American Society of Exercise Physiologists

11th National Conference Program

Challenging Convention

Making Fitness Functional

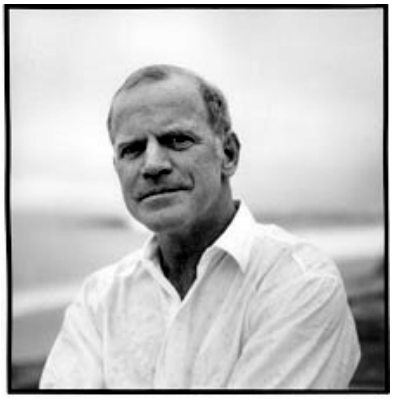
April 2nd through 4th, 2009

Midwestern State University

Wichita Falls, Texas

2009 American Society of Exercise Physiologists National Conference
Invited Speakers

Kary Mullis
Nobel Laureate in Chemistry



Kary Banks Mullis received a Bachelor of Science degree in chemistry from the Georgia Institute of Technology in 1966. He earned a Ph.D. degree in biochemistry from the University of California, Berkeley, in 1972 and lectured in biochemistry there until 1973. That year, Dr. Mullis became a postdoctoral fellow in pediatric cardiology at the University of Kansas Medical School, with emphasis in the areas of angiotensin and pulmonary vascular physiology. In 1977 he began two years of postdoctoral work in pharmaceutical chemistry at the University of California, San Francisco.

Dr. Mullis joined the Cetus Corp. in Emeryville, California, as a DNA chemist in 1979. During his seven years there, he conducted research on oligonucleotide synthesis and invented the polymerase chain reaction. In 1986, he was named director of molecular biology at Xytronyx, Inc. in San Diego, where his work was concentrated in DNA technology and photochemistry. In 1987 he began consulting on nucleic acid chemistry for more than a dozen corporations, including Angenics, Cytometrics, Eastman Kodak, Abbott Labs, Milligen/Biosearch and Specialty Laboratories.

Dr. Mullis received a Nobel Prize in chemistry in 1993, for his invention of the polymerase chain reaction (PCR). The process, which Dr. Mullis conceptualized in 1983, is hailed as one of the monumental scientific techniques of the twentieth century. A method of amplifying DNA, PCR multiplies a single, microscopic strand of the genetic material billions of times within hours. The process has multiple applications in medicine, genetics, biotechnology and forensics.

Dr. Mullis has authored several major patents. His patented inventions include the PCR technology and UV-sensitive plastic that changes color in response to light. His most recent patent application covers a revolutionary approach for instantly mobilizing the immune system to neutralize invading pathogens and toxins, leading to the formation of his latest venture, Altermune LLC.

Dr. Mullis was awarded the Japan Prize in 1993 for the PCR invention. It is one of international science's most prestigious awards. His many other awards include the Thomas A. Edison Award (1993); California Scientist of the Year Award (1992); the National Biotechnology Award (1991); the Gairdner Award, Toronto, Canada (1991); the R&D Scientist of the Year (1991); the William Allan Memorial Award of the American Society of Human Genetics (1990); and the Preis Biochemische Analytik of the German Society of Clinical Chemistry and Boehringer Mannheim (1990). Dr. Mullis was presented the honorary degree of Doctor of Science from the University of South Carolina in 1994 and inducted into the National Inventors Hall of Fame in 1998.

His many publications include "The Cosmological Significance of Time Reversal" (Nature), "The Unusual Origin of the Polymerase Chain Reaction" (Scientific American), "Primer-directed Enzymatic Amplification of DNA with a Thermostable DNA Polymerase" (Science), and "Specific Synthesis of DNA In Vitro via a Polymerase Catalyzed Chain Reaction" (Methods in Enzymology). His autobiography, "Dancing Naked in the Mind Field," was published by Pantheon Books in 1998.

He is currently a Distinguished Researcher at Children's Hospital and Research Institute in Oakland, California and serves on the board of scientific advisors of several companies, provides expert advice in legal matters involving DNA, and is a frequent lecturer at college campuses, corporations and academic meetings around the world. He lives with his wife, Nancy Cosgrove Mullis, in Newport Beach, California, and in Anderson Valley, California.

What if everything you knew about science was wrong?

Science is a process of trial and error. It always has been. Its strength lies in the fact that mistakes eventually are discovered for what they are, and in the long run, unlike any other global institutions, art, politics, religion, science comes through with the goods. We have been showered by the benefits of this process for the last three hundred years such that average individuals are now in possession of things that kings would have gone to war for in the 17th Century.

What non-scientists and scientists alike do not always understand is that the process often follows false leads that take fifty to a hundred years to repair. Due to the rapidity with which scientific findings are spread in today's world, mistakes, which are a natural and integral part of the process, cause disruptions and misapplication of global resources.

In this last century untested paradigms are often and inappropriately the subject of great public concern.

This is not usually the fault of incompetency or dishonesty. It is the way science has to operate. The public and scientists who publicize new scientific findings have to keep this in mind, so that reactions to science, our most valuable public resource, are not hysterical.

Human caused global warming, ozone depletion, GM foods, expansion of the universe, string theories, the AIDS epidemic, etc. are tentative working hypotheses and subject to normal scientific assessment and revision.

Greg Glassman
Founder and CEO, CrossFit

Greg Glassman, a former gymnast, created the CrossFit training methodology in the 1980s. In 1995, Glassman was hired to train the Santa Cruz, CA police department. The first CrossFit gym also opened that same year in Santa Cruz. CrossFit has since been adopted as the primary fitness delivery method by various elite athletes, military, fire fighting, and law enforcement agencies internationally. The CrossFit website, launched in 2001, provides free workouts to the public, includes an exhaustive video library of exercise demonstrations, and provides free training advice through a very active discussion forum. The website receives more than a million unique visitors each month. The CrossFit brand has grown exponentially with professionally affiliated gyms growing in number from 18 in 2005 to 1,000 on March 2, 2009. Canada's Business News Network recently reported that CrossFit is "one of the fastest growing fitness movements on the planet".

CrossFit

CrossFit training delivers a fitness that is, by design, broad, general, and inclusive. Our specialty is not specializing. This makes this system of training different from virtually all other commercial systems. The CrossFit program is designed for universal scalability making it the perfect application for any committed individual regardless of experience. We've used our same routines for elderly individuals with heart disease and cage fighters one month out from televised bouts. We scale load and intensity; we don't change programs. The needs of Olympic athletes and our grandparents differ by degree not kind. Our terrorist hunters, skiers, mountain bike riders and housewives have found their best fitness from the same regimen. Many thousands of athletes worldwide have followed our workouts posted daily on the CrossFit website and have distinguished themselves in combat, the streets, the ring, stadiums, gyms and homes.

CrossFit is based on experimentation in the gym, experimentation intended to produce constantly improving fitness in all of its participants. To this end the development of the CrossFit system has progressed from the "Black Box" where the primary considerations were inputs (exercise organizations) and outputs (fitness effects) to the point that concrete definitions and explanations are possible using basic biological and physical theories and laws. CrossFit definitions and its scientific underpinnings often seem at odds with conventional exercise science

wisdom. This presentation will carefully and systematically illustrate the scientific and logical foundations upon which CrossFit training is based.

Joe Friel
Author, Founder of Ultrafit, TrainingPeaks, and TrainingBible.com

Joe Friel has trained endurance athletes since 1980. His clients are elite amateur and professional road cyclists, mountain bikers, triathletes, and duathletes. They come from all corners of the globe and include American and foreign national champions, world championship competitors, and an Olympian.

He is the author of ten books on training for endurance athletes including the popular and best-selling Training Bible book series. He holds a masters degree in exercise science, is a USA Triathlon and USA Cycling certified Elite-level coach, and is a founder and past Chairman of the USA Triathlon National Coaching Commission.

Joe conducts seminars around the world on training and racing for cyclists, multisport athletes, and coaches. He also provides consulting services for national Olympic federations, world governing bodies for sport, and corporations in the fitness industry.

He has been active in business as the founder of TrainingPeaks.com, a web-based software company, and TrainingBible Coaching, an international coaching company.

He lives and trains in the high Sonoran desert outside of Scottsdale, Arizona.

The Physiological Concepts Behind the Writing of the *Cyclist's Training Bible*

This talk describes the physiological concepts behind the writing of the *Cyclist's Training Bible* and how the book came to be written in 1995 and revised three times with the most recent being released in February, 2009. It discusses the author's formative experiences and the contributions of coaches, athletes, acquaintances, other books, and, especially, researchers in the field of sports science. It describes how research was applied in establishing the training protocol associated with the widely adopted Training Bible methodology.

Mark Rippetoe
Author, Owner Wichita Falls Athletic Club / CrossFit Wichita Falls

Mark Rippetoe is the owner of Wichita Falls Athletic Club and CrossFit Wichita Falls. He has 10 years experience as a competitive powerlifter. He has coached athletes in barbell and strength sports since 1980, and has worked in the fitness industry since 1978. He is the author of *Starting Strength: Basic Barbell Training*, *Strong Enough?*, and co-author of *Practical Programming for Strength Training*. He has coached numerous national level competitors and thousands of people interested in improving their health and strength. Presently he acts as the strength advisor for CrossFit HQ.

Science vs. Practice

Several years ago, three weightlifters were talking about training one afternoon. The gym owner, the professor, and the student all agreed that their common observation about how trainees progress from the novice through the advanced stage was unrecognized in the exercise science literature. They decided to write a paper about it and get it published in a journal, so that

their common observation could aid other coaches who might not have made the same observation in setting up programs for their athletes. What happened amazed them. After all, such a simple, self-evident observation about human adaptation to stress should either have gone into the "Duh!" column, or been welcomed as a clarification of what everybody else basically already knew. It wasn't. This particular process of "peer-review" publication illustrates a couple of the very important problems exercise science must solve about itself before it can productively investigate its primary topic.

Julien Baker
University of Glamorgan (UK)

Professor Julien S Baker is a Professor of Health and Exercise Science at the University of Glamorgan. He is a Fellow of The Royal Society of Medicine (RSM) and a member of the Clinical Institute of Research (MICR). He has published 120 full papers in peer reviewed journals and 12 book chapters. He is also a member of the Physiological societies of both the UK and USA. Professor Baker will be taking up a new position as Chair and Head of Division of Health and Exercise Sciences, Division of Science, at the University of the West of Scotland in April.

High Intensity Cycle Ergometry

Tests of high intensity power and capacity have been extensively used by exercise physiologists to help characterise athletic groups. However, there is little agreement as to one suitable test which can be considered as a valid indicator of both power and capacity as different test protocols measure different components of high intensity performance. Measurements of these different characteristics can be achieved by computing either the amount of mechanical work that can be performed in a specified time, or by monitoring the time taken to perform a given amount of high intensity work.

The evaluation of high intensity power and capacity may also depend on the interpretation of experimental data. High intensity performance has been assessed predominantly by cycling on stationary friction loaded cycle ergometers.

Cumming, (1974) introduced a friction braked cycle ergometer test which was further developed at the Wingate institute in Israel and became known as the Wingate Anaerobic test (WANT). The prototype was announced by Aylon *et al.* (1974) and since its conception a comprehensive description has been published (Bar - Or, 1981). In test protocols using cycle ergometry where a single exercise bout is performed, it is important to set a resistive force that matches the capability of the muscle. In this way, true maximal power output can be measured at, or close to, optimal velocity. A number of authors have addressed the possibility of predicting the optimal resistive force from body mass. This issue however has not been fully resolved (Bar-Or, 1987).

Because the discipline encompasses both clinical and practical applications, its study has illuminated our understanding of such critical fields such as metabolic considerations associated with high intensity activity, the mechanics of the equipment and its validation, muscle damage parameters, oxidative stress, hormonal characteristics, rehabilitation from injury, enzyme activity and general muscle physiology. The purpose of this presentation is to highlight, and explore possible biochemical, mechanical, and anthropometric influences that may affect our interpretation of high intensity exercise data collected using cycle ergometers.

Brian Chontosh
United States Marine Corps

Captain Brian Chontosh is an active duty Marine Corps Officer with over 16 years of service. During his time he has progressed through the enlisted ranks from Private to Sergeant and is now serving as a commissioned officer; currently selected for Major. His occupational specialty throughout his career has been in the infantry community. He has served as a rifleman, squad leader, platoon commander, assistant operations officer, and has over two and a half years of Company Command. Additionally, he spent three years instructing at the Infantry Officer's Course in Quantico, Virginia. His service found him in combat on several different occasions and decorated for the actions and heroism of his men multiple times. During a 2004 tour of duty in Iraq, he and his company were the focus of a Fox News documentary titled *Breaking Point: Company of Heroes*.

A Military Perspective on 'Functional' Fitness

The Armed Forces have been attempting to model a fitness program to best suit combat preparedness for decades. Lacking up to this point was a clear definition, let alone understanding, of what combat fitness is. As technology advances, the battlefield grows, and the enemy takes the fight into terrain of his advantage, the need for increased functional fitness becomes ever important. Operational tempo has required training to become increasingly efficient and the aversion to acceptable injury has confused a precedent for safety over efficacy. CrossFit's conceptual framework and methodology have finally given the military a usable definition of combat/ functional fitness and the means to achieve these imperatives (efficacy, efficiency, & safety) without conflict. With this program demonstrated increases in physical performance have been observed and measured to include increased endurance, stamina, and strength as well as decreased injury, fatigue, and submission to environmental stressors. These physical benefits are significant and the most tangible, however; often unrecognized are the intangibles: confidence, camaraderie, perseverance, and pride. While these characteristics may be immeasurable they are no less applicable or significant.

Clay Worthington
Sports Science Coach, USA Cycling

Clay Worthington received his Bachelor of Science in Exercise Science and Nutrition from Missouri State University in 2002; graduating with cum laude honors. Barbara Bushman and Dan Wilson were the primary influence of his education during this time. In 2006 he graduated from Midwestern State University with a Masters in Kinesiology. His Masters thesis, “Potentiation of Applied Performance: A critical review”, is a thorough investigation of the peer-reviewed scientific literature of potentiation and its possible mechanisms, and can be found on the internet as a file on the SuperTraining website.

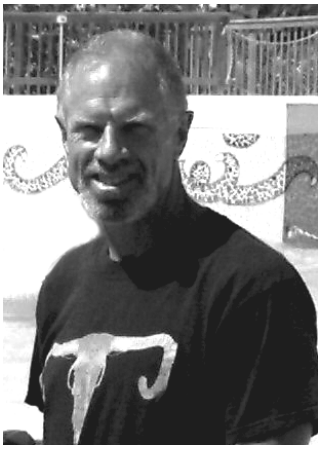
Clay’s work experience is focused within the sport of cycling. Clay worked as a coach and program coordinator for Team Shadow, a junior development cycling club, during his time at Midwestern State. Following this experience, he worked as a coach for Carmichael Training Systems (CTS) performing distance coaching for recreational athletes. From there Clay was accepted into the Coaching Scholarship Program, a program offered for National Governing Bodies (NGB) through the US Olympic Committee (USOC) in Colorado Springs. Meg Stone and Cathy Sellars directed this program, which provided aspiring coaches from multiple NGB’s the opportunity to study under some of the top sports scientists in the nation including Mike Stone, Randy Wilbur, and Bill Sands. The

young coaches were also promised the opportunity to study under NGB coaching staff, arguably some of the best in the field, and to travel to experience international competition. Clay was mentored by USA Cycling coaches and staff including Des Dickie, Gary West, Jim Miller, Noel Dejonckheere, and Pat McDonough. Clay was one of two coaches to be asked back for the second year of this program, and the only coach to complete the two year course. USA Cycling hired Clay as the Sports Science Coach in 2007 to perform duties as both a sports scientist and coach. Clay's coaching responsibilities have been almost exclusively to the specialized discipline of track cycling where he has worked with sprint specialists, endurance specialists, men, women, juniors, and U23 athletes. Clay was the Junior World Team Coach for the track team in 2006 and 2007, and recently was named director of the U23 Madison Program. The first two athletes Clay directed in the Madison program recently became the first American team in history to win the amateur six day series.

Potentiation and Applied Performance

Potentiation is a scientific exploration of performance enhancements through physical exertion, and the practice is embedded in the minds of practitioners (i.e. coaches, athletes, etc) of many sports and many sporting types (fitness based, field, team, strength/power, endurance, etc). Scientific reviews still consider evidence of potentiation to be equivocal despite a considerable amount of evidence demonstrating both enhanced muscular twitch properties as well as enhanced performance in sporting variables (power, speed, jump height, etc). This discussion will attempt to quickly, but thoroughly, collect and present the peer-reviewed scientific literature's definition, importance, mechanism of occurrence, influencing factors, and practical application of potentiation. The goal of the discussion is to challenge the current ideas that potentiation may or may not occur, how it occurs, and how we can use it in day-to-day sport training.

Frank Wyatt
Associate Professor, Midwestern State University



Frank B. Wyatt received his Bachelor of Science in Education from the University of North Texas, his Master of Arts from San Francisco State University and his Doctorate in Education from the University of Northern Colorado. During that time, Dr. Wyatt has worked in the field of Exercise and Sport Science for more than two decades. He has won awards for his research and teaching at Western Kentucky University, Wichita State University and Louisiana Tech University. With numerous publications in peer reviewed journals as well as presentations at professional meetings, Dr. Wyatt continues to research performance related variables associated with physiological thresholds and cardio-pulmonary function. An avid cyclist he holds a 3rd Degree Black Belt in Taekwondo and recently published his book, "The Tao of Training". Dr. Wyatt is married to his wife Cindy and has two children, Carpenter and Sallisa.

Physiological Thresholds: Training and Adaptation

Physiological thresholds (i.e., lactate, heart rate, ventilatory) have been investigated and reported repeatedly in the research literature. PURPOSE: The purpose of this study is to investigate various physiological thresholds associated with cycling performance and to determine the metabolic mechanisms of their occurrence and adaptation. METHODS: Archived data from maximal tests of cyclists were utilized. Primary data analysis were from ventilatory measures (V_E, VO_2, VCO_2, V_E/VO_2,V_E/VCO_2), heart rate (bpm) and lactate (mM). Scatter-plot analyses of the primary data from increased work rates allowed for threshold determination. Bivariate correlation and regression analysis were performed to determine threshold association and trend-lines, respectively. All statistical analyses were considered significant at $p \leq 0.05$. RESULTS: Threshold identification for the variables lactate, heart rate and ventilation were established through polynomial, logarithmic, and quadratic regression trend-lines, respectively. Significant associations were established between break points for threshold

determination with lactate, heart rate and ventilation. DISCUSSION: The physiological thresholds of lactate, heart rate and ventilation are linked through metabolic processes. The metabolic connections between the aforementioned thresholds provide information for training to allow for adaptation.

Lonnie Lowery
Associate Professor, University of Akron

Dr. Lonnie Lowery is an Exercise Physiologist, licensed nutritionist and Associate Professor of Nutrition at The University of Akron in Akron, Ohio. He is also the Editor of the ASEP-Newsletter, along with Jonathan Mike, and a past ASEP President. Dr. Lowery's research interests involve dietary proteins and fats and their roles in sports nutrition. He has written extensively in the lay media and is currently involved with www.IronRadio.org, a free podcast, website and educational audio library for sports nutrition and resistance training topics.

Dietary Protein in Sports Nutrition: The Need for Trans-disciplinary Cooperation

Professional groups often have their own unique cultures and views. These qualities can become detriments, however, when trans-disciplinary communication is lacking and a sort of isolationism prevails. For example, self-reinforcing opinions could lead to internally-created certifications that may not be the equal of simply making an appropriate referral. This happens in interdisciplinary topics like weight management and sports nutrition. A controversial issue common to both of these settings is dietary protein. This presentation offers the author's interdisciplinary perception of how dietary protein is understood by Exercise Physiology (EP) researchers compared to opinions from practicing dietitians and dietetic educators (RDs). New and old data from EPs on the issue are compared to statements from dietetic textbooks and nutrition conferences. Finally, suggestions for enhanced professional cross-talk and better protection of the public are offered.

Schedule of Events

Thursday, April 2, 2009

5:00-9:00 pm Board of Directors Meeting
Conference registration in Ligon Coliseum – Room 223

Friday, April 3, 2009

Fain Fine Art Amphitheater (Registration Continues in Fain Fine Art Building)

8:00-8:15 Opening Remarks – Howard Farrell, Vice-President, Midwestern State University
8:15-8:20 Introduction - ***Endurance Training and Performance***
8:20-8:35 Rebecca Shafer, Appalachian State University
8:35-9:00 David Morris, Appalachian State University
9:00-9:15 Joey Gregg - Midwestern State University
9:20-9:25 Introduction - ***Legal and Theoretical Aspects***
9:25-9:40 Tommy Boone, College of St. Scholastica
9:40-9:55 Joseph Warpela, College of St. Scholastica
9:55-10:10 Keri Kulik, Indiana University of Pennsylvania
10:10-10:25 Lon Kilgore, Midwestern State University
10:30-11:00 Catered Poster Session & Social
11:00-11:05 Introduction - ***Anaerobic Training and Performance***
11:05-11:20 Christina Feldmann, Marquette University
11:20-11:35 Kaitlyn Waring, Pacific Institute for Sport Excellence
11:35-11:50 William Ebben, Marquette University
12:00-1:15 Lunch
1:15-1:25 Introduction - ***The CrossFit Phenomenon***
1:25-2:15 Greg Glassman - Founder and CEO of CrossFit
2:15-3:05 CPT Brian Chontosh - United States Marine Corps
3:05-3:55 Mark Rippetoe - Author, Starting Strength and CrossFit strength consultant
4:00-5:00 CrossFit Round Table Discussion
5:00-6:00 ***Kary Mullis - Nobel Laureate - What if everything you knew about science was wrong?***
6:15-8:00 Sponsored Banquet at Sikes Lake Center

Friday Poster Presentations (Presenter at Poster 10:30 to 11:00)

9:00 Friday to 11:00 Saturday

Anatomical Applications in Exercise
Stanley Mukundi - University of Houston-Clear Lake
Lon Kilgore - Midwestern State University
Tyler Vander Zanden - Marquette University

Physiological Adaptation in Exercise
B.M. Ziegler - Wichita State University
James Heimdal - University of Maryland-Eastern Shore
Alissa Donaldson - Midwestern State University
Chad Touchberry - University of Missouri-Kansas City
Svea Wanntke - Midwestern State University

Bio-Behavioral Aspects of Exercise
Luke Garceau - Marquette University
Elise Brown - Midwestern State University

Clinical and Health Aspects of Exercise and Physical Activity
Christina Feldman - Marquette University
B. Lutsch - Marquette University
Larry Birnbaum - College of St. Scholastica
Kelly Brooks - Louisiana Tech University
Ryan Amick - Friends University

Saturday, April 4, 2009

Fain Fine Art Amphitheater

8:00-8:05	Introduction - ***Physiology and the Bike***
8:05-8:55	Clay Worthington, USA Cycling Sports Science Coach
8:55-9:45	Julien Baker, University of Glamorgan
9:45-10:15	Intermission
10:15-11:05	Frank Wyatt, Midwestern State University
11:05-11:55	***Boone Lecture - Lonnie Lowery, University of Dayton***
12:00-2:00	Sponsored Luncheon in Commanche Suites (Clark Student Center)
12:45-1:45	***Joe Friel - Author, Cyclists Training Bible***
1:45-2:00	Adjournment

Open Scientific Session 1 – Aerobic Training and Performance

Comparison of running paces at blood lactate and pH thresholds and average pace during a competitive running trial

Rebecca Shafer
Appalachian State University

Metabolic acidosis is a known contributor to fatigue during high-intensity exercise. Traditionally, lactate production and accumulation have been suggested to be major contributors to acidosis during exercise. These beliefs have prompted some researchers to study the relationship between running pace at lactate threshold and performance during competitive, endurance running events. Some investigations have challenged the relationship between lactate production and acidosis, as well as the predictive capacity of work rates at lactate threshold and sustainable work rates during competitive events. PURPOSE: To compare running paces that elicited blood lactate (PLT) and pH (PpHT) thresholds and average pace during a 7-km time trial (PTT), all assessed on a motor-driven treadmill. METHODS: Twelve competitive runners, 7 males and 5 females [23 $\pm$ 9 yrs, 60 $\pm$ 9 kg, 54.4 $\pm$ 7.8 mL·kg·min^{-1}] performed a progressive exercise test to determine PLT and PpHT, and a simulated competitive 7-km run. A one-way repeated-measures analysis of variance was conducted, followed by a univariate analysis for significant differences between PLT, PpHT, and PPT. All data are reported as means $\pm$ SD. Level of significance was set *a priori* at $P<0.05$. RESULTS: Mean values for PLT, PpHT, and PTT were 13.5 $\pm$ 2.1 km·h^{-1}, 14.7 $\pm$ 2.3 km·h^{-1}, and 14.2 $\pm$ 2.1 km·h^{-1}, respectively. Significant differences were observed between each of the measured variables ($P<0.05$). CONCLUSION: These results suggest that neither pace at lactate threshold nor pace at pH threshold offers an accurate reflection of competitive running pace during simulated 7-km footraces.

Comparison of ventilatory, lactate, and pH thresholds from progressive exercise tests

David Morris
Appalachian State University

Ventilatory threshold (VT) is marked by an exponential increase in ventilation during progressive exercise tasks. A primary cause of VT is an increase in carbon dioxide production resulting from proton buffering via the carbonic anhydrase reaction. Traditional beliefs have focus on lactate production as the primary source of protons, and many have attempted to establish relationships between lactate threshold (LT) and VT. However, dissociations between the occurrences of LT and VT and current viewpoints on lactate production and acidosis have challenged lactate production as a contributor to VT. PURPOSE: We sought to compare the occurrences of VT, LT, and pH threshold (pHT) during progressive exercise tests. METHODS: Eight cyclists and 9 runners (28 ± 7 yr, 64.6 ± 7.5 Kg, 58.8 ± 6.6 ml · Kg^{-1} · min^{-1}) performed progressive exercise tests while blood and expired air were collected for analyses. VT was established by plotting ventilation volumes against their respective work rates. LT and pHT were established by plotting blood lactate and pH values against their work rates. The oxygen consumption levels at each of the three thresholds were determined and compared using a one-way repeated measures ANOVA followed by univariate analyses. Level of significance was set *a priori* at $P < 0.05$. RESULTS: Mean oxygen consumptions at VT (3.30 ± 0.65 L · min^{-1}) did not differ significantly from LT (2.93 ± 0.54 L · min^{-1}) and pHT (3.35 ± 0.16 L · min^{-1}) ($P = 0.08$, 0.78, respectively). A significant difference was observed between LT and pHT ($P = 0.048$). CONCLUSION: As expected, no significant differences were observed between pHT and VT. The results also demonstrated a dissociation between LT and blood acidosis. Furthermore, power analysis suggests that statistically significant differences between oxygen consumptions at LT and VT would be achieved with an $n = 32$.

Determination of Ventilatory Threshold through Quadratic Regression Analysis

Joey Gregg, Frank Wyatt, Lon Kilgore, Cory Pack
Midwestern State University

The ventilatory threshold (V_T) has been used to measure physiological occurrences in athletes. Models have been created to detect V_T with limited accuracy. PURPOSE: The purpose of this study was to establish a mathematical model for detecting the ventilatory threshold utilizing the ventilatory equivalent of carbon dioxide (V_E/VCO_2) and the ventilatory equivalent of oxygen (V_E/VO_2). METHODS: The methodology was a mathematical analysis of data archived from the cardio-respiratory laboratory in the Department of Kinesiology at Midwestern State University. Procedures for archived data collection included breath-by- breath gas analysis averaged every 20 seconds (s) measured through open circuit spirometry (ParVo Medics™). A ramp protocol on a cycle ergometer (Velotron™) was used which increased work 25 $w \cdot min^{-1}$ beginning with 150 watts, until volitional fatigue. Subjects were highly trained cyclists (n=27) from the area with ages ranging from 18 (y) to 50 (y). Prior to testing, all subjects signed an informed consent approved by the university Humans as Subjects Review Committee. Mathematical analyses utilized Microsoft Excel™ spreadsheets to create scatter-plots and regression analyses to establish trend-lines of V_E/VO_2 and V_E/VCO_2. RESULTS: A polynomial trend-line along the scatter-plots for V_E/VO_2 and V_E/VCO_2 was used with a significant correlation coefficient (r=0.82) of the data and trend-line. The equations derived from the scatter-plots and trend-lines were quadratic in nature due to the fact that they have a polynomial degree of two. The mean (SD) % VO_{2max} of the V_T established through the trend-line intersections was .79 (.09). CONCLUSION: A system of equations which were quadratic in nature established the lines of best fit allowing for an accurate identification of V_T. The exact point of V_E/VO_2 and V_E/VCO_2 crossover, the intersection or solution to the system, was established as the V_T with the subsequent increased slope of V_E/VCO_2 as respiratory compensation.

Open Scientific Session 2 – Anaerobic Training and Performance

The Effect of Resistance Training on Hamstring and Quadriceps Muscle Activation Magnitude and Timing

Christina Feldman, William Ebben, Erich Petushek, McKenzie Fauth, Luke Garceau, and Brittney Lutsch
Marquette University

Introduction: Weak hamstrings are part of the etiology of anterior cruciate ligament (ACL) injury and women are particularly at risk for ACL injuries due to lower hamstring strength and less optimal timing of hamstring recruitment compared to men (1,2). Previous research has evaluated hamstring and quadriceps muscle activation during lower body resistance training exercises and dynamic movements (2,3,4). This study evaluated the effect of a 6-week lower body resistance training program on hamstring and quadriceps activation and timing during movements similar to those thought to cause ACL injuries. Methods: Thirteen women (age = 19.5 ± 1.05 years) were randomly assigned to a 6-week resistance training group, and 12 women (age = 19.7 ± 1.56 years) were randomly assigned to a non-exercising control group. The training group performed 6 weeks of resistance training prioritizing hamstring exercises (3,4). All subjects completed pre- and post-tests by performing 2 repetitions each of the drop jump (jump), and a sprint and cut at a 45-degree angle (cut). Electromyography, normalized to MVIC, was used to quantify rectus femoris, vastus lateralis, vastus medialis, lateral hamstring, and medial hamstring activation. Results: Data were analyzed using independent samples *t*-tests. Subjects who performed resistance training demonstrated statistically higher hamstring to quadriceps activation ratios after training for the pre- and post-landing phase of the cut and the pre-landing phase of the jump ($p \leq 0.05$), with a trend toward significantly higher hamstring to quadriceps ratio post-landing phase of the jump as well ($p = 0.10$). No differences in timing of muscle activation were found. The control group demonstrated no significant differences in any of the variables assessed. Discussion: Resistance training that prioritizes hamstring-based exercises (3,4) is effective in increasing the activation of hamstrings compared to quadriceps muscles. Higher hamstring to quadriceps activation ratios during jump landings and cutting may promote knee stability and reduce ACL injury.

Validity and Reliability of Wingate Anaerobic Testing on the Velotron Cycle Ergometer

Kaitlyn Waring and Tony Webster
Pacific Institute for Sport Excellence

The 30 second Wingate anaerobic test (WAnT) was originally developed on mechanically braked cycle ergometers. Information on the validity and reliability of the WAnT using modern electromagnetically braked bicycle ergometers is scarce in the scientific literature. In this study, WAnT performance measures were compared between a mechanically resisted Monark cycle ergometer and an electromagnetically braked Velotron cycle ergometer. Eleven healthy cyclists performed six WAntTs (three on each ergometer, alternating ergometers on each successive occasion) with approximately 7 days between each test. Performance was measured as peak power output (PPO), mean power output (MPO), lowest power output (LPO) and fatigue index (FI). The first tests on each ergometer were treated as familiarization trials to minimize learning effects. Reliability of all performance measures by the Velotron using intraclass correlations (r) and coefficients of variation (CV) were as follows: PPO, r = 0.952, CV = 7.9%; MPO, r = 0.996, CV = 1.6%; LPO, r = 0.983, CV = 3.8%; and FI, r = 0.940, CV = 6.2%. There was no difference between the Monark and Velotron in MPO (491.5 $\pm$ 158.4W vs. 479.8 $\pm$142.9) or LPO (361.9 $\pm$ 119.0 vs. 346.4 $\pm$ 89.9W). For the Velotron PPO (785.1 $\pm$ 249.0 vs. 608.4 $\pm$ 198.8W; $P < 0.005$) and FI (53.6 $\pm$ 12.1 vs. 40.0 $\pm$ 8.2; $P < 0.001$) were higher than for the Monark. The results of the present study suggest that the Velotron cycle ergometer produces reliable performance data for the WAnT but the validity of some of these measures, especially PPO and FI, is questionable. Therefore we cannot recommend this ergometer for the performance of the WAnT.

Relationship Between Training Status and Concurrent Activation Potentiation

William Ebben, Erich Petushek, and Luke Garceau
Marquette University

Introduction: Concurrent activation potentiation (CAP) is manifested by simultaneous activation of muscles other than the prime movers and is thought to enhance the acute performance of strength and power tasks (1). Previous research demonstrated that CAP augmented performance variables by 14.6 to 20.5 percent (2,3). Concurrent activation potentiation has been studied in athletic and recreationally fit subjects, though the role of training status on CAP remains unclear. The purpose of this study was to evaluate the relationship between subject training status as assessed by strength to mass ratio and the effect of CAP. Methods: Analysis included two samples of subjects; one that performed isometric knee extension on a dynamometer (21.2 ± 1.6 yr; 74.4 ± 8.0 kg) and another that performed back squats and jump squats on a force platform (21.3 ± 1.4 yr; 76.9 ± 13.2 kg). For subjects that were tested on the dynamometer, the independent variable was subject torque to mass ratio, and the dependent variables included the ratio of CAP versus non-CAP conditions of knee extensor torque and rate of torque development (RTD). For subjects that were tested on the force platform, the independent variable was subject strength to mass ratio and the dependent variables included the ratio of CAP versus non-CAP conditions of the back squat and jump squat ground reaction forces and rates of force development (RFD). Results: Pearson's correlation analyses demonstrated no relationship between subject torque to mass ratio and the ratio of CAP and non-CAP torque ($R = 0.19$, $P \leq 0.93$) or RTD ($R = 0.21$, $P \leq 0.33$). Similarly, the correlation analyses revealed no correlation between subject strength to mass ratio and the ratio of CAP to non-CAP squat peak force ($R = -0.04$, $P \leq 0.87$), jump squat peak force ($R = 0.20$, $P \leq 0.35$) back squat RFD ($R = 0.16$, $P \leq 0.48$), and jump squat RFD ($R = 0.33$, $P \leq 0.13$). Discussion: Results of this analysis revealed no correlation between subject training status and performance enhancement due to CAP. Thus, CAP works equally for trained and untrained subjects.

Open Scientific Session 3 - Legal and Theoretical Aspects

The Invisible Profession

Tommy Boone
The College of St. Scholastica

Exercise physiologists are great researchers but poor at healthcare. Consider those in academia, for they have better laboratory technology than physical therapists. Yet, while academic exercise physiologists publish their papers, attend national meetings, and build their resumes, they fail to take into account the power of exercise as medicine. In the end, their work, rooted in the significance of earlier thinking, proves to empower themselves while leaving their students hanging without financial stability or credibility. Today's politics and indifference are staggering and overbearing. Both leave us with little movement forwards, with lost time to gain a footing in healthcare, with a sense of hopelessness over our future. But all this can change. We can grow beyond the current paradigm and its need to keep us unchanged. The ASEP Vision is not about being satisfied with the status quo. It is not about leaving things as they are. It is by necessity all about "rocking the boat' because our students deserve more. We deserve more. Change begins with us. ASEP is about starting over and thinking differently. This isn't radical thinking. It is straight from the gut, and it is the proper way to gain the respect of other professionals. In short, this means that students should graduate from an ASEP accredited exercise physiology program who are taught by academic exercise physiologists who are Board Certified. This thinking is in place today, and it will when shared by all of us make us visible. Our visibility will be in essence the result of the efforts of ASEP leadership (and you) in kick starting how we should think about the professionalism of exercise physiology. Every academic exercise physiologist should do his or her best to change what is to what can be by demonstrating the willingness to look at the problem and make dramatic changes. The ASEP leadership has a path cleared for anyone who is interested in serving the profession and anyone who wants to be part of it. All they have to do is stop being driven by the failed sports medicine rhetoric and start examining what students actually need to be successful healthcare professions.

An Analysis of Certifications Offered by the Big 3: ACSM, ASEP, and NSCA

Joseph Warpeha
The College of St. Scholastica

Certification in the exercise/fitness field traces its origins to the 1970's when a handful of options were available. These earliest credentials were born, presumably, as a response to the growing trend of exercise not only in the general population for health and fitness but also in clinical populations for rehabilitation as well as athletic groups for performance enhancement. In less than 40 years, literally hundreds of options have appeared for exercise-related certifications from dozens of organizations. The requirements for sitting for these exams range from a high school diploma and CPR card to a graduate degree with considerable documented practical experience. This talk will focus on certifications offered by the ACSM, ASEP, and NSCA. In general, certifications from these three organizations are considered by many to collectively represent the top tier of exercise-related certifications. Specifically, the history of each of these certifications will be examined as will a comparison of the prerequisites, fee structures, renewal requirements, and the perception of each by practitioners in the field as well as the general public. The differentiation of certification, registration, and licensure will also be discussed. Reasons for creating and offering various certifications will be explored ranging from the frequently cited and obvious to the less-talked-about motives which are an unfortunate reality in some situations. Finally, the evolution of these certifications will be chronicled and theories as to why certain changes have occurred will be presented. Ultimately, the listener should gain a better understanding of the general topic of exercise-related certifications and, more specifically, those offered by the ACSM, ASEP, and NSCA. The purpose is to enable the listener to make an educated decision regarding the choice of which certification(s) to pursue and/or recommend.

From Dodgeball to Dropping the Ball: Where is Physical Education going wrong?

Keri S. Kulik and Justin R. Kulik
Indiana University of Pennsylvania

Physical education has been a part of the school curriculum since the late 1800's and school sports has been a component of educational institutions since the early 1900's. However, alarming health trends are emerging suggesting that schools may no longer be providing students with adequate opportunities to engage in physical activity. The question is why? The authors hypothesize that this may have a multi-factorial answer with issues such as time devoted to physical education, student to teacher ratio, facilities and teacher training being leading causes. While the first three issues are primarily concerned with school district policy and personnel, the latter is primarily a function of the teacher preparation programs currently being implemented by state universities providing health and physical education certification. A thorough understanding of the concepts of human physiology and biomechanics as it relates to the design and implementation of a quality exercise program apply to exercise physiologists as much as they do to a physical education teacher. In fact, perhaps to a greater degree considering the numbers of students who are exposed to physical education and the amount of direct contact teachers have with students each year. A 2007 research study surveying current physical education teachers reported only a 65% proficiency in basic understanding of exercise physiology topics such as power, metabolic response to exercise, strength training and body mass index (BMI). This is extremely alarming considering that these concepts are required for developing an effective exercise program with measureable results. In addition, a background rich in exercise physiology content may assist physical education teachers in overcoming hurdles mediated by school district policy such as time restrictions and facilities. The authors will propose a theoretical model for physical education teacher education programs and will demonstrate how this model may translate into improved physical education programs which may help to address the health concerns currently facing children.

Paradigm Lost – Scientific Misdirection in Exercise Physiology

Lon Kilgore
Midwestern State University

Exercise physiology has long been defined as the study of the function of the human body during exercising conditions. While this definition is broadly accepted, it must be understood that exercise physiology is a sub-division of physiology, the study of the physical and biochemical function of living organisms. Physiology is itself a sub-division of biology. It must also be understood that the principles of physiology are universal, meaning that exercise physiologists must follow the same rules and laws that govern scientific inquiry and professional practice followed by physicists, chemists, and biologists.

Several scientists practicing within the field of exercise physiology have noted that the existing scientific literature, accumulated over more than a half century, cannot be used to provide fitness practitioners any effective guidance on improving VO_2max nor maximal strength, two of the most essential elements of physical fitness. This limitation in application pervades every area of exercise physiology and suggests that exercise physiologists may have failed to investigate relevant topics, to ask applicable research questions, to draw appropriate conclusions based on data produced, or they have not followed the same rules of research execution and analysis followed by other scientific disciplines.

The resolution of this problem requires an organized and concerted effort to reconnect with the classical sciences in order to (1) create or re-construct absent or misapplied definitions, (2) to identify a quantifiable end product of exercise participation, and (3) to adopt a relevant and operational paradigm derived from exercise physiology's parent discipline, biology. Exercise physiology, as an area of study, and exercise physiologists in particular must address these critical issues before field practitioners can derive any practical benefit from exercise physiology research.

Posters by Topic

Anatomical Applications in Exercise

Walking Kinematics in Terrestrial and Simulated Lunar Conditions: Effect of Center of Mass Location

Stanley Mukundi, Alexandria Burley, Melanie Charles, Amanda Culver, Sam Cyr, Mallory Jennings, Heather Paul, Terry Dupler, William Amonette
University of Houston – Clear Lake

Extravehicular activities (EVA) on the lunar surface will require ambulation in unique environmental conditions. To support EVA, a new space suit system including pressure garments and life support subsystems (PLSS) are being developed. The PLSS has considerable mass, thus its positioning may alter gait. The purpose of this research was to quantify lower extremity and trunk biomechanics during terrestrial and simulated lunar ambulation with two center of mass (COM) locations. While wearing a PLSS (7.7 Kg) two subjects walked on a treadmill at 1.8 mph in two gravitational conditions: earth gravity (Eg=9.81 m/sec2) and lunar gravity (Lg=1.6 m/sec2). Lg was simulated using a KC135 aircraft that performed parabolic maneuvers. During both, the COM of the PLSS was altered by repositioning 6.8 Kg in two positions: Left side of PLSS, and Back of PLSS. Reflective markers were placed on the lateral malleolus, knee joint line, greater trochanter, and mid axillary line; video data were collected at 60 Hz by a camera positioned at the left lateral side of the subject. Stride length was measured at heel strike; knee and trunk angles were analyzed during the midstance phase of gait using two-dimensional motion capture software. Differences in means and effect sizes (Cohens *d*) were calculated. Minimal differences were observed in the knee (1.88, *d*=0.44) and trunk angles (-0.03, *d*=0.01) when comparing Eg and Lg in the back COM condition. Larger differences were observed for the left COM: knee angle (-10.98, *d*=3.22) and trunk angle (-7.99, *d*=2.10). Large variations were also observed in stride length under both conditions: back (0.12m, *d*=4.85) and left (0.14m, *d*=3.82). These data suggest that shifting the COM of the PLSS in Lg and Eg results in altered biomechanics. More research is warranted to determine the impact of PLSS location on gait patterns of astronauts in lunar gravitational conditions.

Pilot Evaluation of the Scapular Alignment Model of the Deadlift

Lon Kilgore, Stef Bradford, & Mark Rippetoe
Midwestern State University & CrossFit Wichita Falls

It is our proposition that an association exists between three elements during any pulling motion with a barbell; (1) the foot, (2) the bar, and (3) the scapula. Observation of numerous publically available video recordings and bar path analyses provides evidence that a barbell suspended from the arms a few inches from the ground, as in a snatch, clean, or specifically relevant to the present research, the deadlift, will lie within a line identified by two points, the middle of the foot and on or near the scapular spine.

It was conjectured that that a lifted barbell would be suspended under a common point around which all scapular rotation occurs (intersection of the x, y, and z axes) and above the cuneiform bones. It was assumed the scapular landmark represented a point of coordinated muscular action across the scapula and that a barbell of significant load would, as a consequence of gravity and anatomy, assume a position under the common rotation point when lifted from the floor.

To examine this possibility, a camera was placed vertical to a loaded barbell (185 kg) representing nearly double bodyweight of a subject (94 kg). Dots identifying the acromion, scapular spine at the medial border, and the inferior angle were placed on the subject. The subject was then placed in position – barbell over the cuneiforms of the foot and the scapular spine placed just anterior of the plane passing perpendicular through the bar. The subject deadlifted the bar and a sequence of photographs were taken recording the orientation of the bar relative to the scapula and foot during lifting.

The conjectured bar-scapula orientation was rejected as the loaded barbell assumed, immediately upon elevation, a position at midpoint along the long axis of the scapula. These findings suggest a refinement in our recommended deadlift starting position is required. Specifically it supports the assumption of the foot position previously described - bar over cuneiforms. However, the subject must place the midpoint of the long axis of the scapula, acromion to inferior angle, over the bar. We propose that when these conditions are met, the barbell can be lifted in the most efficient manner possible, a straight line.

Program Design for the Optimal Adaptation of Bone

Tyler Vander Zanden, Erich Petushek, and Willam Ebben
Marquette University

Introduction: The primary function of bone is to serve as rigid levers upon which muscle and tendon pull in order to perform a wide array of physiological tasks (1). During sport and exercise, stresses imposed on bone initiate a cascade of adaptive responses, positively influencing bones' rigidity, geometry, and content. New ideas offer insight as to which training methods promote osteogenesis. Therefore, this review identifies key variables that will optimize the likelihood for bone formation. **Methods:** Health Sciences in ProQuest, Medline via Ovid, and SPORTDiscus were searched for this review. The following keywords and combinations were searched: "bone adaptation," "bone formation," "bone growth," "bone mass," "bone strength," "BMC," "BMD," "exercise," "resistance training," "biomechanics," and "mechanotransduction." **Theoretical Foundations:** Bone is an anisotropic material composed of a strong collagenous matrix, embedded with stiff mineral crystals (2). The multi-layer design of bone includes the periosteum which contours around a dense shell of cortical (compact) bone. Intermingled with the cortical bone is an inner layer of trabecular (spongy) bone, which surrounds the bone marrow cavity. Blood vessels occupying a network of canals in the marrow cavity extend through the layers of bone to provide nutrients. In response to stress or mechanical loading, osteoblasts initiate remodeling, strengthening bone at the site of deformation (3). This sequence of cellular events is due to bone's high sensitivity to hydrostatic pressure gradients within bone's fluid-filled lacunar-canalicular network (1,4). Resent research offers evidence with respect to what types of training modes may be optimal (5). **Practical Application/Exercise Prescription:** Research indicates that short duration and higher rates of dynamic loading best drives fluid through the lacunar-canalicular network system, stimulating osteogenesis, and thereby improving geometry and strength by increasing bone mineral density (1,4,6,7). **Conclusion:** Program design should include exercises that are dynamic, high impact, higher in loading rate, and which are biomechanically specific to the area of desired adaptation. Programs promoting osteogenesis should also limit the number of repetitions in-session and incorporate rest periods between exercise repetitions and sessions.

Physiological Adaptation in Exercise

Bone Response to Varied Volumes of Bicycling in Adult Males

B.M. Ziegler and J.A. Patterson
Wichita State University

This study was designed to investigate the relationship between bone mineral density (BMD) and weekly training volume (TV) in recreational adult male cyclists. Methods: Eleven male participants (n=11; 38.9 +/- 5.5 yrs) were tested in duplicate, 12 weeks apart, for BMD at four sites: total body (TB), lumbar (L), hip (H), and distal radius (R). Participants were also measured for weight, % body fat, and $VO2_{max}$. TV, in hours, over the 12 weeks was also recorded for each participant at their usual self-selected volume. Statistics: Dependent t-tests were performed for all measurements to analyze changes over time. Mean values for all BMD measurements, weight, $VO2_{max}$, and % body fat were calculated for each participant. Pearson's correlation coefficients were calculated for all mean BMD measurements against TV, weight and age. Results: Mean scores were found for TV (7.65 +/- 3.24 hr/wk), VO_2max (4408.55 +/- 465.95 ml), weight (80.00 +/- 15.03 kg), and % body fat (17.77 +/- 4.86 %). No differences were found in BMD measurements (TB, L, H, R) or weight, % body fat, or $VO2_{max}$ over time. No significant correlations were found between any mean BMD measurement (TB, L, H, R) and TV (r = 0.130, r = -0.057, r = -0.221, r = 0.321). Conclusion: These results suggest that there is no significant relationship between BMD and training volume in adult male cyclists. Therefore, training volume is not predictive of BMD in adult male cyclists. BMD appears to be dependent on factors other than those tested in this study. However, further study over a longer training period is needed to investigate this possible relationship more thoroughly.

Effect of a Pre-Season and In-Season Strength and Conditioning Program on NCAA-IA Football Players

James Heimdal
University of Maryland – Eastern Shore

The purpose of the investigation was to evaluate a pre-season and an in-season collegiate football strength and conditioning program. Eighty three male volunteers participated in the study. All athletes had previous lifting experience. All subjects performed an 11 wk program (summer). This program consisted of a 4-day per week scheduled. The total volume for a daily workout in the summer was set at 200 repetitions per workout. All subjects also performed an 18-wk program (in-season). The program consisted of a 3-day per wk schedule. The total volume for a daily workout in the season was set at 150 reps per workout. Note that 4 out of the 18 weeks in-season program were two a day practices (preseason). The volume for a lifting session was scaled back in accordance with the rigors of the two practices. All subjects were tested 3 times during the study: pre-test (beginning of summer), post-test (end of the summer), final-test (end of in-season). All subjects were tested in four core areas (Body weight (BW), Squat (SQ), Bench press (BP), and Clean (C). A one repetition maximal (1-RM) test was used to determine maximal scores. Each subject was assigned into one of 9 sub-groups. The groups include: wide receivers, defensive backs, linebackers, tightends, running backs, quarterbacks, kickers, offensive linemen, and defensive linemen. Mean (M) and standard deviation (SD) were recorded using a Repeated Measure of Analysis of Variance (RMANOVA) test. The significance was set at $p \leq 0.05$. A comprehensive review of the specific strength and conditioning program and the rate of adaptation/progression/maintenance by the subjects will be included in the presentation. The practical implication of these adaptations on athletic performance and/or injury prevention requires further investigation.

A Meta-analysis of Biomarkers Associated with Overtraining Syndrome

Alissa Donaldson, Frank Wyatt, Tyler Fagan, and Elise Brown
Midwestern State University

Overtraining (OT) syndrome has been investigated extensively with little agreement as to reliable markers for detection. A meta-analytic review is a procedure designed to compile studies in an area with hopes of reaching a consensus view. **PURPOSE:** The purpose of this meta-analysis was to provide summary quantitative findings of biomarkers (i.e., blood) associated with the overtraining syndrome. **METHODS:** A meta-analytic research design was utilized to investigate selected studies allowing for a coding process to record data. Thirteen studies met inclusion/exclusion criteria. Biomarkers included samples taken with subjects in normal (N) condition and during OT. These biomarkers were the following: glutamine (um), glutamate (um), cortisol ($nmo*l^{-1}$), IL-6 (nm), testosterone ($mg*dL^{-1}$), total cholesterol ($mg*dL^{-1}$), glucose ($mg*dL^{-1}$), leptin ($ng*mL^{-1}$), hematocrit (%), hemoglobin ($g*L^{-1}$), norepinephrine ($pg*mL^{-1}$), epinephrine (pg/ml), creatine kinase ($u*L^{-1}$) To determine magnitude of difference between N and OT, the effect size calculation of M_2-M_1/SD_1 was used where M_2 is the mean of the OT sample, M_1 was the mean of the N sample and SD_1 is the standard deviation of the N sample. **RESULTS:** Combined sample size (N) was 238 subjects with the mean time in OT of 6.6 (weeks). The following are mean (SD) of combined subject demographics: height (cm) 175.4 (2.4); weight (kg) 71.7 (2.6); body fat (%) 11.8 (0.9); age (y) 23.5 (2.03); VO_{2max} ($ml*kg^{-1}*min^{-1}$) 55.4 (0.8). Mean (SD) biomarker changes from N to OT were the following: Glutamine -56.3 (-2); glutamate 49.7 (2); cortisol -89.7 (-12.2); IL 6 -0.52 (0.12); testosterone -88.9 (-30); cholesterol 4.6 (-1.6); glucose -13.3 (1.9); leptin 0.15 (-0.11); hematocrit -0.83 (-0.4); hemoglobin -20; norepinephrine 36 (-4.1); epinephrine -2.2 (-3.5); creatine kinase 29.2 (8.5). Effect size calculations for the above biomarkers were considered large for the following: glutamine (-4.02), glutamate (8), cortisol, (-1.4), IL 6 (-5.2), glucose (-1.1). **CONCLUSION:** From this analysis, the noted biomarker changes and direction of change (+, -) indicates considerable immune-suppression and increased stress with athletes experiencing the OT syndrome.

Thromboxane A2 induces hypertrophic fetal gene expression in isolated cardiac ventricular muscle

Chad Touchberry, Jessica Stone, Stephanie Schaller, Krushangi Patel, and Michael Wacker
University of Missouri – Kansas City

Inflammation is a key factor in the development of cardiac pathology. Thromboxane A2 (TxA2) is an important inflammatory mediator that induces platelet aggregation and vasoconstriction, which can indirectly lead to cardiac ischemia, hypertrophy and heart failure. Our laboratory, however, has shown that TxA2 administration can directly induce cardiac arrhythmias by altering intracellular calcium (Ca^{2+}) dynamics. These Ca^{2+} changes and arrhythmias were attenuated by TxA2 receptor (TxA2R) and triphosphoinositol (IP3) blockade. These findings suggest that activation of cardiac myocyte TxA2Rs increases intracellular Ca^{2+} and elicits activation of IP3 signaling. Both Ca^{2+} and IP3 have been linked to cardiac hypertrophy, therefore we aimed to determine if TxA2R stimulation can also directly induce hypertrophic signaling. C57BL/6 male mice were used to harvest cardiac ventricular tissue strips. These tissue strips were incubated in culture media with or without the TxA2 mimetic, U-46619 (10uM). Exposure to U-46619 increased extracellular signal-regulated kinase (ERK) phosphorylation, a key marker of hypertrophic signaling. Ventricular strips were also incubated with or without U-46619 for 6 hours and then allowed to recover for 18 hours in fresh culture media. This chronic exposure to U-46619 increased the expression of fetal genes (beta-myosin heavy chain, atrial natriuretic peptide, and skeletal alpha-actin), which are hallmarks of pathological hypertrophy. These findings support our hypothesis that cardiac TxA2Rs mediate classic markers of pathological hypertrophy. Since exercise is known for its potent anti-inflammatory effects, our future experiments plan to elucidate if exercise may prevent these pathological maladaptations by TxA2.

Evaluation of four different warm-up protocols on simulated soccer performance

Svea Wanntke
Midwestern State University

Performing warm-up exercises prior training and competition is a well accepted practice among athletes and coaches. The warm-up has long been proposed to optimize performance and prevent injuries via several physiological mechanisms. However, the construction of warm-up protocols for sport teams is widely variable and is primarily based on the personal preferences and experiences of the responsible coach. The purpose of this study was to examine the effect of four different warm-up protocols on soccer-skill performance (dribbling ability, passing accuracy, and agility) by comparing the different warm-up protocols (general, general-specific, and specific) on soccer-skill performance in women collegiate soccer players.

Sixteen Midwestern State Women Soccer Players participated in this study. Each participant performed four different warm-up protocols on different days. The warm-up protocols were: no warm-up, general warm-up, general-to-specific warm-up, and a specific warm-up. Soccer skill performance was tested with the "Modified Zelenka Test", a standardized assessment of soccer dribbling, passing, and agility performance. Two trials were completed in each testing condition. The time to completion of both trials was measured to determine agility, missed cones were counted to determine dribbling ability, and missed goals were counted to determine passing accuracy. Repeated measures ANOVA were used to determine differences between the warm-up protocols. Statistical analysis revealed no significant differences in dribbling ability, passing accuracy and agility between the four warm-up protocols suggesting that none of the protocols tested provides as measurable performance advantage in soccer-specific skills.

Bio-behavioral Aspects of Exercise

A brief review of feedback strategies on muscular performance: theoretical foundations and practical applications

Luke Garceau, Rebekah Chee, and William Ebben
Marquette University

Introduction: Exercise physiologists are challenged to develop motivational techniques to improve performance of athletes and patients. One option, verbal encouragement, has been demonstrated to improve performance during a variety of physical tasks. For example, verbal encouragement increased peak force during an isometric elbow flexion exercise (1). Post exercise verbal encouragement, using approximately 95 word statements, resulted in a significant raise in women's bench press efficacy (2). Bench press performance accomplishments, in addition to verbal encouragement, improved measures of self-efficacy (3). Research suggests that high self-efficacy predicts improved endurance (4) and strength (5) performance, thus emphasizing the significant relationship that exists between performance and self-efficacy (6). Positive feedback such as verbal encouragement promotes strength gains, but verbal feedback in an athletic setting is not always positive. Previous research has assessed the effects of positive verbal feedback on acute strength and power exercises (1,2). Current literature assessing the effects of negative verbal feedback on muscular performance is limited, though negative feedback, following a 200-yd swim trial, has been shown to be detrimental to performance (7). These studies demonstrate a need for future research assessing the effectiveness of negative verbal feedback during muscular performance tasks. Purpose: The objective of this presentation is to synthesize previous research assessing encouragement strategies during strength and power activities in order to determine the most effective nonchemical, healthy, and economically viable methods for developing athlete and patient strength and power.

Psychological Markers of the Overtraining Syndrome

Elise Brown, Frank Wyatt, and Alissa Donaldson
Midwestern State University

The overtraining (OT) syndrome is characterized by performance plateaus and decrements and is manifested through various physiological and psychological variables. A qualitative review will summarize specific factors associated with OT to better understand this syndrome. PURPOSE: The purpose of this review is to summarize psychological aspects associated with the OT syndrome. METHODS: This study reviewed 13 articles that qualified for the inclusion/exclusion criteria. The variables measured include tension, anger, fatigue, confusion, depression, vigor, sleep, stress, and self-perceptions of physical status. Participants were measured during a normal (N) phase, midway phase (MW), and OT phase. In the review, selected variables (i.e., anger, depression, etc.) were noted in terms of direction (+, -) of change in the OT state compared to the N state. RESULTS: Combined sample size (N) was 238 subjects with the mean time in OT of 6.6 (weeks). The following are mean (SD) demographics of subjects from the selected studies: height (cm) 175.4 (2.4); weight (kg) 71.7 (2.6); body fat (%) 11.8 (0.9); age (y) 23.5 (2.03); VO_{2max} ($ml*kg^{-1}*min^{-1}$) 55.4 (0.8). Three articles reported decreases in tension at OT, and one noted increases at MW. Fatigue increased at OT in 6 studies and showed no change in a separate study. Confusion did not change in two studies, increased at OT in another, and increased at MW then declined at OT in a final article. Vigor reportedly remained stable in two studies and decreased in two other studies. Anger did not change in 2 articles, decreased in another, and increased in a different study with its peak at MW. There was no change in depression in three studies, but a decrease was reported in a separate article at OT with an increase at MW. Studies reported impaired sleep patterns, increased wakefulness, and decrements and stability in sleep quality. Two studies indicated increased levels of stress with one specifying stress related to training, sleep, and health. Findings showed a decreased perception of strength, decreased perception of recovery, and no change in perception of muscle soreness. CONCLUSION: From this review, athletes in an OT state may experience disturbances in various sleep, self-perception, and mood factors.

Clinical and Health Aspects of Exercise and Physical Activity

The Effect of Resistance Training on Hamstring and Quadriceps Muscle Activation Magnitude and Timing

Christina Feldman, William Ebben, Erich Petushek, McKenzie Fauth, Luke Garceau, Brittney Lutsch
Marquette University

Introduction: Weak hamstrings are part of the etiology of anterior cruciate ligament (ACL) injury and women are particularly at risk for ACL injuries due to lower hamstring strength and less optimal timing of hamstring recruitment compared to men (1,2). Previous research has evaluated hamstring and quadriceps muscle activation during lower body resistance training exercises and dynamic movements (2,3,4). This study evaluated the effect of a 6-week lower body resistance training program on hamstring and quadriceps activation and timing during movements similar to those thought to cause ACL injuries. Methods: Thirteen women (age = 19.5 ± 1.05 years) were randomly assigned to a 6-week resistance training group, and 12 women (age = 19.7 ± 1.56 years) were randomly assigned to a non-exercising control group. The training group performed 6 weeks of resistance training prioritizing hamstring exercises (3,4). All subjects completed pre- and post-tests by performing 2 repetitions each of the drop jump (jump), and a sprint and cut at a 45-degree angle (cut). Electromyography, normalized to MVIC, was used to quantify rectus femoris, vastus lateralis, vastus medialis, lateral hamstring, and medial hamstring activation. Results: Data were analyzed using independent samples *t*-tests. Subjects who performed resistance training demonstrated statistically higher hamstring to quadriceps activation ratios after training for the pre- and post-landing phase of the cut and the pre-landing phase of the jump ($p \leq 0.05$), with a trend toward significantly higher hamstring to quadriceps ratio post-landing phase of the jump as well ($p = 0.10$). No differences in timing of muscle activation were found. The control group demonstrated no significant differences in any of the variables assessed. Discussion: Resistance training that prioritizes hamstring-based exercises (3,4) is effective in increasing the activation of hamstrings compared to quadriceps muscles. Higher hamstring to quadriceps activation ratios during jump landings and cutting may promote knee stability and reduce ACL injury.

Most Effective Training Mode for Improving the Hamstring to Quadriceps Ratio to prevent ACL Injuries During Sports Simulated Movements

B. Lutsch, C. Feldmann, E. Petushek, M. Fauth, C. Vogel, L. Garceau, and W. Ebben
Marquette University

Introduction: Previous research indicates that hamstring activation stabilizes the knee, which aids ligaments in maintaining joint stability and equalizes articular surface pressure distribution (1). Additionally, hamstring resistance training reduces the extent of the hamstring to quadriceps (H:Q) muscle imbalance which may prevent ACL injuries (2,3). Anterior cruciate ligament (ACL) injuries are common for female athletes, accounting for 69.0% of all serious knee injuries (4). Research investigating activation of hamstring and quadriceps muscles during lower body resistance training exercises indicates that women have lower H:Q ratios, which were present regardless of exercise type or subject strength (5,6). This finding suggests that hamstring training may be particularly beneficial for female athletes in preventing ACL injuries. Prior research has found gender differences in activation timing and magnitude of the hamstring and quadriceps muscles during simulated sports movements thought to commonly cause ACL injuries (7). Our laboratory is currently studying the effects of resistance and plyometric training on the H:Q ratio and the activation timing and magnitude of hamstring and quadriceps during sports simulated movements of cutting and jumping. Purpose: The purpose of this presentation is to synthesize studies investigating hamstring and quadriceps activation in order to determine the most effective training mode to improve the H:Q ratio. Thus, athletes will be able to incorporate training which optimally decreases the risk of ACL injuries during sports movements.

The Cardiovascular and Hemodynamic Effects of Sitting With Legs Crossed During Blood Pressure Measurement

Larry Birnbaum, Tommy Boone, and J-P Nabarra
The College of St. Scholastica

This study was designed to evaluate the cardiovascular responses (oxygen consumption, VO_2; cardiac output, Q; heart rate, HR; stroke volume, SV; arteriovenous oxygen difference, a-vO_2 diff), hemodynamic responses (blood pressure, BP; systolic blood pressure, SBP; diastolic blood pressure, DBP; double product, DP), and ventilatory responses (minute ventilation, V_E; tidal volume, T_V; frequency of breath, F_b) when measuring BP during feet flat (Control) and legs crossed (Treatment) positions. Twelve active males participated in the study. The subjects' VO_2, Q, V_E and F_b were assessed using the Medical Graphics CardiO2 metabolic analyzer. Analysis of variance with repeated measures (SPSS ver. 15) was used to determine if there were significant differences between the Treatment and Control sessions. An alpha level of 0.05 was used to determine statistical significance. The statistical analyses revealed significant increases in HR, Q, SBP, MAP, and DP in the legs crossed position. These findings suggest that the legs crossed position elicited an increase in BP that can be misleading. The significant increase in SBP indicates that the heart is working harder, given the increase in DP which is highly correlated with myocardial oxygen consumption.

Physical Activity, Daily Limitations, Body Weight Change, Disease, and Prior Injury in Former Athletes

Kelly Brooks and Kristal Brooks
Louisiana Tech University

Collegiate athletes undergo high intensity training regimens that may result in chronic injuries and affect their ability to engage in physical activity. The purpose of this on-going study is to investigate the effects of prior participation in collegiate athletics on physical activity patterns, limitations in activity, and weight gain. Former Division I college athletes, and a demographically-similar group of alumni (controls), were surveyed via e-mail. The athletes were identified by each University's alumni department. The survey included questions about current health and activity status. At this point, former athletes returned 710 surveys, and controls returned 3374 (35% return rate). Athletes reported significantly ($p<0.05$) more limitations during daily activity (32%) and during physical activity (45%) than controls, who reported limitations 21% during daily activity and 30% during physical activity. Athletes also reported that a past injury effects their daily activity (19%) and physical activity (27%) significantly more frequently than controls who felt an injury affects activity 5.3% and 6.5%, respectively. Athletes reported performing physical activity with an injury (72%) and with an illness (62%), which was significantly greater than what the controls reported, with 16% exercising with an injury and 23.5% exercising with an illness. Male athletes reported a significantly greater increase in body weight vs. controls ($p<0.05$). Athletes reported doing fewer ($p<0.05$) hours per week of anaerobic/mixed activity than controls. The data suggest that prior collegiate athletics participation seems to have long term consequences in terms of limitations in activity and in body weight change (males). The higher incidence of major injuries and chronic injuries, and disability from these injuries in athletes (Friery, JEP, 2006) may explain these differences in part. These data will help to determine the potential risks associated with competitive collegiate athletics. This study has been repeated and data has been collected from many institutions, with results repeating themselves. Many interesting measures have resulted from the survey, and are continuing to be analyzed.

Evaluation of Exercise Tolerance in a Patient Pre and Post LVAD Support

Ryan Amick
Friends University

Left Ventricular Assist Device's (LVAD) have become a viable treatment alternative to heart transplantation. While under LVAD support, some have shown significant recovery of native heart function

allowing for the removal of the device. CASE REPORT: The patient in this study was diagnosed with idiopathic dilated cardiomyopathy and demonstrated worsening heart failure over a five-year period with a maximum left ventricular end diastolic diameter of 8.99 cm and an ejection fraction of 20-25%. Upon implantation of a LVAD, the patient's central hemodynamic function returned to near normal and the device was removed. Four months post explantation a cycle ergometry graded exercise peak VO2 test was performed. Exercise began at 0 Watts and increased 25 Watts per 3 minute stage. 12 lead EKG was used to determine heart function. RESULTS: The patient showed improvement in peak aerobic capacity when compared to pre LVAD cardiopulmonary stress tests. VO2 increased from pre LVAD measures of 11.8 ml·kg·min-1 to 17.0 ml·kg·min-1. Time to maximal exertion increased from 5 minutes 27 seconds to 15 minutes. CONCLUSION: The results from this case study indicate that significant improvements in native heart function is possible with a period of mechanical unloading through LVAD support. Although this is a single case study, it is the only known report of exercise capacity testing pre and post LVAD support. As technology for mechanical circulatory support improves the number of patients receiving LVAD's will increase creating a need for a greater understanding of potential rehabilitation limitations.

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Marcos Sanchez, MD, EPC
Cathryn Dooly, PhD