peak or VJ. CONCLUSION: MIPS demonstrate the potential to augment production of anaerobic power during a Wingate cycle test, accompanied by higher blood lactate accumulation.

Presenter: William Conkright
Poster Category: Nutrition
Poster Number: 2

Energy Expenditure and Load Carriage Exceeded Military Recommendations in Special Operations Forces Deployed to Afghanistan

William Conkright and Nicholas Barringer

Special Operations Forces (SOF) undergo difficult missions in extreme environments, while carrying heavy loads, the combination of which results in a high energy output. Energy expenditure in excess of intake may result in weight loss and impaired performance.

PURPOSE: To determine the energy expenditure of Army SOF Soldiers based on present-day missions in the Central Command (CENTCOM) region.

METHODS: Demographics of the participants were as follows: age (yrs) 30±3.5, height (in) 70.65±2.8, weight (lbs) 195.2±24, enlisted (86%), officer (7%), warrant officer (7%), years in the Army 8.3±3.9, and total time deployed during career (yrs) 1.26±1.2. Surveys were collected from 46 SOF Soldiers operating in eight locations in the CENTCOM theater of operations. Outcomes revealed the mission energy requirements and difficulty of exertion pre-, during-, and post-mission. A physical activity factor was determined based on multiple aspects surrounding mission intensity and used to calculate estimated energy expenditure based on a SOF-specific equation.

RESULTS: During a six-month deployment, participants underwent a multitude of missions (17.25±8.66). Ninety percent of respondents reported carrying a load 40% heavier than the recommended fighting load (32.9±8.62 vs. 21.8 kg, respectively) based on military doctrine. Average estimated energy expenditure (4848±525 kcal·day-1) far exceeded the military dietary reference intake of 3400 kcal·day-1. All but three respondents reported a rate of energy expenditure exceeding the benchmark of 300 kcal·day-1 necessary to maintain adequate energy reserves upon enemy contact.

CONCLUSION: Excessive load carriage is a major contributor to high energy expenditure. The reported loads carried by SOF Soldiers exceeded the recommendations in Army doctrine. Additionally, their high energy expenditure, if not matched by an equally high energy intake, may result in performance decrements and compromise mission success. Special attention must be given to pack weights during pre-mission planning and nutrition strategies aimed at meeting mission demands and recovery from strenuous activity.

Presenter: Drew M. Donnell
Poster Category: Sports Medicine and Injury Prevention
Poster Number: 5

Risk Factors and Outcomes of Revision Arthroscopic Posterior Shoulder Capsulolabral Repair

James P. Bradley MD, Justin W. Arner MD, Sachidhanand Jayakumar BS, Dharmesh Vyas MD PhD

Purpose: Risk factors and outcomes of revision arthroscopic posterior capsulolabral repair of the shoulder are currently not well defined.

Hypothesis: Athletes who require revision arthroscopic posterior unidirectional capsulolabral repair will have poorer outcomes and return to play when compared with those undergoing primary procedures, with risk factors including younger age, injury size, bone loss, and anchor number. This was a case-control study.

Methods: A total of 297 shoulders that underwent arthroscopic posterior capsulolabral repair at minimum 2-year follow-up were reviewed. In addition to surgical data, ASES, stability, range of motion, strength, and pain scores as well as return to sport were compared pre- and postoperatively between those who did and did not require revision surgery.

Results: Nineteen shoulders required revision surgery (6.4%) at 8.9-year follow-up. Significant risk factors included female sex (P = .001), dominant shoulder (P = .005), and concomitant rotator cuff injury (P = .029). Patients with <3 anchors were more likely to require revision (odds ratio = 3.48). Smaller glenoid bone width was a risk factor for requiring future revision surgery (P< .001), but glenoid labral, chondral, and bone version and labral width were not risk factors. All patients had significant improvements in ASES, pain, range of motion, and strength scores after the original surgery; however, those who required revision surgery had less improvement (P< .05). Stability improved significantly for nonrevisions (P< .001) but did not for revisions (P = .662). In the nonrevision group, 64.3% returned to sport at the same level, which was significantly higher than the 15.4% of the revision group (P = .004). Overall, 78.6% of the nonrevision group and 61.6% of the revision group returned to sport at some level (P = .280).

Conclusion: Athletes underwent revision arthroscopic posterior capsulolabral repair at an incidence of 6.4% with identified significant risk factors.

Presenter: Drew Michael Donnell
Poster Category: Sports Medicine and Injury Prevention
Poster Number: 6

Syndesmotic Ankle Injuries: A Comparison of Etiology, Mechanism of Injury, and Return-to-Play Time in NFL and NHL Athletes

Drew Michael Donnell, Joanna Costello, Daniel Leigey, James Bradley, Dharmesh Vyas

Although syndesmotic injuries represent less than 10% of ankle sprains among all athletes, these injuries are characterized by greater morbidity and longer recovery time in comparison to severe lateral ligament sprains. Prior studies indicate an unexplained disparity in time lost to injury for syndesmotic pathologies among certain subgroups: Wright et al. reported a mean return-to-play time of 45 days for 14 examined NHL players, whereas Osbahr et al. reported a mean return-to-play time of 15 days for 36 examined NFL players. The purpose of our study is to examine the differences in mechanism of injury, severity, diagnosis, and treatment of syndesmotic injuries and determine if the variation among these factors is associated with return-to-play time among US professional football and hockey players. We reviewed the injury databases and medical records of the Pittsburgh Penguins and Pittsburgh Steelers in order to identify athletes who incurred syndesmotic injuries (without prior history or co-existing pathology) within the last ten years. We collected the following data: return-to-play time (days), MRI imaging studies, age, height, weight, position within sport, date of injury, side of injury, mechanism of injury, and surgical intervention. Analyses revealed 8 professional hockey and 26 professional football players that suffered injuries over the course of the ten-year study horizon. The median return-to-play times were 36 days (mean=39.5, range=16-79) and 13 days (mean=17.7, range=1-68) for hockey and football athletes, respectively. Non-parametric univariable analyses indicated preferential involvement of the PITFL and lesser extent of syndesmotic widening among NHL athletes. The sport-specific survival curve indicated a statistically significant difference in return-to-play time. Our study, unique in its direct access to injury databases of two professional teams from different sports, confirms a known disparity in recovery times among athletes. Specifically, the results suggest that these new findings may account for differences in time lost.

Presenter: Cecile Garfunkel
Poster Category: Strength and Conditioning
Poster Number: 13

Adherence and Acceptance of a High Intensity Interval Training Program for Wheelchair Users with Spinal Cord Injury

Cecile Garfunkel, BS, Sarah Bass, BS, Anas Dighriri, BS, Alicia Koontz, PhD, RET

High Intensity Interval Training (HIIT) is known to result in a vast amount of physiological benefits in regard to health and physical fitness. HIIT is often performed using the lower extremities and widely tested on healthy, unimpaired subjects or in populations with chronic conditions (e.g., stroke, heart failure, obesity). Little research has been conducted to determine the effectiveness and benefits of performing HIIT within a clinical population of Spinal Cord Injuries (SCI).

Purpose: to explore the adherence and acceptability of a 6-week HIIT program for wheelchair users with SCI.
Methods: The HIIT training protocol consisted of two supervised training sessions per week and one optional unsupervised session. Each training session consisted of handcycling for 2-3 min warm-up, 10, 1:1 min work/recovery phases at 90% peak power output (PPO) and 0-20% PPO and 2-3 min cool-down. Study outcomes included the feeling scale, ratings of perceived exertion, and heart rate throughout training. A VO2 max testing and modified Wingate protocol using an arm ergometer was conducted pre and post training. Questionnaires assessed willingness to continue HIIT training and enjoyment of program.

Results: 8 men and 2 women have enrolled in the study to date, 2 withdrew before training. Of the remaining 8, 6 participants (75%) were 100% compliant with the HIIT protocol. One subject performed extra HIIT sessions unsupervised. All subjects reported “Very Satisfied” with the overall HIIT experience and sufficiency of HIIT. Subjects either stated “Very Likely” (42.8%) or “Somewhat Likely” (57.1%) to continue HIIT on a hand cycle. All subjects reported that they were very likely to recommend HIIT.

Discussions: A majority of subjects met the minimum training sessions and enjoyed doing HIIT. Most did not complete a third session for reasons related to time or an inability to setup or transfer independently. This study provides foundation for future research involving longer intervention periods with a follow-up (non-training) period to explore the health benefits and carry over effect of performing HIIT training compared to conventional training methods.

Presenter: Kellen Krajewski
Poster Category: Sports Medicine and Injury Prevention
Poster Number: 7

Exploratory Analysis of Ground Reaction Forces During Loaded and Unloaded Marching at Different Velocities

Kellen T. Krajewski (1), Camille C. Johnson, Dennis E. Dever (1), Alex Rawcliffe (2), Scott Graham (4), Richard Simpson (3), Chris Connaboy (1)
(1) Neuromuscular Research Laboratory, University of Pittsburgh, USA
(2) Ministry of Defense, UK
(3) University of Arizona, USA
(4) Edinburgh Napier University, UK

INTRODUCTION
Load carriage factors into all occupational tasks in the military, altering performance capabilities and increasing musculoskeletal injury (MSI) risk. Physical employment standards aim to assess maximal mechanical and physiological qualities to predict high-risk MSI predisposition during load carriage. A dearth of research exists concerning propulsive variability as load and velocity increases. Impulse is an indicator of mechanical efficiency/energy dissipation. The purpose of this exploratory pilot study is to assess the kinetic differences in the lower extremities at different loads and velocities.

METHODS
Four healthy adult subjects attended one session to perform walking tasks at various loads and marching velocities. Subjects performed two trials, five minutes each of an unloaded condition (UL) and a loaded condition (LD) with 30% of their body mass. Velocity linearly increased every minute and was standardized across all participants. The starting velocity was 1.5 m/s and subsequent velocities (increasing every minute) were: 1.77 m/s, 2.05 m/s, 2.33 m/s, and 2.61 m/s. Stage 1-3 was at marching velocities and stage 4 is a running velocity/forced march. Five strides of each limb were captured at each stage. Impulse was calculated and normalized by weight for each stride. Descriptive statistics were performed and GRF waveform plots constructed were constructed for each stride in consecutive order of execution.

RESULTS
Mean contact times for UL at each stage were: 1=0.59s, stage 2 =0.55s, stage 3=0.5s, stage 4=0.37s. Mean impulse for UL at each stage were: stage 1=4.84NS, stage 2=4.49NS, stage 3=4.18NS, stage 4=3.64NS. Mean contact times for LD at each stage were: stage 1=0.62s, stage 2=0.46s, stage 3=0.49s, stage 4=0.32s. Mean impulse for LD at each stage were: stage 1=4.85NS, stage 2=4.43NS, stage 3=3.73NS, stage 4=2.97NS.

CONCLUSIONS
Higher impulses were observed during the UL condition when normalized by weight. Considering the loaded condition had longer contact times, except during running that implies that the forces generated over that time period were less. Lower impulse magnitudes can indicate smaller propulsive forces and greater force absorption and energy dissipation. All of the participants were in a non-fatigued state and assessment indicated no potential risks to injury. However, this style of gait, while potentially protective against injury, is metabolically expensive and would be difficult to maintain for long periods of time. Load carriage assessed under fatigued conditions may offer stronger predictive value to determine a recruit's occupational readiness.

Presenter: Alexis A. Pihoker
Poster Category: Strength and Conditioning
Poster Number: 11

Markers of Bone Formation Are Augmented Following Three Months of Ballistic Training

Alexis A. Pihoker, Joseph R. Pierce, Jeffery S. Staab, Dennis E. Scofield, Carl M. Maresh, FACSM, William J. Kraemer, FACSM, Bradley C. Nindl, FACSM

PURPOSE: To test the hypothesis that two (2EX) vs one (1EX) session per day of ballistic resistance exercise produces greater adaptations in markers of bone turnover when equated for total exercise volume but differing in osteogenic index.

METHODS: Seventeen healthy individuals (6M/11W; 21.7 ± 3.7 y (mean ±SD), body mass (kg): 67.3 ± 11.2; height (cm): 165.2 ± 11.6; body fat (%): 31.3 ± 9.0) volunteered to participate. Participants performed ballistic non-linear periodized resistance training three days per week in the 1EX (3M/8W) or 2EX (3M/3W) group. An acute exercise test (AET; 10 sets of 10 plyo-jumps; Plyopress 625 III) was done at pre- (PreTr) and post-intervention (PostTr). Serum markers of bone turnover were analyzed immediately prior to (PreEx) and following (0 and 60 minutes PostEx) the AET using immunoassays. These included markers of bone formation (BAP, Osteocalcin, P1NP) and resorption (TRAP, CTx), and a hormonal marker (Vitamin D). PreTr vs PostTr changes in biomarker AET-induced responses were compared across groups using integrated area under the curve (AUC) analyses from the 90 minutes surrounding the AET (PreEx to 60 minutes PostEx) and 2×2 RMANOVA using GraphPad Prism software.

RESULTS: There were no significant group × time interactions for any bone biomarker ($p \geq 0.05$). There were significant main training effects for BAP and P1NP, such that AUC concentrations increased by 9.9% and 14.3% respectively, following training (Mean ± SD; BAP PreTr: 2002 ± 1653 vs. PostTr: 2201 ± 1783 U/L*90min, $p=0.01$; P1NP PreTr: 5898 ± 7321 vs. PostTr: 6742 ± 7124 µg/L*90min, $p=0.03$).

CONCLUSION: Exercise-induced markers of bone formation increased following 12 weeks of ballistic periodized resistance training, with no differences between exercise programs differing in OI. Markers of bone resorption did not change. This indicates that the ballistic exercise training program stimulated favorable changes in bone turnover, regardless of training frequency.

Presenter: Adam Popchak
Poster Category: Sports Medicine and Injury Prevention
Poster Number: 8

Assessment of Restoration of Muscular Performance Following Shoulder Stabilization Surgery

Adam Popchak, Brittany Lynch, Kevin Wilson, Albert Lin

Background: Arthroscopic shoulder stabilization has been shown to reduce subsequent instability and result in excellent clinical outcomes. However, generally only 65% achieve preinjury levels of sport participation after stabilization.4 Frequently, return to sports clearance is provided 6 months after surgical shoulder stabilization. The purpose of this study was to investigate the physical status of patients 6 months after shoulder stabilization surgery. We hypothesized there would be residual deficits in strength, function, and endurance testing compared to the uninjured upper extremity and population norms.

Methods: 43 competitive and recreational athletes who had undergone stabilization surgery completed a battery of tests and measures in conjunction with their 6-month post-operative follow-up visit with their physician. The battery of measures included self-reported functional level using the Subjective Shoulder Value7 (SSV), scaled 0 – 100% with 100% representing an entirely normal shoulder, the Brophy Activity Rating Scale8 (Brophy), isometric and isokinetic strength assessments, repetition to failure endurance testing, and completion of the Closed Kinetic Chain Upper Extremity Test (CKCUE) and the Unilateral Shot Put test. Comparisons were made to the contralateral, non-injured side to assess for symmetry using paired t-tests or its non-parametric equivalent. Additionally, symmetry was dichotomized as either being achieved (≥ 90%) or failed (< 90%) for unilateral tasks.

Results: Self-reported function was high, with the Brophy (13/20 (8 – 15)) and the SSV (88.7% ± 12.8). Isometric internal rotation (IR) at 90° abduction was significantly increased in the involved arm ($p = 0.02$) compared to the uninvolved arm, with no other motions showing significant side-to-side differences. However, as high as 35% failed to reach 90% symmetry to the uninjured side with the other motions tested. Peak torque with isokinetic testing was significantly lower in the involved arm with ER at 60°/s and at 180°/s, as well as IR at 60°/s (all $p \leq 0.01$). Failure to achieve 90% bilateral symmetry was seen in as high as 54% of patients for the motions tested. There were no significant difference with repetition to failure procedures for the posterior rotator cuff with ER at 0° and 90° ($p > 0.4$). Nevertheless, 29% of patients were unable to achieve 90% symmetry to the uninjured side. The mean number of touches with the CKCUE test was 23.4 ± 3.6, with 25.6% unable to achieve the goal of ≥ 21 touches. There were no significant differences in the distance achieved with the Unilateral Shot Put test ($p = 0.7$), with the vast majority achieving symmetry.

Conclusions: Despite relatively high levels of self-reported function, isolated strength deficits remain, especially in the posterior rotator cuff. When specifically examining the posterior shoulder musculature, 23% – 54% of patients tested where unable to achieve 90% symmetry with strength or endurance testing. With the exception of the Unilateral Shot Put, all methods were able to detect high rates of failure to achieve expected levels of strength or function. Isokinetic testing was the most discriminate at detecting isolated weakness and failure to achieve 90% symmetry.

Clinical Relevance: The inability to return to pre-injury levels of sport participation at the usual time of medical clearance is a multi-factorial issue. Likely contributing to lack of readiness to return is the isolated weakness and deficits in the shoulder identified with common procedures. Identification of such deficits can allow the clinician to direct interventions specifically aimed to abolish remaining shortfalls and best prepare their patient for a return to their desired sports activity.

Presenter: Felix Proessl
Poster Category: Sports Medicine and Injury Prevention
Poster Number: 9

Altered Brain Morphology In Women With History Of ACL Rupture: A Structural MRI Study

Felix Proessl, Anne Z. Beethe, Adam J. Sterczala, Courtenay Dunn-Lewis, Christopher Connaboy, Bradley C. Nindl, Shawn D. Flanagan, William J Kraemer

Anterior cruciate ligament ruptures (ACLR) are among the most common musculoskeletal injuries in young women. Despite the presence of supraspinal alterations after ACLR, the global and localized morphological underpinnings have yet to be elucidated.
PURPOSE: This study aimed to determine whether brain morphology differs in individuals with a history of ACLR compared to healthy controls with no history of injury.

METHODS: Twenty (10 ACL, 10 controls) age- and physical activity-matched women (age: 20.9±2.9yr, weight: 65.9±8.8kg, height: 165.2±6.2cm) underwent 3T T1-weighted structural brain magnetic resonance imaging. Mean cortical thickness, grey matter and white matter volume were measured globally and within 70 and 95 anatomically defined regions of interest (ROIs), respectively. Surface-based morphometry was performed. Between-group differences were assessed with t-tests and ANOVAs, while correcting for multiple comparisons by controlling the false discovery rate (FDR).

RESULTS: Mean duration since the completion of rehabilitation after ACLR was 3.1±1.1yr. Five injured the left leg and all but two participants were right foot dominant. Cortical thickness was significantly greater for controls compared to ACL in the left precentral gyrus (3.62±0.22 vs. 3.19±0.39mm, respectively P=0.019) and left paracentral lobule (3.70±0.23 vs. 3.27±0.26mm respectively; P=0.025). Neither difference survived the FDR correction.

CONCLUSION: Three years after ACL rupture, young women demonstrated persistent alterations in cortical thickness relative to individuals without a history of injury. Together with evidence of other supraspinal and neuromuscular deficits, these preliminary findings suggests cortical involvement in the ACLR pathological process. Thus, neurophysiological assessments should be considered in addition to traditional musculoskeletal measurements.

Presenter: Aaron M. Sinnott
Poster Category: Sports Analytics and Wearables
Poster Number: 4

Prolonged Exposure to an Isolated, Confined, and Extreme Environment: Impact on Vigilance and Cognitive Function

Aaron M. Sinnott, Kellen T. Krajewski, Alice D. LaGoy, Richard J Simpson, Joanne L Bower, Candice A Alfano, Christopher Connaboy

Astronauts are required to perform a variety of cognitively demanding tasks in the face of psychosocial stressors occurring throughout extended periods in isolated, confined and extreme (ICE) environments. However, vigilance and cognition have not collectively been studied during a long-duration ICE environment exposure. PURPOSE: Investigate vigilance and cognition during an ICE environment simulation. METHODS: 110 participants were assigned to either inland or coastal Antarctic sites and completed the Psychomotor Vigilance Task (PVT) and Spaceflight Cognitive Assessment Tool for Windows (WinSCAT) each month. A series of 2 (site) X 5 (time) ANCOVAs were conducted to evaluate monthly performances between sites whilst controlling for time of day. RESULTS: A within-subjects' effect was identified for WinSCAT performance ($p<.01$); post-hoc analysis revealed an improved performance at months 2-4 compared to month 1 ($p<.01$). Between-subjects' effects were identified for PVT as the coastal site had a longer (worse) RT at month 4 ($p=.029$), and more lapses at months 1 ($p=.03$), 3 ($p=.02$) and 4 ($p<.01$). No between-site differences in WinSCAT performance or interactions for any outcome were observed. CONCLUSION: Vigilance and cognitive performance were marginally affected during an ICE environmental simulation. Other factors require consideration to comprehensively understand the deleterious effects of ICE environment exposure.

Presenter: Jordan Weaver
Poster Category: Strength and Conditioning
Poster Number: 12

A Kinetic Model to Predict Human Muscle Growth

Jordan Weaver

Adult human beings are typically at a steady state, instinctually changing eating habits and activity levels to maintain a predisposed weight. However, it is often desirable to increase muscle mass for a range of reasons, ranging from athletic performance to self-confidence. Most recently, lean mass has been proposed as an indicator of many healthcare related outcomes, including post-operative recovery, mortality, and hospital stay duration. Increasing mass requires a caloric surplus, with activity level and surplus magnitude dictating the ratio of synthesis of muscle and fat tissue. A thorough understanding of muscle growth rates can optimize this ratio and be foundational for dietary calculations.

Existing predictive models of muscle growth have two shortcomings. First, these models are typically linear, while real muscular adaption is a continuous process. Second, they rely on "Training Years" to predict the current rate of growth, under the assumption that no regression occurs and that all training is equally effective in producing growth. Third, they typically must exclude either low- or high-body mass predictions to fit the opposite.

The Weaver Kinetic Model is a rate-law based prediction which seeks to address all three of these problems. First. the model is based on linear data from Lyle McDonald and regressed to fit a 1st order rate law to muscle growth. The model is based on current Fat-Free Mass Index (FFMI), and thus is not reliant on "Training Years" and the related implicit assumptions. Finally, the Weaver Model is continuous, predicting growth from an emaciated state of FFMI 15 to a fully muscled frame of FFMI 25.

Presenter: Robert Whitehurst
Poster Category: Sports Medicine and Injury Prevention
Poster Number: 10

The Addition of Blood Flow Restriction Training to Eccentric Exercise Results in Improvements in Tissue Stiffness and Function in Achilles Tendinopathy: A Randomized Placebo-controlled Pilot Study

Robert Whitehurst (1), Mita Lovalekar(1), Brad Nindl (1)
(1) University of Pittsburgh

BACKGROUND: Chronic Achilles tendinopathy is characterized by a softening of the elastic property of the tendon which can be quantified with Shear Wave Elastography (SWE). Blood flow restriction training (BFR) may increase tenocyte proliferation and repair when combined with a loading protocol, thereby restoring stiffness to softened tendons.

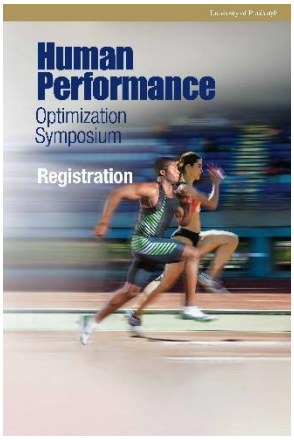
PURPOSE: The purpose of this study was to evaluate the benefit of BFR in addition to eccentric exercise in rehabilitation of chronic Achilles tendinopathy in pain, tissue stiffness, and function to a group doing sham BFR with eccentric exercise.

METHODS: Participants presenting with unilateral Achilles tendinopathy to outpatient physical therapy clinics performed eccentric exercises as a home exercise program (HEP) 2x/ day. Participants came into the clinic 2x/week for 12 weeks and were randomized to perform either BFR (limb occlusion pressure = 80%, n = 6) or sham BFR (limb occlusion pressure <10%, n = 5). Tendon stiffness was quantified with SWE as Young's modulus in symptomatic (SYM) and asymptomatic (ASY) tendons at baseline and after 12 weeks along with measures of pain and function.

RESULTS: Baseline demographics of participants were (n = 11, age = 33.9 ± 10, weight = 80.6 ± 16.3 kg, male = 63.6%, weeks of symptoms = 34.1 ± 24.1). The change in Young's modulus in the BFR group was approximately twice that of the sham BFR group (123.2 ± 71.4 kPa vs 67.4 ± 185.8 kPa) in the SYM tendons (Cohen's d = .40). Statistically significant within group differences were seen in the BFR group from baseline to 12 weeks ($p < .05$) in tissue stiffness, dorsiflexion, and triple hop which were not seen in the sham BFR group. Both groups saw statistically significant improvements in single leg heel raise pain and single leg hop height.

CONCLUSIONS: The addition of BFR to eccentric exercises resulted in larger improvements in tendon stiffness and function compared to sham BFR and eccentric exercise. This work was funded by the AMEDD Advanced Technology Initiative #6042, TATRC, US Army MRMC.

Thank you for attending the first Human Performance Optimization State of the Science Symposium in Pittsburgh, PA.



We will be sending out information on the next Symposium soon.

Questions can be directed to Katy Wharton at whartonkm@upmc.edu