From RMACSM Website.

CATEGORIES-

1. Submissions are welcome from undergrduate and graduate students; medical students, medical residents/fellows; researchers; clinicians; post-doctoral fellows; faculty; and others.

2. Designation of one of the following ***Categories*** for your abstract or clinical case study will be required at the time of submission:

   A. Undergraduate/graduate student, medical student or mentored intern
   B. Medical resident/fellow
   C. Professional- researcher, post-doctoral fellow, clinician, faculty, other

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AWARDS & JUDGING-

1. Only undergraduate/graduate students, medical students, mentored interns and medical residents/fellows (Categories A & B), will have their posters judged and be eligible to compete for the following awards:

   1st place: $450*
   2nd place: $350*
   3rd place: $250*
   4th place: $150
   5th place: $100
   6th place: $100
   Best undergraduate poster: $100 (also eligible for above awards)
   Best Clinical Case Study poster: $100 (also eligible for above awards)

A contestant can only win one award. In teh event that the best undergraduate poster is also one of the first six places, the next best undergraduate poster will win the award. This also holds true for the best clinical case study poster.

2. The top three posters from Categories A & B will be announced on Friday evening. The presenters of the top three posters (*) are required to give a ten-minute oral presentation of their poster followed by a five minute Q & A.

3. Mentors for the undergraduate/graduate students, medical students, and mentored interns are eligible for a monetary award based upon the **Mentor** sponsoring/supporting the most student/intern poster submissions (Category A).

4. Only submissions from undergraduate/graduate students, medical students, mentored interns, and medical residents/fellows (Categories A & B) who are currently completing their program of study or completed their program of study within 12 months of the regional meeting date are eligible for judging and awards. Furthermore, in order to be classified in Category A or B, the work to be presented must have been performed while a student, intern or resident/fellow. Students/trainees who have completed their program of study beyond 12 months, but who still wish to submit an abstract, are eligible to submit under the Professional category (Category C).

CATEGORY A

1. Athletic Performance Assessment of SWAT and Patrol Police Officers over a 12-week Training Program

Abelbeck KG, Tiffany Lipsey, and Raoul F. Reiser II

Law enforcement, especially Tactical Operations Officers (SWAT) rely on strength and power not just for performance of their job, but in some cases, in life and death situations. Sports athletes have been trained and tested to these standards but this has been lacking in law enforcement populations. **PURPOSE**: The aim of this study was to evaluate physical performance of police officers in both SWAT (SO) and patrol officer (PO) groups before, during and after a training program focusing on strength and power development. **METHODS**: Eight healthy male sworn SWAT officers SO (age= 35.5 ± 7.5 yr, mass=100.0 ± 19.6 Kg, height= 184.4 ± 8.5 cm) and eight PO (age= 36.1 ± 8.2 yr, mass= 91.2 ± 13.1 Kg and height= 176.4 ± 7.9 cm) were tested for anaerobic power (AP) output using the Margaria-Kalamen Test, estimated VO_{2max} (VO), body composition (%BF), leg strength (LS), and flexibility prior to training, after 6 weeks and after 12 weeks of training. The training program focused on strength and explosive power in an undulating periodization format. Subjects trained four days per week with functional and traditional weight training exercises in each session. **RESULTS**: There were no significant differences ($p>0.05$) prior to training between SO and PO in age, height, total body mass, Lean body mass (75.6 ± 11.4 Kg) %BF (20.0 ± 5.9%), LS (149.5 ± 34.9 Kg), VO (49.0 ± 14.0 ml/kg/min) and flexibility (47.4 ± 7.7 cm). Total body mass, flexibility and VO did not change over time. Lean body mass and LS increased over 12 weeks by 3.25% and 15.5%, respectively in both groups ($p\leq0.001$). %BF decreased by 13.1% over the 12 weeks in both groups ($p\leq0.001$). AP was not different between groups prior to training (170.6 ≤ 27.6 Kg*m/s), though it increased by 13.5% ($p\leq0.001$) over 12 weeks of training in the SO but not in the PO. **CONCLUSIONS**: The training program was successful in improving lean body mass, reducing percent body fat and increasing LS in both the PO and SO groups. The SO group had a greater response to training in AP compared to the PO group. The reason for this is unclear, especially considering similar starting points. One possibility is greater motivation during training and testing in the SO group.

Category A

2. A SINGLE HIGH-ALTITUDE TRAINING BOUT IMPROVES HIGH-ALTITUDE AEROBIC PERFORMANCE FOLLOWING 1 WEEK OF LOW-ALTITUDE TRAINING

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Consecutive bouts of aerobic exercise at high-altitude are known to improve subsequent aerobic exercise performance at high altitude due to a variety of acute and chronic adaptations referred to as altitude acclimatization. However, it is unclear whether these benefits can be elicited by a single bout of high-altitude exercise followed by several days of training at lower altitude. **PURPOSE**: We investigated whether a single bout of hill running exercise performed at high-altitude improves running performance, arterial oxygen saturation (SaO2), hematocrit (HCT) and perceived exertion (RPE) during a strenuous timed run at high-altitude performed 1 week following the training stimulus. **METHODS**: Participants were well-trained competitive runners (VO_{2max} 52 ± 2 ml/kg/min, aged 42 ± 5 yrs, n = 8) living in Fort Collins, CO (5,003 ft) that were naïve to higher altitudes for at least 8 weeks. All were training regularly (66 ± 3 miles/wk) and refrained from any non-prescribed altitude exposure for the duration of the study. Baseline testing consisted of a timed run on the Mt. Evans Scenic Byway in Colorado (11.5 miles at 11,500-14,100ft) followed by one week of training in Fort Collins. Runners were then randomized to perform a 12 mile hill running workout in Fort Collins (LOW; 6,000-7,000ft, n = 4)) or Mt. Evans (HIGH; 13,100-14,100ft, n = 4). All runners then engaged in 1 week of routine training in Fort Collins followed by a post-test run at Mt. Evans that was identical to the baseline test. **RESULTS**: The HIGH group experienced a 4.7 ± 2 % improvement in high-altitude run time (7.1

min faster; P = 0.09), while the LOW group ran 0.5 ± 1.5 % (1.3 min) slower (P = NS). Mean SaO2 was 3% higher in the HIGH in the post vs. pre-test at 14,100ft (P = 0.02), but 1% lower in the LOW group (P < 0.05 for group difference). In addition, SaO2 tended to stabilize at higher levels in the HIGH vs. LOW (+2.25% vs., -2.99%, respectively) following completion of the post-test at 14,100ft (P = 0.10). HCT tended to increase in both groups from pre to post testing, but there were no differences in HCT, or RPE, between HIGH and LOW groups. **CONCLUSION**: A single high-altitude training bout prior to 1 week of low-altitude training improves subsequent aerobic performance and arterial O2 saturation at high-altitude, while a single bout performed 2 weeks prior to testing is ineffective.

Category A

Mentor: Adam Chicco, PhD

3. HEALTHIER OPTIONS AT A HIGH SCHOOL CONCESSION STAND: NEEDS ASSESSMENT FINDINGS

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PURPOSE: In the initial step of a goal to achieve healthy choices in concession stands at the high school level, a needs assessment was performed to examine the needs and wants of spectators in regards to concession stand choices. **METHODS:** A comprehensive survey was created and university researchers, along with trained high school students, administered 192 surveys to spectators at two football games during the fall 2010 season. Using a five point scale, participants were asked to rank their opinion of the food at the concession stand. The survey also queried about respondent gender and zip code, who they were buying food for, why they were buying it, and what items they usually purchased. Respondents were also were asked to pick their top choices out of 13 healthy options that might be offered at the concession stand in the future. It was determined that any item that was chosen by approximately 30% of respondents, is easily integrated into the menu and that could be purchased in bulk would be included in the recommendations to the School District. Paired choices were the final component to the survey in which a healthy choice and an unhealthy choice were provided, and participants were asked to choose between the two. Descriptive statistics were calculated for variables of interest. All statistical analyses were performed with PASW 18 software. **RESULTS**: Although 40% of respondents believed they ate healthy foods, approximately 40% said they did not wish for healthier choices at the concession stand. Among healthier choices, grilled chicken sandwiches, jerky, chewy granola bars, string cheese, baked chips and flavored water were the most popular items. When choosing between an unhealthy or healthy option, respondents were on average 50% more likely to choose the unhealthy food. **CONCLUSION**: Based on the survey results, the 6 aforementioned items were recommended to the school district. Additional recommendations included making current concession stand food items healthier, increasing the price of the most popular items to offer the healthier options at a lower price, and implementing an educational component to help game spectators learn about healthy foods and help them make healthier food choices on an everyday basis. Changes to the concession stand will be implemented in the early months of 2011.

Category A
Mentor: TK Behrens, PhD, CHES, FACSM

4. THE PHYSIOLOGY OF MINIMALIST RUNNING AT DIFFERENT INTENSITIES – A PILOT PROJECT

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Currently it's trendy to run with a minimalist shoe. Interestingly, very little data exists to support this type of running and racing as advantageous. PURPOSE: The purpose of this pilot study was to investigate the differences

between select physiological variables when barefoot (BF) vs. wearing Vibram Bikilas (VIB) (minimalist "toe" shoe) vs. wearing a training shoe (TS) (~ 9 oz.). METHODS: This study was a pilot project involving trained endurance runners who ran an average of 30 miles or more weekly for the past 6-months. Outcome variables included: rate of perceived exertion (RPE), blood lactate accumulation (BLA), and heart rate (HR) observed during paced runs at 50-, 70-, and 90-percent of VO2max in each footwear condition (mentioned above) with a 5-minute rest between each intensity bout and a 10-min rest between the three conditions. RESULTS: No significant findings between conditions were evident ($p > 0.05$). For ease of reporting outcomes (mean), only 90% of VO2max pace will be reported here. Related to RPE, BLA (mmol/L), and HR (bpm), respectively, measured values were 14.6, 6.0, and 158.6 for BF; 14.8, 4.0, and 156.3 for VIB; and 14.2, 5.0, and 156.6 for TS. DISCUSSION: Slight trends were noted suggesting that VIB do not hamper performance and may even enhance it by eliciting a lower HR and BLA vs. the other conditions at various intensities. However, VIB seemed to invoke a slightly greater RPE. This warrants additional research.

Category A

Mentor: SN Drum, FACSM

5. EFFECTS OF FAMILY SOCIAL SUPPORT ON ANTENATAL PHYSICAL ACTIVITY

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Despite national guideline recommendations that all pregnant women free of obstetric complications engage in regular physical activity, the prevalence of physical activity rates remain significantly lower among pregnant women compared to the general population. Identifying what are intrapersonal, interpersonal, and environmental facilitators is important for successfully engaging in antenatal physical activity. Moreover, there is a dearth of literature examining the effects of types of behavioral change agents, such as social support, on antenatal physical activity. **PURPOSE:** The present cross-sectional study addresses this gap in the literature by examining the effects of different types of social support on antenatal physical activity. **METHODS**: A 66-item survey assessing social support (i.e. overall and family social support), self-efficacy, beliefs, perceived behavioral control, and behavioral skills was administered to sixty-eight pregnant women (mean age 28yrs). Women were separated into exercisers (3 times per week for 20 minutes or longer) or non-exercisers. The sample was 60% Caucasian, 38% African American, 14% other with Hispanic Ethnicity with 26% of the women engaging in regular exercise, half of the women primaparous, and 37% receiving Medicaid. A 5-item Likert scale survey was used to assess familial social support for antenatal physical activity and the SSQ-6 was used to assess overall social support. Logistic regression was conducted using SPSS software. **RESULTS:** Women who reported that they were regular exercisers were more likely to report higher family social support than Non-Ex, even when controlling for parity, marital status and type of healthcare coverage, there was still a significant relationship between family social support and engagement in physical activity (OR=1.195, p-value=.006 and CI (1.052,1.358)). When behavioral change agents (self-efficacy, overall social support, perceived behavioral control, and behavioral skills) were added, the significance of the model was attenuated. **CONCLUSION:** These findings suggest that future design and implementation of antenatal physical activity interventions should incorporate strategies to increase social support for antenatal physical activity from family members.

Category A

Mentor: J Leiferman, PhD

6. EFFECT OF A 6-SESSION SCHOOL-BASED NUTRITION AND PHYSICAL ACTIVITY INTERVENTION: A MID-POINT EVALUATION

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Recent reports have highlighted the severity of obesity in children by suggesting that today's generation of children will be the first for over a century for whom life expectancy falls. PURPOSE: To determine the impact of a nutrition and physical activity education intervention on basic nutrition and physical activity knowledge and behaviors. METHODS: Baseline through midpoint data for nineteen girls (n = 13; age =5.37 ± .49 years) and boys (n = 6; age = 5.37 ± .49 years) at an elementary school in Colorado Springs, CO participating in a 6-session intervention are presented. StarFit Kids delivered the 45-minute monthly intervention session involving a nutrition education component, coupled with reinforcing physical activities. The nutrition education portion consisted of the food guide pyramid, food groups, servings and portions, and making healthy food choices based on USDA guidelines. The physical activity component was used to reinforce knowledge through activities such as heart healthy tag, food group relays, and know your servings tag. At baseline of the program the fruit and vegetable consumption and physical activity logs were distributed to parents/guardians by the classroom teacher. Parents of the participants were instructed to complete the logs. Combined daily Fruit and vegetable consumption were logged on the fruit and vegetable logs. Additionally, the physical activity "Move It" logs tracked minutes of physical activity involvement such as walking, jogging, biking, and sports played per day by participants. Further, a survey used by children during the physical education class inquired about the food guide pyramid and healthy food choices. At the midpoint of the program the logs and child surveys were distributed again. A paired samples t-test was used to evaluate data for both fruit and vegetable serving consumption and physical activity from baseline to the midpoint of the program. RESULTS: Preliminary results indicated a 67% increase in fruit and vegetable serving knowledge. The children surveyed also demonstrated an increase in knowledge of whole grains servings by 25%. Students reported 2.86 ± 1.80 servings·d^{-1} of fruits and vegetables and 42.74 ± 15.25 minutes of physical activity·d^{-1} at baseline. At midpoint of the program 3.26 ± 1.92 fruit and vegetable servings·d^{-1} and 33.57 ± 14.83 minutes of physical activity·d^{-1} were recorded, though no statistical differences were found. CONCLUSION: At midway through the intervention student knowledge of the food guide pyramid has increased, however behavior changes been inconsistent. Researchers will collect follow-up data during 2011, which should shed light on these findings.

Category A

Mentor: TK Behrens, PhD

7. THE EFFECTS OF OBESITY ON THE BIOMECHANICS OF GRADIENT WALKING

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Walking is a popular form of exercise for the prevention and treatment of obesity. However, walking may be a source of biomechanical loads that link obesity and musculoskeletal injury and pathology. During level walking, obese adults may adopt a more erect gait pattern (less knee flexion during stance) that reduces lower extremity net muscle moments (NMM, Nm/kg) compared to non-obese individuals. Walking uphill requires greater hip and knee NMM, but the effects of obesity on the biomechanics of uphill walking are not known. **PURPOSE:** To quantify the biomechanics of level and gradient walking in obese and non-obese adults. **METHODS:** Twelve obese, 100.5 (15.7) kg, 33.4 (2.4) kg/m^2, (mean (SD)) and eleven non-obese, 68.3 (11.5) kg, 22.0 (2.0) kg/m^2 adult volunteers participated in this study. We measured ground reaction forces and three-dimensional lower extremity kinematics while subjects walked on a dual-belt force measuring treadmill at 1.25 m/s with the treadmill grade set at -3, 0, 3, 6 and 9°. We calculated NMM at the hip, knee and ankle. **RESULTS:** During uphill vs. level walking, all participants walked with greater hip and knee flexion and ankle dorsiflexion during early-mid stance. Peak hip flexion (heel strike) was greater in the obese vs. non-obese when walking up the steeper grades (55 vs. 45° at 6° and 57 vs. 39°

at 9°, respectively). Compared to level walking, knee joint range of motion during early stance increased during downhill and decreased during uphill walking, with no differences between the groups. Absolute early-stance hip and knee extensor NMM were greater in obese individuals and increased when walking uphill vs. level walking. Peak early-stance hip extensor NMM in the obese and non-obese adults were 0.78 vs. 0.88 Nm/kg, respectively, during level walking and increased to 1.24 vs. 1.19 Nm/kg, respectively, while walking up the 9° incline. Peak early-stance knee extensor NMM in the obese and non-obese adults were 0.3 vs. 0.37 Nm/kg, respectively, during level walking and increased to 0.71 vs. 0.54 Nm/kg, respectively, while walking up the 9° incline. **CONCLUSION:** While obese adults may be able to walk on level ground with relatively small joint loads, our results suggest that their joint loads increase disproportionally compared to non-obese adults when they walk uphill.

Category A

Mentor: RC Browning, PhD

8. WEIGHT-BEARING ASYMMETRIES WHEN LIFTING: SYMMETRIC VERSUS STAGGERED STANCE

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In order to reduce the load on the lumbar spine, a staggered lifting stance is oftentimes prescribed. If a staggered stance causes one limb to be stressed more than the other, chronic exposure may lead to unequal development and even injury. **PURPOSE**: The goal of this study was to determine if weight distribution on the lower limbs is altered when lifting a crate from the floor level to standing hip height with a staggered compared to symmetric stance. **METHODS:** Nine healthy young men (n=6) and women (n=3) [age = 22.0 ± 1.3 yrs, height = 172.6 ± 9.4 cm, body mass = 69.7 ± 11.3 kg (mean ± stand. dev.)] all with right leg as their preferred kicking leg volunteered. Subjects performed 15 lifts, five lifts each in three separate stances including right foot forward staggered (RFFS), left foot forward staggered (LFFS) and a symmetric stance (SS). Five subjects returned a later day to assess repeatability. Weight distribution was quantified by subtracting the percent of the average vertical force under their left foot during the lift from that under their right (%Rt-Lt). **RESULTS:** Weight distribution was significantly different in all three lifting conditions with subjects placing more weight on the trailing leg in the staggered stances [p=0.004: LFFS = 5.3 ± 6.9 %Rt-Lt, RFFS = -7.9 ± 9.0 %Rt-Lt, SS = -1.4 ± 2.3 %Rt-Lt]. When adjusted for the asymmetry present during SS lifting, the amount of load on the trailing leg was similar [LFFS = 6.7 ± 7.1 %Rt-Lt, RFFS = -6.5 ± 8.0 %Rt-Lt]. Repeat measures were consistent with initial visits, where more weight was typically placed on the trailing limb. However, intraclass correlations expressed some variability, especially with RFFS lifts (Chronbach's Alpha ≥ 0.608). When surveyed on which asymmetric lift they preferred after their initial visit, 78% chose their preferred kicking leg forward. When asked overall which lift was preferred, all subjects noted the SS. **CONCLUSION:** A staggered stance when lifting, though protective of the back, may lead to its own set of problems. Considering that symmetric stance was chosen as the most comfortable, it may be the suggested technique when the object is small and not awkward. If it is necessary to lift with an asymmetric stance, it is important to alternate the forward foot to eliminate unequal limb loading over time.

Category A
Mentor: RF Reiser II

9. THE EFFECT OF MODERATE ALCOHOL CONSUMPTION ON FUEL UTILIZATION, PERCEIVED EXERTION AND RUNNING PERFORMANCE BETWEEN GENDERS

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The effect of alcohol on performance has been examined in many studies. There are varying results depending on the type of activity, the amount of alcohol consumed and the gender that is being investigated. Aerobic and anaerobic threshold performance has been examined in detail using significant amounts of alcohol. However, there

have been very few studies that have looked at the effect of moderate alcohol consumption, defined as less than a 0.08% BAC, on race pace runs to exhaustion. In addition, gender differences of moderate alcohol consumption with regard to its effect on fuel utilization have not been widely investigated in the literature. **PURPOSE:** To measure running performance to exhaustion the day after a glycogen depletion run and moderate alcohol consumption ($\leq$ 0.08% blood alcohol content). **METHODS:** Ten subjects (5 male and 5 females) that trained at least 40 miles per week performed a VO_2 Max Test on a treadmill to determine intensity at 75% for a 45 minute glycogen depletion run (GDR) and 80% for a run to exhaustion (RTE). The amount of beer consumed by each subject to achieve the legal limit of 0.08% blood alcohol content was measured with a breathalyzer by Officers of the Grand Junction Police Department 14 days prior to the trials. The blood alcohol content range for all subjects was 0.064 - 0.072%. One week after the VO_2 Max Test subjects performed a GDR followed by administration of either beer (AB) or non-beer (NA) consumed with a spaghetti dinner ad libitum. Subjects were blind to treatment. Fuel utilization was measured using the respiratory exchange ratio (RER). Rate of perceived exertion (RPE) was evaluated at even time intervals during trials. The following morning subjects performed a RTE at 80% of their VO_2 Max. A second GDR was conducted 10 hours later with cross-over administration of treatment (AB or NA) and consumption of a spaghetti dinner. In the morning of the third day a final RTE was performed. **RESULTS:** The RTE measured in time, between genders, was assessed using a two way analysis of variance (ANOVA) with repeated measures. Two additional ANOVA's with repeated measures were used to examine the differences of RER between trials and RPE between trials. The results indicated females performed significantly better on beer for their RTE than males ($F_{1,8}$=6.58, p=0.03). RER and RPE showed no significant difference, however a trend for greater CHO reliance was observed. **CONCLUSIONS:** It appears that moderate amounts of alcohol appear to increase time to exhaustion in women and decrease it in men. The fuel utilization data (RER) cannot explain the performance results.

Category A

Mentor: Guy W. Leadbetter, PhD

10. THE PHYSIOLOGICAL EFFECTS OF BACKPACKING WITH TREKKING POLES

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While the activity of backpacking has been around for hundreds of years, the use of trekking poles when backpacking is a more recent endeavor. **PURPOSE:** The purpose of this study was to examine change in objective and subjective physiological variables when using trekking poles while hiking up a moderate incline with a backpack. **METHODS:** Measures were taken in an attempt to create the most realistic backpacking setting possible. Five older women (age 57-72 yrs) from a local hiking group volunteered for this study. Each walked at a self-selected hiking pace at a gradient of 10 percent for 10 minutes while carrying 10 percent of their total bodyweight with and without poles on an oversized treadmill (Fitnex Bionex Treadmill). During each 10-min condition, hikers' heart rate (HR), ventilation rate (VE), oxygen consumption (VO2), rate of perceived exertion (RPE), and respiratory exchange ratio (RER) were observed every minute. Continuous gas analysis (ParvoMedics True One System, Provo, UT) was utilized. **RESULTS:** There was little change in the examined variables between hiking conditions when walking uphill. Results for each variable related to with and without poles, respectively, included: HR (129.9 vs. 130.3 BPM), VE (39.3 vs. 39.5 L/min), VO2 (19.6 vs. 20.7 mL·kg-1·min-1), RPE (12.4 vs. 12.6), and RER (.88 vs. .86). **CONCLUSION:** The results implied that using trekking poles elicited no hiking performance advantage at a self-selected pace in this small group of older women. A larger sample size with a greater manipulation of hiking intensity (and percent grade) may lead to greater differences between conditions.

Category A
Mentor: S Drum, FACSM

11. POTASSIUM CHLORIDE AND ADENOSINE TRIPHOSPHATE-MEDIATED VASODILATION ARE INDEPENDENT OF NITRIC OXIDE AND PROSTAGLANDINS IN THE HUMAN FOREARM

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The vascular endothelium is capable of producing a variety of substances that elicit vascular smooth muscle cell (VSMC) relaxation including nitric oxide (NO) and prostaglandins (PGs). Endothelium-dependent dilation (EDD) can occur independent of NO and PGs and is through VSMC hyperpolarization. Only a small portion of the complex hyperemic response to exercise is blocked by NO and PG inhibition, and these substances are incapable of blunting sympathetically-mediated vasoconstriction that occurs in the vasculature of exercising tissue. In contrast, recent data indicate that adenosine triphosphate (ATP) and potassium chloride (KCl) are capable of overriding sympathetic vasoconstriction and both substances are thought to be involved in exercise hyperemia. *In vitro* studies have shown both KCl and ATP can cause VSMC hyperpolarization, but this has not been established *in vivo* in humans. **PURPOSE:** To test the hypothesis that KCl and ATP-mediated vasodilation occurs independent of NO and PGs and thus is through hyperpolarization. **METHODS:** In 13 young, healthy adults, forearm blood flow (venous occlusion plethysmography) was measured and vasodilatory responses (forearm vascular conductance; %FVC) were calculated in response to local intra-arterial infusion of KCl and ATP before and after local inhibition of NO synthase (L-NMMA) and cyclooxygenase (Ketorolac) to inhibit the production of NO and PGs, respectively. **RESULTS:** Increasing doses of KCl caused progressive vasodilation (%FVC: 46 ± 9%, 91 ± 15%, 179 ± 42%) that was augmented following combined NO and PG inhibition (%FVC: 93 ± 16%, 142 ± 23%, 265 ± 40%; $P < 0.05$). ATP elicited dose-dependent vasodilation (%FVC: 234 ± 50%, 375 ± 75%, 514 ± 98%) and these responses were unchanged with NO/PG inhibition (%FVC: 256 ± 32%, 431 ± 75%, 615 ± 92%; P = NS). Acetylcholine-mediated vasodilation was blunted by ~60% (n=4) demonstrating effective inhibition of NO and PG synthesis. **CONCLUSIONS:** Inhibition of NO and PGs does not impair the vasodilatory response to local infusions of KCl and ATP. Integrating our findings with those from isolated vessels suggests that KCl vasodilation is mediated through direct hyperpolarization of VSMC whereas ATP, which has been shown to cause EDD, results in an endothelium-derived hyperpolarization, independent of NO and PGs. NIH Grant: HL102720

Category A
Mentor: FA Dinenno, PhD

12. Accuracy of Fitbit activity monitor to predict energy expenditure with and without classification of activities

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The Fitbit activity monitor is a consumer device for predicting energy expenditure (EE) and tracking activity patterns. To improve the EE estimation accuracy, Fitbit provides a web-based software program that allows a user to classify periods as distinct activities (based on the compendium of physical activities). However, the effect of this manual activity classification on EE estimation accuracy is not known. **PURPOSE:** To compare the EE prediction accuracy of the Fitbit before and after classifying activities. **METHODS:** Fifteen adults (7 male), 71.91(17.3) kg, 24.17(3.9) kg/m^2, completed a four hour stay in a room calorimeter. Participants wore Fitbit on the right hip, and performed a series of randomly assigned activities/postures including supine, seated (quietly and using a computer), standing, walking, stepping, cycling, sweeping, and self-selected activities. We used the web-based software to classify each activity, and compared the estimated EE to the measured EE before and after activity classification. **RESULTS:** Without activity classification, Fitbit significantly underestimated EE (368(18) vs. 499(24)kcal, mean(SE)). Classifying activities resulted in improved estimates of EE (516(13) vs. 499(24)kcal, mean(SE)). Root mean square error for non-classified EE was 136.7kcals (27.4%) and was reduced to 64.25kcals (12.9%) with activity classification. The non-classification estimates always underestimated EE, while the classified

values were underestimated about half of the time, and were more accurate in all but two subjects. **CONCLUSION:** Fitbit is most accurate when the time is taken to classify the activities that were performed while wearing the device, though this may not be practical for the average consumer.

Category A

13. TREATMENT OF HUMAN CORONARY ARTERY ENDOTHELIAL CELLS WITH PROTANDIM INDUCES NRF2 AND PHASE II ANTIOXIDANTS ENZYMES AND AFFORDS PROTECTION AGAINST AN OXIDATIVE CHALLENGE

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Cardiovascular disease is the leading cause of death in the United States and increased oxidative stress has been implicated in vascular disease initiation and progression. Increasing endogenous antioxidant defenses has been proposed as a potential intervention. The phytochemical composition Protandim has been shown to induce the transcription factor nuclear factor (erythroid-derived 2)-like 2 (Nrf2) and phase II antioxidant enzymes, potentially helping cells to maintain redox balance and affording protection against oxidative challenges. **PURPOSE:** The purpose of this study was to determine if treating human coronary artery endothelial cells (HCAEC) with Protandim induces Nrf2 and endogenous antioxidant defenses. In addition, we examined whether Protandim treatment protects HCAEC from damage induced by an oxidative challenge. **METHODS:** All experiments were performed on primary HCAEC cells between passage 3 and 8. Nrf2 was activated by supplementing cell culture growth medium with 0-50μg/ml Protandim. Nrf2 activation was assessed using immunocytochemistry to visualize Nrf2 nuclear localization and Western blotting to determine induction of the phase II antioxidant enzyme heme oxygenase-1 (HO-1). The cells were exposed to an oxidative challenge by treatment with 1.25μM hydrogen peroxide (H_2O_2) and the resulting nuclear DNA fragmentation was detected by TUNEL assay. **RESULTS:** HCAEC treated with 20μg/ml Protandim exhibited Nrf2 nuclear localization and increased HO-1 protein expression. Treating cells with H_2O_2 induced apoptosis in approximately 50% of cells. Treating HCAEC with Protandim prior to H_2O_2 resulted in protection from H_2O_2 induced cell death. **CONCLUSIONS:** These data suggest that treating HCAEC with Protandim induces Nrf2 and phase II antioxidant enzymes and protects cells from an oxidative challenge. These data support the use of Protandim as a means of increasing endogenous antioxidant defense systems.

Category A

Co-Mentors Dr. Benjamin Miller PhD and Dr. Karyn Hamilton PhD

14. A Prospective Controlled Outcome Study of Adult Autologous, Culture Expanded Mesenchymal Stem Cell Treatment for Symptomatic Osteoarthritic Hip and Knee Joints

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BACKGROUND: Adult autologous mesenchymal stem cells (MSCs) show promising potential as multipotent therapeutic agents in regenerative medicine, including for a number of orthopedic applications. In the present study the authors describe the results of a needle out-needle in procedure of harvest, culture, and intra-articular reimplantation of MSCs in patients with symptomatic knee and hip osteoarthritis (OA). **METHODS:** Subjects were enrolled as a convenience sample from patients

presenting to a clinical practice for symptomatic OA. A total of 218 patients who underwent MSC therapy were followed for an average of 11 months; 153 for osteoarthritis (OA) of the knee, and 65 for OA of the hip. There were 31 untreated patient candidates who were recruited as controls and followed for an average of 12 months. The patients underwent bone marrow aspiration with isolation and culture expansion of MSCs using a serum free, autologous platelet lysate. Autologous MSCs were then injected into the intra-articular space along with a platelet product, utilizing imaging guidance. Select patients underwent pre and post 3.0T MRI imaging. Percentage of symptomatic change relative to pre-treatment, function, and visual analog scale data were collected at 3, 6, 12, and 24 months. **RESULTS:** At a mean follow-up of 11.3 months, knee patients fared better than hip patients and both did better than the controls. The mean reported pain relief was +53.1% in the knee OA group (n=133 reporting), +30.4% in the hip OA group (n=42 reporting) (p=0.008 for knee vs. hip comparison) and -5.0% (n=25 at 12.0 months after first contact) (p<0.001 for control vs. knee/hip groups). Significant decreases were seen in 4 out of 5 of the VAS score metrics and in most functional metrics in the knee group. There were no serious complications reported among any of the treated patients. **CONCLUSIONS**: Percutaneous implantation of cultured MSCs into either a knee or hip joint was associated with patient reported improvement in pain and function that was not seen in an untreated control with the strongest effects seen in knee patients. Randomized, placebo controlled trials are an important next step in continuing to explore the efficacy of MSCs harvest, culture, and reimplantation as a less invasive and safer alternative to more invasive surgical approaches to symptomatic OA.

Category A
Mentor: Christopher J. Centeno, M.D.

15. Postural Steadiness in Young, Elderly, Elderly Fallers, and Neuropathy Patients

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PURPOSE: Postural stability, a contributor to functional mobility, can be significantly affected by aging. Aging is often accompanied by other comorbidities such as peripheral neuropathy. Since neuropathy degrades sensory function in the feet, the compensatory mechanisms utilized to maintain postural steadiness could be affected. Vision is a major contributor in the mix of afferent information integrated during postural tasks. Thus, neuropathy-related sensory impairment may alter the importance of visual feedback for these patients. **METHODS:** Twelve young (Y, 23±3 yrs), 13 healthy elderly (HE, 73±8 yrs), 9 elderly fallers (EF, 77±7 yrs), and 32 peripheral neuropathy patients (PN, 72±8 yrs) underwent an assessment of their maximum voluntary contraction (MVC) force and postural control during quiet standing. The subjects performed 60s trials with eyes open (EO) and closed (EC). Anterior/posterior (AP) sway (APsway), path length (PL), and elliptical area (Earea) were measured on force platforms. **RESULTS:** Values are pooled for the HE and EF groups. Dorsiflexor (DF) MVC force was reduced (P<0.01) in HE/EF (206±71 N) and PN (174±76 N) compared with Y (295±87 N). Plantarflexor (PF) MVC force was also reduced (P<0.01) in HE/EF (418±228 N) and PN (395±256 N) compared with Y (920±303 N). Group differences: APsway, PL, and Earea were 45%, 141%, and 130% greater (P<0.05) for PN compared with Y and 23%, 57%, 97% greater for PN compared with HE/EF. Visual conditions: Pooled across groups, APsway, PL, and Earea were 30%, 44%, and 51% greater, respectively, (P< 0.001) for the EC than the EO condition. Vision effects for groups: The PN group displayed substantially greater changes from the EO to EC condition compared with the other groups (group x visual condition interaction, P<0.001) for APsway (64% increase), PL (74% increase), and Earea (98% increase). **CONCLUSION:** Peripheral neuropathy produces sensory dysfunction sufficient to significantly impair postural stability compared with age-matched older adults. When the benefit of visual feedback is removed and the reliance on cutaneous sensation and proprioception is increased, postural stability is substantially worsened for subjects with peripheral neuropathy.

Funded by the Poudre Valley Foot and Ankle Clinic and the College of Applied Human Sciences Pilot Grant Program

Category A

16. DOES "HIGH ALTITUDE HELP," A BOTANICAL HERB FORMULA, AID ACCLIMATIZATION TO HIGH ALTITUDE?

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Thousands of individuals make their way to high altitude every year, whether for recreation or job related. It is an ongoing struggle to find non-prescription drugs (less side effects) to prevent or alleviate acute mountain sickness and thus enhancing our stay at altitude. **PURPOSE:** The purpose of the study was to compare High Altitude Help (HAH) versus placebo for alleviating acute mountain sickness (AMS) and to determine if HAH improves exercise performance compared to placebo. The subjects (n=54, 28 females and 26 males) began taking the HAH tincture by mouth two times per day, four days prior to ascent. A shuttle run, "bleep test", was performed by all subjects 1 week prior to ascent and at altitude for an estimation of VO^2maximum. Appropriate medical staff were present for safety concerns. **RESULTS:** HAH administration had no effect for either ameliorating AMS symptoms or increasing performance ($p \geq 0.05$ and $p \geq 0.05$, respectively. AMS incidence was almost equal in placebo vs. treatment. **DISCUSSION:** Certain herbs in the botanical formula when tested by themselves have been shown to alleviate AMS yet when added to an herbal mixture we found no significant difference. Possibilities are numerous including; unknown dose of each herb, competition for similar receptor sites and/or negative interaction between the herbs themselves. **CONCLUSION:** These results indicate HAH is not effective in reducing symptoms of AMS, and the conclusion is robust in terms of sample size and statistical analysis. Further investigation of individual HAH herbs and their effect on AMS symptoms is warranted.

Category A
Mentor: Guy W. Leadbetter, PhD

17. THE EFFECT OF SUB-SENSORY MECHANICAL NOISE ON PROPRIOCEPTION AT THE ANKLE IN YOUNG ADULTS

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The sense of proprioception, or joint position sense, is conveyed in large part by muscle spindles, the length sensors embedded in muscle. The function and sensitivity of muscle spindles can change significantly in conditions where proprioception is impaired, such as aging or diseases like neuropathy. Artificial application of electrical or mechanical noise to the foot sole can improve postural stability, presumably via improvement of sensory function and proprioception. **PURPOSE:** The purpose was to determine whether sub-sensory vibration applied to the ankle plantarflexor (PF) and dorsiflexor (DF) tendons would bring muscle spindles closer to threshold and improve proprioception at the ankle. **METHODS:** Young men (N=10, 22.9 ± 1.85 yrs) and women (N=10, 22.5 ± 2.55 yrs) with no history of serious ankle sprains underwent assessment of joint movement perception threshold (JMPT) to determine the ability to detect movement of the dominant ankle. A motorized, instrumented platform slowly (0.25 deg/s) rotated the ankle joint. Subjects, listening to noise via headphones, pushed a stop button at the moment they perceived ankle movement. The degrees of movement were recorded. JMPT was assessed in the direction of plantarflexion (PF) and dorsiflexion (DF), with vibration (VIB) or without vibration (NOVIB). The order of VIB presentation was counterbalanced and the movement direction was randomized. **RESULTS:** Pooled across movement directions, the difference in JMPT between VIB and NOVIB did not reach statistical significance (1.34 ± 0.33 vs. 1.56 ± 0.39 deg, P=0.12). Furthermore, the null VIB effect was similar (P=0.40) for DF (1.04 ± 0.15 vs. 1.38 ± 0.28 deg) and PF (1.64 ± 0.55 vs. 1.74 ± 0.51 deg). Pooled across VIB conditions, JMPT for the DF and PF direction were similar (1.21 ± 0.20 vs. 1.69 ± 0.52 deg, P=0.20). **CONCLUSION:** The input of low amplitude, sub-sensory mechanical noise to the DF and PF tendons did not result in statistically significant improvements in ankle joint movement perception. The trend in favor of statistical significance (P=0.12) for the VIB effect, however, suggests that more testing may be necessary

to solidify this preliminary finding. The finding could also be explained by the fact that these young subjects did not exhibit impaired proprioception. Supported by NIH AG035147.

Category A

Mentor: BL Tracy, PhD

18. ACCURACY OF METABOLIC PREDICTION EQUATIONS FOR OBESE ADULTS WALKING AT VARIOUS SPEED AND GRADE COMBINATIONS

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Obesity is due to an imbalance of energy intake and expenditure, and both diet and physical activity are essential tools in weight management. Accurate estimates of physical activity energy expenditure are essential if obese individuals are to successfully manage their weight. Equations that predict metabolic rate during walking are used to determine energy expenditure but it is not known if these equations are accurate for obese individuals, particularly when walking uphill. **PURPOSE:** To compare the ACSM and Pandolf metabolic prediction equations to measured oxygen consumption and metabolic rate values in obese individuals walking across a range of speeds and grades. **METHODS:** Twenty six obese adult volunteers, mass = 102.3(15.8) kg, BMI = 35.0(4.5) kg/m^2, (mean (SD)), participated in this study. We measured oxygen consumption while subjects walked on a dual-belt force measuring treadmill at ten different speed/grade combinations ranging from 0.50 m/s to 1.75 m/s and 0° to 9°. **RESULTS:** As expected, oxygen consumption and metabolic power increased with walking speed and grade, ranging from 11.4(0.3) mlO_2/kg/min (399(15.8) W) at 1.25 m/s, 0° to 19.5(0.3) mlO_2/kg/min (683(21.9) W) at 1.50 m/s, 3°, (mean (SE)). During level walking, the ACSM equation underestimated oxygen consumption, particularly at the fastest walking speed (22% at 1.75 m/s, 14.0 vs. 17.8 (0.4) mlO_2/kg/min, $p<0.001$). The Pandolf equation accurately predicted level walking metabolic power. During uphill walking, the ACSM prediction equation consistently overestimated oxygen consumption by 5-13%. The Pandolf equation overestimated metabolic power by 0.6-12% in all but the slowest speed, steepest grade condition (0.5 m/s, 9°), during which metabolic power was underestimated by 4.9% (464(14.4) vs. 489(14.9)W). **CONCLUSION:** The ACSM prediction equation may not accurately estimate oxygen consumption in obese adults during uphill or fast, level walking and could result in a significant overestimate of energy expenditure during uphill walking. These results suggest the need to develop a revised ACSM equation for the obese population in order to ensure weight management success. Alternatively, one could consider using the Pandolf equation to estimate metabolic rate and energy expenditure in obese adults.

Supported by NIH Grant R03AR059264

Category A: Ray Browning, PhD

19. IMPACT OF TIMING OF PROTEIN INTAKE ON NITROGEN BALANCE IN OLDER INDIVIDUALS IN NEGATIVE ENERGY BALANCE

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We have previously shown that in older adults, consumption of protein in the form of chocolate milk immediately after exercise enhances nitrogen balance when energy balance is maintained. Since some older individuals consume lower calorie diets, it is important to know if these benefits also occur during hypocaloric feeding. **Purpose:** To investigate if consumption of protein immediately after exercise can improve nitrogen balance in

older individuals consuming a hypocaloric diet. **Methods:** In a randomized crossover design, healthy sedentary male (n=2; age=67.0±1.4 yrs; BMI=27.5±0.5 kg/m²) and female (n=8; age=63.0±5.6 yrs; BMI=22.7±1.9 kg/m²) subjects completed two separate 3-day exercise and nutrition interventions. Exercise (60 minutes of stationary cycling at 55% of VO_{2max}) was performed daily at 4:30 PM. Diets were hypocaloric (-15% daily intake), with a protein+carbohydrate (PRO+CHO) or carbohydrate only (CHO) drink consumed at 10 am and the opposite drink consumed after exercise (5:30 PM). Both diets (15% protein, 30% fat, and 55% carbohydrate) were isonitrogenous and isocaloric with only the timing of the drinks differing. A 24-hour stay in a metabolic chamber confirmed negative energy balance while 24-hour urine collections determined nitrogen balance. **Results:** The mean energy balance was (-14.01 ± 5.74 %kcal) in the PRO+CHO trial and (-13.96 ± 5.75 %kcal) in the CHO trial. The 3-day mean nitrogen balance was not significantly greater in the PRO + CHO trial (0.426 ± 1.653g N) trial than the CHO trial (0.259 ± 1.645g N) (p=0.280). **Conclusion:** Older individuals in negative energy balance do not maintain a significantly more positive nitrogen balance by consuming protein after aerobic exercise as opposed to earlier in the day. These results differ from our previous work and indicate that energy balance is an important determinant of the anabolic effect of protein feeding. This work was funded by the Colorado Agriculture Experimental Station grant #COL00604, a career development support from National Institute on Aging K01AG031829-01 (B.F.M.), and the University of Colorado Denver Clinical and Translational Science Award (1UL1 RR025780).

Category A
Mentor: Benjamin F Miller, Ph.D.

20. IMPROVED PLANTARFLEXOR CONTROL AFTER NERVE DECOMPRESSION SURGERY OF THE LOWER LIMB

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Peripheral neuropathy, whether idiopathic or diabetic in origin, reduces sensation, proprioception, and function in the legs and feet. This disabling nerve dysfunction is often exacerbated by compression of swollen nerves at anatomical entrapment sites including the fibular neck (common peroneal n.), tarsal tunnel (tibial n.), and dorsum of the foot (deep peroneal n.). The goal of surgical nerve decompression (ND) is to release the pressure on the nerve to restore nerve function. **PURPOSE:** Previous research on this procedure has been limited to subjective sensory and quality-of-life outcomes. The purpose of this study is to objectively measure ankle control before and after ND surgery. **METHODS**: Eight patients (68.5 ± 6.4 yrs) completed pre/post surgical visits. Before and after recovery from surgery, the ability to control a constant force with the dorsiflexor (DF) or plantarflexor (PF) muscles was assessed with visual (VIS) and without visual feedback (NOVIS) and with low-amplitude vibration (VIB) applied to the DF and PF tendons. Change in ankle control was quantified by comparing pre and post surgical values for the coefficient of variation of force (CV=SD force/mean force *100). **RESULTS:** The increase in maximal PF force production was not statistically significant after surgery (324 ± 248N to 393 ± 173N, P=0.22). Steadiness of the PF muscles improved after surgery for the NOVIS condition (5.03 ± 3.2% to 2.62 ± 1.27%, P=0.02) but not significantly for the VIS condition (5.76 ± 2.10% to 4.49 ± 2.64%, P=0.08). Before surgery, VIB improved PF control (5.03 ± 3.2% to 4.0 ± 2.65% P=.03), whereas after surgery VIB had no effect (2.62 ± 1.27% to 2.7 ± 0.94%, P=0.72). There were no changes in the control of the DF muscles with NOVIS or VIB. **CONCLUSIONS**: Significant improvement in PF force steadiness post-surgery for the NOVIS condition suggests that the surgery worked to improve sensory feedback from the ankle joint and foot. Improved steadiness before surgery for NOVIS+VIB compared with NOVIS suggests that ankle tendon vibration improved proprioception. The lack of similar findings for VIB after surgery suggests that sensory feedback and proprioception improved enough that VIB had no effect. Changes in motor control and sensory function after ND surgery may underlie the improvement postural stability often reported by patients.

Category A
Mentor: Brian L. Tracy

21. BARIATRIC SURGERY DECREASES THE USE OF PRESCRIPTION MEDICATION

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As the obesity epidemic grows in the United States, bariatric surgery has become an increasingly common intervention for obese patients suffering from health conditions associated with their weight. Evidence indicates that bariatric surgery can help alleviate or resolve some health conditions often associated with obesity. **PURPOSE**: The goal of this study is to characterize bariatric patient medication use over time, specifically characterizing changes from pre to post-surgery. **METHODS**: A random sample of 400 patients who underwent either gastric bypass (Roux-en-Y) or gastric banding surgery performed by the Northern Colorado Surgical Associates was selected from the Bariatric Outcomes Longitudinal Database (BOLD) retrospectively. Pre-operative and post-operative (6 month and 1 year) patient data describing number and types of medication used were entered into a database using SPSS software. Medications were categorized by drug class, and patients were indicated as either taking or not taking medication from a specified drug class. The data were analyzed for changes in medication use pre and post-surgery. **RESULTS**: Ongoing analysis indicates that patient rates of medication use declined 6 months and 1 year post bariatric surgery when compared to pre-surgery usage. **CONCLUSION**: Preliminary results indicate bariatric surgery patients generally experience a decreased requirement for medications previously indicated for type II diabetes and hypercholesterolemia post bariatric surgery. This adds to the evidence that bariatric surgery can help decrease the health burden of obese patients. Further investigation to characterize prescription medication usage patterns pre and post surgery is ongoing.

Category A

Co-Mentors Dr. Benjamin Miller PhD and Dr. Karyn Hamilton PhD

22. Nrf2 in cultured skeletal muscle **cells: A role in mitochondrial biogenesis?**

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Mitochondrial dysfunction is thought to play a role in the pathogenesis of many chronic conditions including aging, non-insulin dependent diabetes, and neurodegenerative diseases. Peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC-1α) is thought to be an important transcriptional co-activator for regulating mitochondrial biogenesis, yet some evidence suggests that mitochondrial biogenesis can occur independent of PGC-1α. Nuclear erythroid-related factor 2 (Nrf2), a transcription factor that up regulates expression of phase II antioxidant enzymes, can potentially regulate transcription of at least one of the main transcription factors involved in mitochondrial biogenesis, specifically nuclear respiratory factor-1 (NRF1). Protandim is a combination of phytochemicals that has been shown to activate Nrf2 in other cell types but its effects on skeletal muscle cells are unknown. **Purpose**: To determine whether Protandim can induce mitochondrial biogenesis via Nrf2 activation in C2C12 skeletal muscle cells. **Methods**: C2C12 myoblasts were grown to 95% confluence and then induced to differentiate into myotubes. Myotubes were treated with Protandim (0-100 μg/ml) for 12 hours. Nrf2 activation and mitochondrial biogenesis were assessed with western blotting. **Results:** Treatment with100 µg/ml of Protandim increased the phase II enzyme HO-1. Preliminary analyses also suggest that expression of CoxIV, a mitochondrial

protein, also increased. **Conclusion:** Results from these experiments suggest that treatment of skeletal muscle cells with the Nrf2 activator Protandim results in increases in Nrf2 regulated protein expression and preliminarily, mitochondrial biogenesis. Future experiments will be focused on investigating of the role of Nrf2 activation in mitochondrial biogenesis following muscle contractile activity.

Category: A

Mentor: KL Hamilton, PhD

23. IMPLEMENTING THE EXERCISE IS MEDICINE ON CAMPUS™ CAMPAIGN AT THE UNIVERSITY OF COLORADO AT COLORADO SPRINGS

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PURPOSE: To develop a plan of action for implementing ACSM's Exercise is Medicine on Campus™ (EIM) campaign at the University of Colorado at Colorado Springs. The campaign's purpose was to create a collaborative effort between different campus departments to encourage physical activity and its health benefits for the campus population. **METHODS:** Key campus departments were contacted in an effort to gather support on this campaign. The campus health center and recreation center responded with interest to be involved. A meeting was held with both departments and strategies were put into place on how each department could participate. The strategies were developed from the three levels of engagement of the campaign: education, screening and intervention. Tools used for implementation included a campus specific manual for EIM, flyers, brochures, physical activity screening, referrals, social networking promotions, and campus activities. **RESULTS:** The campaign and data collection began February 1, 2011. Specifically, education and physical activity screening have been implemented, while the intervention level and evaluation of EIM will occur at a later date. **CONCLUSIONS:** Based on previous research at other campuses, the EIM campaign has been received and encourages a physically active population on campus. We hope to find similar results on this campus and be an example for other campuses as well.

Category A
Mentor: Timothy Behrens, PhD

24. PLASMA MATRIX METALLOPROTEINASE-9 IS UNCHANGED FOLLOWING DOWNHILL RUNNING IN CONCENTRICALLY-TRAINED INDIVIDUALS

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Currently, a universally accepted systemic indicator of skeletal muscle damage that is sensitive to the occurrence and magnitude of muscle injury does not exist. Identification of such a blood parameter could provide a minimally-invasive quantification of the extent to which the muscles have been damaged and the need for tissue remodeling. There is evidence to suggest that muscle extracellular matrix-degrading enzymes and their inhibitors, matrix metalloproteinases (MMPs) and tissue inhibitors of metalloproteinases (TIMPs), may be mechanistically involved in the muscle damage and repair response following eccentric exercise, but their utility as potential systemic indicators is unclear. **PURPOSE:** To quantify systemic changes in MMP-9 and TIMP-1 following a downhill running bout in concentrically-trained individuals, and to compare these changes to other traditional indicators of muscle injury. **METHODS:** Nine concentrically-trained males (n=4) and females (n=5) performed 30 minutes of downhill treadmill running at an incline of -10°. Plasma creatine kinase (CK) activity, MMP-9 and TIMP-1 concentrations, and

soreness ratings were collected pre-, immediately post-, 1-, 2-, 4-, and 7-days post-exercise. Leg press strength was also measured in a subset of subjects (n=4). **RESULTS:** Soreness significantly increased from 6.78 ±11.2 mm (Mean ±SD) pre-exercise to 50.78 ±20.50 mm at 1-day post- (p=0.000) and 30.89 ±19.78 mm at 2-days post-exercise (p=0.005). Leg press strength was significantly decreased immediately- and 1-day post-exercise (p=0.008; p=0.036). Plasma CK activity was significantly increased from 72.5 ±34.8 U/L pre-exercise to a peak of 195.8 ±155.3 u/l at 1-day post-exercise. There was no significant change in either plasma total MMP-9 (p=0.230) or TIMP-1 (p=0.615) protein levels at any time during the 7-day time course. **CONCLUSIONS:** Although downhill running produces classical signs of the occurrence of skeletal muscle damage, plasma MMP-9 and TIMP-1 protein levels did not change following this task in concentrically-trained individuals. These results suggest that MMP-9 and TIMP-1 are not sensitive systemic indicators of skeletal muscle damage, but this does not preclude a role for matrix degrading enzymes and their inhibitors at the level of the skeletal muscle tissue following injury.

Category A
Mentors: DL Allen, PhD & WC Byrnes, PhD

25. IMPACT OF TIMING OF PROTEIN INTAKE ON NITROGEN BALANCE IN HYPERCALORIC OLDER INDIVIDUALS

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We have previously shown that in older adults, consumption of protein in the form of chocolate milk immediately after exercise enhances nitrogen balance when energy balance is maintained. Since it is known that hypercaloric diets increase nitrogen retention, it is important to know if the timing of protein intake after aerobic exercise provides further increases in nitrogen retention compared to the consumption of carbohydrate only post exercise. PURPOSE: To investigate if consumption of protein and carbohydrate (PRO + CHO) immediately after exercise as compared to carbohydrate only (CHO) can improve nitrogen balance in older individuals consuming a hypercaloric diet. METHODS: In a randomized cross-over design, subjects completed two separate 3-day exercise and nutrition interventions. Exercise (60 minutes of stationary cycling at 55% of VO_{2max}) was performed daily at 4:30 PM. Diets were hypercaloric (calculated at +15% daily intake), with a PRO+CHO or CHO drink consumed at 10 am and the opposite drink consumed after exercise (5:30 PM). Both diets (1.2 g protein/kg bodyweight, 30% fat, and balance as carbohydrate) were isonitrogenous and isocaloric with only the timing of the drinks differing. A 24 hour stay in a metabolic chamber confirmed positive energy balance while 24-hour urine collections determined nitrogen balance. RESULTS: The mean energy balance was (+ 9.53% ± 5.37%) in the PRO+CHO trial and (+13.67 ± 3.84%) in the CHO trial. Preliminary analysis indicates a trend towards increased nitrogen retention in the PRO + CHO trial (2.328 ± 1.482g N) than the CHO trial (1.428± .803g N). CONCLUSION: It seems that older individuals in positive energy balance may maintain a more positive nitrogen balance by consuming protein after aerobic exercise as opposed to earlier in the day. These results indicate that a practice as simple as changing when protein is consumed may help maintain muscle mass in older individuals at risk for muscle loss. This work was funded by the Colorado Agriculture Experimental Station grant #COL00604, a career development support from National Institute on Aging K01AG031829-01 (B.F.M.), and the University of Colorado Denver Clinical and Translational Science Award (1UL1 RR025780).

Category A
Mentor: BF Miller, PhD

26. Age – Related Co-Contraction Effects On Balance Recovery Using the Ankle Strategy After Tether Release

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Aging typically leads to an increased risk for falls. Fall risk has been associated with, amongst other variables, a decline in muscle strength and power, and an increase in antagonistic co-contraction. The role of antagonist co-contraction has been mainly examined under slip-like conditions where initial neural response is from distal proprioception and reflexes. **PURPOSE:** To examine ankle muscle co-contraction levels in young and older adults during balance recovery from a tether-release induced perturbation where a greater initial reliance is on vestibular input. **METHODS:** 18 healthy adult women [9 young (22.3±3.3 yrs) and 9 older (75.2±4.2 yrs) (AVG±SD)] with no history of falls or injury first performed isometric plantar flexion (PF) and dorsiflexion (DF) maximum voluntary contraction (MVC) trials while ankle strength and surface electromyography (sEMG) of the gastrocnemius (GAS), soleus (SOL), and tibialis anterior (TA) were recorded. Balance recovery trials using the ankle strategy were performed with 80% of their maximum recoverable load pulling horizontally backwards at the waist. sEMG data were analyzed during the 100 ms prior to release and in 100ms epochs from 100-400 ms following release. **RESULTS:** Height, weight, and foot length were similar between groups ($p>0.05$). There were no differences in ankle torque normalized by height and weight for PF ($p=0.31$) and DF ($p=0.15$) isometric trials. There were no differences in GAS and SOL activity levels between groups prior to tether release or during the 100-400 ms epochs ($p>0.05$). TA activity was significantly greater in the older adults during the 300-400 ms epoch (young: 23.5±5.8 %, older: 38.7±9.4 %, $p<0.01$). **CONCLUSIONS:** Similar to slip induced perturbations, the older adults exhibited more TA antagonistic co-contraction during balance recovery. However, it occurred during a slightly later stage of recovery than might be expected from cutaneous and proprioceptive dominated recovery. This delayed response may be in part because vestibular input requires more involvement from higher centers compared with distal proprioceptive inputs. Vestibular-dominated perturbations may impede older adults that rely on stabilizing the joint to prevent falling. *Supported in part by Grant Number R49/CCR811509 from the Centers for Disease Control and Prevention.*

Category A
Mentor: Raoul Reiser II, PhD FACSM

27. EFFECTS OF BMI Z-SCORE AND PLAYGROUND ENVIRONMENT ON LEVELS OF PHYSICAL ACTIVITY IN LOW SOCIOECONOMIC SCHOOL STUDENTS

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Childhood obesity is a substantial public health problem. Interventions designed to increase physical activity during school recess (e.g. renovated playgrounds) in the most at-risk children may help alleviate this problem. PURPOSE: To determine the relationship between BMI z-score and levels of physical activity during recess and after school in traditional vs. renovated (Learning Landscapes, LL) elementary school playgrounds. METHODS: We measured 5-6 days of free-living physical activity using wrist-mounted Actical accelerometers (15 second epochs) in 271 elementary school children. This data was collected as part of the baseline measures for the Intervention of PhysicaL Activity in Youth (IPLAY) Study. Students were enrolled in schools serving low SES families (77% free and reduced lunch) in the Denver, CO metropolitan area. We determined BMI z-scores using measured height and weight. We summed total accelerometry counts during recess and after school (end of school – 11pm) periods and divided by the number of minutes in each period to quantify average activity (counts/minute) during recess and after school. We ran a Univariate ANOVA to determine between-subject effects of BMI z-score, presence of LL and sex on average recess and after school activity. RESULTS: Overall, there was a trend toward decreased recess activity with increased BMI z-score ($R^2=.311$, $p=.052$). Boys at schools with LL playgrounds had significantly lower recess activity levels as BMI z-score increased ($R^2=.155$, $p=.002$), while recess activity was not related to BMI z-score in boys without LL playgrounds. Recess activity for girls did not vary significantly as BMI z-score increased, regardless of the playground environment. Average after school activity (735 counts/min) was 64% lower than

recess activity (2051 counts/min) and was not related to BMI z-score for either sex or playground group. CONCLUSIONS: Our results suggest that overweight children tend to be slightly less active than their non-overweight counterparts during recess. However, the wide range of activity levels during recess and the finding that recess activity levels were only moderately greater than after school suggests that increases in recess activity can be achieved via targeted interventions, particularly in girls.

Supported by NICHD/NCI/NIDDK R01HD057229

Category A
Mentor: R. Browning, Ph.D.

28. Endurance Exercise Attenuates Cardiotoxicity Induced by Androgen Deprivation and Doxorubicin

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Besides doxorubicin's (DOX) well known cardiotoxic effects, it is associated with irreversible testicular damage. In an attempt to preserve testicular function during DOX treatment, androgen deprivation therapy (ADT) using goserelin acetate is gaining clinical popularity as it temporarily suppresses gonadal function thereby minimizing DOX's gonadal damage. However, DOX's cardiac dysfunction is a major clinical concern as well, and evidence suggests that ADT may exacerbate DOX-induced cardiac dysfunction. Exercise has been shown to protect against DOX-induced cardiac dysfunction, but the effects of exercise on cardiac function during combined ADT and DOX treatment are currently unknown. **PURPOSE:** To determine whether exercise training can attenuate the combined cardiotoxic effects of ADT and DOX. **METHODS:** Male Sprague Dawley rats were randomly assigned to experimental groups: control implants (CON), androgen deprivation therapy (ADT), doxorubicin (DOX), or (ADT+DOX). Animals received ADT or control implants on day 1 and 29 of the 56 day protocol. Animals were then assigned to either sedentary activity (SED) or forced treadmill endurance exercise (TM). Exercise commenced on day 1 of the protocol. On day 15, animals received DOX at 1.5 mg/kg/d i.p. for 10 consecutive days or an equivalent volume of 0.9% SAL. On day 57, cardiac function was assessed *in vivo* (echocardiography) and *ex vivo* (isolated perfused working heart). **RESULTS:** DOX alone as well as ADT+DOX treated animals possessed significantly ($P < 0.05$) depressed left ventricular developed pressure (-21% vs. -27%), maximal rate of pressure development (-29% vs. -32%), and minimal rate of pressure development (25% vs. 31%) respectively compared to sedentary control animals. Endurance exercise training attenuated ($P > 0.05$) all cardiotoxic effects of ADT+DOX treatment. **CONCLUSIONS:** Treadmill training protected against combined ADT+DOX dysfunction, suggesting that cardiac function can be preserved in the clinical setting if cancer survivors concurrently endurance train while undergoing ADT and DOX treatment.

Category A
Mentors: Reid Hayward, Ph. D. and David Hydock, Ph. D.

29. STROKE SURVIVORS: FORCE PRODUCTION AND MOTOR CONTROL IN HAND MUSCLES

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Stroke is the leading cause of adult disability, costing the US alone between $13 to $30 billion per year. There is a large societal burden associated with loss of independence, reduced quality of life, and health costs. Independence is in large part dependent on successful performance of daily tasks that require optimal force production and motor control. **PURPOSE:** The purpose of this investigation was to evaluate force production and motor control by comparison of the involved (INV) and noninvolved (NON) hand of hemiparetic stroke survivors. **METHODS:** Maximal voluntary pinch grip (MVC) force and force fluctuations during steady constant-force contractions at 2.5% MVC were measured with a force transducer between the thumb and the index finger. Constant-force trials were performed with (VIS) and without (NOVIS) on-line visual force feedback. The standard deviation (SD) and coefficient of variation (SD/mean force*100, CV) of force were taken as measures of the fluctuation amplitude. The CV is a normalized expression of steadiness that allows for between-subject comparisons. Greater steadiness is reflected as lower values for SD and CV of force. **RESULTS:** For the 11 subjects studied, the MVC force was less in the INV compared with NON hand (36.6 vs. 50.5 N, P<0.01) and the CV of force was greater for the INV vs. NON hand (7.7 vs. 3.0%, P=0.02) with VIS. In the NOVIS condition, the CV of force was also greater in the INV vs. NON hand (5.4 vs. 2.8%, P=0.03). The SD values were similarly different between INV and NON hands. No significant differences between VIS and NVIS conditions were noted for the INV and NON hands (P=0.16 and 0.26, respectively). **CONCLUSION:** In this limited sample, stroke substantially impaired strength and steadiness in pinch grip force. This characterization of post-stroke motor control serves to quantify previously anecdotal accounts of weakness and unsteadiness in stroke affected hand muscles.

Category A

Mentor: Brian L. Tracy, Ph.D.

30. SHORT-TERM SPRINT INTERVAL TRAINING: INFLUENCE OF EXERCISE MODALITY

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Sprint interval training is recognized as a time-efficient alternative to traditional endurance exercise training. The majority of studies have examined effects of sprint interval training performed on a stationary cycle ergometer. Recently, it has been demonstrated that similar benefits are attainable from running exercise. However, to date, there has been no direct comparison between running and cycle ergometer sprint training. **PURPOSE**: To compare morphological, physiological and endurance based adaptations to short-term sprint interval training performed on either a stationary cycle ergometer or indoor running track. **METHODS:** 11 recreationally active, healthy adults (5 males, 6 females, 24 ± 2 years (mean ± SE)) were randomly assigned to an exercise modality. Subjects completed 9 sessions of 4-8, 30-second sprints over a 3-week period on either a stationary cycle ergometer or indoor running track. **RESULTS:** Pre-training, there were no morphological, physiological or endurance based differences between the groups (all *P*>0.24). Following sprint interval training, body mass increased irrespective of exercise modality (69.0 ± 3.8 *vs.* 70.1 ± 3.38 kg; *P*=0.007). This increase could be attributed almost entirely to an increase in fat free mass (51.5 ± 3.3 *vs*. 52.4 ± 3.3 kg; *P*=0.03) as determined by dual-energy X-ray absorptiometry. Maximal oxygen consumption was unaffected by sprint-interval training (43.0 ± 1.6 *vs.* 43.5 ± 1.8 ml/kg/min; *P*=0.51), regardless of exercise modality. In the running group, the % improvement in 10 km time trial running performance (4.5 ± 1.3%) was greater than the % improvement in 40 km time trial cycling performance of the cycling group (0.0 ± 1.7%),

although the magnitude of this improvement did not attain statistical significance (*P*=0.07). **CONCLUSION:** These preliminary data suggest short-term sprint interval training increases lean mass, irrespective of whether the exercise modality is stationary cycling or indoor track running. While neither sprint modality increases maximal oxygen consumption, indoor track running may improve running performance to a greater degree than stationary cycling improves cycling performance.

Category A
Mentor: C. Bell, Ph.D.
Funding: Office of Naval Research

31. ENERGY EXPENDITURE DURING PASSIVE CYCLING: THE EFFECTS OF LEG MASS, CADENCE, AND ADAPTATION

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Passive cycling, during which a motor drives the pedals, increases energy expenditure above rest. The magnitude of this increase is similar to that seen with activities classified as non-exercise activity thermogenic (NEAT). NEAT activities have been associated with weight management and modification of chronic disease risk factors. However, little is known about the factors that influence energy expenditure during passive cycling. **PURPOSE:** To quantify how leg mass, cycling cadence, and adaptation influence the increase in energy expenditure during passive cycling. **METHODS:** Eleven sedentary to recreationally active non-cyclists (5M, 6F, age 18-30) participated. The role of leg mass was studied within subjects by comparing one- and two-leg passive cycling. Cycling trials were performed at both 60 and 90 RPM to study the influence of cycling cadence. Adaptation was studied using multiple cycling trials and a 30-minute passive cycling trial. Rest and active (no load) cycling trials were performed for energy cost comparisons. **RESULTS:** Passive cycling significantly ($p<0.03$) increased energy expenditure above rest for all cycling trials. The increases in energy expenditure above rest during passive cycling were greater when two legs were compared to one leg (37% vs. 15% at 60 RPM; $p=0.008$ and 93% vs. 44% at 90 RPM; $p=0.001$). The increase in energy expenditure was greater for 90 RPM compared to 60 RPM two-leg passive cycling (93% vs. 37%; $p<0.001$). The increase in energy expenditure was repeatable over multiple trials and was sustained for exercise durations of 30 minutes. Compared to the passive cycling trials, energy expenditure during active (no load) cycling at 60 and 90 RPM was significantly greater. **CONCLUSION:** Increases in energy expenditure during passive cycling are directly related to the amount of activated leg mass and cycling cadence and not influenced by adaptation.

Category A

Mentor: WC Byrnes, PhD.

32. Cancer-Related Fatigue and the Impact of Psychological and Physiological Variables

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Fatigue has a negative impact on individuals during and following cancer therapy. Fatigue appears to be manifested early in the disease process and often worsens with treatment. There is minimal information on what psychological and physiological parameters contribute to cancer-related fatigue. **PURPOSE:** To assess potential psychological and physiological variables that may contribute to cancer-related fatigue. **METHODS:** A total of 593 cancer survivors, including 127 males (62.0 ± 13.7 yrs) and 466 females (55.0 ± 11.8 yrs) that had undergone radiation and/or chemotherapy were eligible for this study.

Participants completed Piper fatigue and Beck depression inventories. Additionally, a comprehensive physical assessment was performed prior to the exercise intervention. Physical performance was determined during an initial assessment including VO_2 peak (multistage treadmill protocol), muscular endurance (paced submaximal protocol to fatigue), body composition (skinfolds), and body weight. A multiple imputation regression analysis ascertained the effects of multiple variables on fatigue. **RESULTS:** Depression, body weight, lower body endurance, and age were significantly ($P<.05$) associated with cancer-related total fatigue. VO_2 peak approached significance ($P=.07$) while upper body endurance and body fat percentage were not significantly associated with total fatigue. **CONCLUSION:** The results of this study imply that activities of daily living may be more difficult in cancer survivors with greater body weight and poor body strength ultimately increasing total fatigue. Therefore, cancer rehabilitation programs need to include interventions addressing decrements in cancer survivors' ability to complete activities of daily living as opposed to improving athletic performance.

Category A

33. Accuracy of research and consumer physical activity monitors in estimating energy expenditure

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The use of accelerometers to estimate physical activity energy expenditure (EE) is common in a research setting. Recently, accelerometry-based physical activity monitors have been introduced for consumers but there are few data comparing EE estimation accuracy for these consumer devices compared to those used in research. **PURPOSE:** To determine the accuracy of EE estimates from a variety of physical activity monitoring devices during activities of daily living. **METHODS:** Nineteen adults (10 male, 9 female), mass: 75.14 (17.1) kg, BMI: 25.07(4.6) kg/m^2, completed a four hour stay in a room calorimeter. Participants wore three physical activity monitoring devices used in research: Actical, Actigraph, were worn at the hip, and the IDEEA sensors were secured to the proper limb and chest positions. In addition, participants wore two consumer devices: Philips DirectLife and Fitbit. Each individual performed a series of randomly assigned postures/activities including supine, seated (quietly and using a computer), standing, walking, stepping, cycling, sweeping, as well as a period of self-selected activities. We used the device manufacturer's software to estimate EE and compared these estimates to the measured EE. The time resolution for DirectLife was one hour, and the epoch length of the Actigraph was one second, summed by the hour. Therefore, we were able to extract from these devices 3hours of data, and the remaining devices had a resolution of between one and five minutes which allowed us to compare EE during a 3.5 hour period. **RESULTS:** The total 3 hour EE was 455(18) kcal and the total 3.5 hour EE was 503(18) kcal (mean(SE)). The DirecLlife (449(13) kcal) and IDEEA (445(23) kcal) estimates of EE were similar to the measured EE . The Actigraph, Fitbit and Actical devices significantly underestimated EE (339 (19) kcal, 363(18) kcal and 383(17) kcal, respectively). Root mean square errors were 62.1(14%), 88.2(18%), 122.2(27%), 130.1(26%), and 143.2(28%) for DirectLife, IDEEA, Actigraph, Actical and Fitbit respectively. **CONCLUSIONS:** The research and consumer physical activity monitors tested have a wide range of accuracy when estimating EE. Given the similar hardware of these devices, these results suggest that the algorithms used to estimate EE are primarily responsible for their accuracy.

Category A

34. EMPLOYEE WEIGHT LOSS COMPETITON EFFECTIVENESS BASED ON WEEKLY GOAL SETTING

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Several wellness initiatives have been implemented in many different organizations. These initiatives include weight loss strategies and other healthy lifestyle changes. **PURPOSE:** The purpose of this research was to determine the success of individuals participating in a company-wide weight loss competition. **METHODS:** A large corporation in southern Colorado invited employees to participate in a 5 week weight loss competition. Participants were required to attend an orientation sessions where an initial weight was taken. Reasonable weekly weight loss goals were then suggested based on the individuals' Body Mass Index (BMI) by a registered dietitian. The participants chose their own weekly weight loss goals given the information provided. Each person would need to attend two of the three classes offered during the challenge in order to qualify as a winner of the challenge. The weight loss was self-reported via email during the challenge with the exception of the initial and final weights. Points were also awarded throughout the program. **RESULTS:** Twenty-three participants signed up for the study (males = 2, females = 21). Twenty-two completed the four week program. The mean weight prior to the intervention was 207.96 ± 48.8 lbs. The final mean weight was 199.54 ± 44.51 lbs. Overall, there was a 116.8 lb weight loss among the participants. This was an average weight loss of 5.31 ± 5.2 pounds per person for the duration of the competition. The first week had the greatest mean weight loss (2.39 ± 1.6 lb) and decreased linearly until the final week (.25 ± 2.8 lb). Every person in the challenge attended the required two out of the three classes offered. **DISCUSSION:** Overall, the individuals in this competition were successful in their weight loss (approximately 2.5% of body weight during the intervention). It appears that the methods used in this challenge including: weekly information sessions, proper goal setting, and limiting weight change promoted weight loss within this organization.

Category A
Mentor: T Behrens, PhD

35. OXIDATIVE STRESS AND HEMATOLOGICAL RESPONSES TO A MULTIMODAL EXERCISE INTERVENTION IN A CANCER SURVIVOR RECEIVING HIGH-DOSE CHEMOTHERAPY

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Despite evidence from animal models indicating that oxidative stress and hematological responses mediate the side effects of many cancer chemotherapy regimens, no clinical studies to date have examined oxidative stress and hematological dynamics in cancer survivors during chemotherapy, and potential modulation with exercise. **PURPOSE:** To determine the effects of exercise on reactive carbonyl derivatives (RCD), a marker of oxidative stress, and hematological parameters in a cancer patient receiving chemotherapy. Additionally, to evaluate alterations in functional parameters. **METHODS:** The subject was a 60-yr-old female, diagnosed with stage IIIC1 endometrial cancer, receiving chemotherapy (paclitaxel, carboplatin). Assessments evaluating functional parameters (muscular strength, VO_2peak, fatigue) were performed one day prior to the first chemotherapy cycle and again at 3- and 6-months**.** Exercise was performed three times per week for one hour and consisted of treadmill walking and total body strength exercises. Plasma RCD concentrations were measured only at nadir time points, while white blood cells (WBC), red blood cells (RBC), hemoglobin (HGB), and platelets (PLT), were collected prior to each treatment and at nadir. **RESULTS:** The subject had high baseline plasma RCD (6.13 $nmol \cdot mg^{-1}$), likely associated with her tumor burden. Following the exercise intervention, RCD levels dropped to 24% of baseline (1.47 $nmol \cdot mg^{-1}$). VO_2peak improved 16% between baseline and 6-months (23.0 to 27.3 $mL \cdot kg^{-1} \cdot min^{-1}$). Combined upper body strength increased 21%, while combined lower body strength improved by 9%. Both WBC and PLT concentrations dropped during the course of chemotherapy (-66.5% and -55.8%, respectively), but rebounded to within normal ranges following each nadir period. **CONCLUSION:** Even during a

chemotherapy regimen which reduced WBC and PLT concentrations, a prescriptive exercise intervention mediated an increase in VO_2 peak and muscular strength with a concomitant decrease in oxidative stress.

Category A
Mentor: Carole Schneider, PhD

36. ACTIVATION OF NRF2 AND UPREGULATION OF PHASE II ENZYMES IN CARDIOMYOCYTES BY THE PHYTOCHEMICALS IN PROTANDIM

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Increased production of reactive oxygen species has been implicated in the pathogenesis of cardiovascular disease (CVD), with enhanced endogenous antioxidants proposed as a potential mechanism for promoting redox balance. Protandim is a supplement composed of a combination of five widely studied medicinal plants derived from botanical sources [*Bacopa monniera*, *Silybum marianum* (milk thistle), *Withania somnifera* (Ashwagandha), *Camellia sinensis* (green tea), and *Curcuma longa* (turmeric)]. **PURPOSE:** To determine if treatment of cardiomyocytes with Protandim activates nuclear factor erythroid related factor-2 (Nrf2), induces phase II detoxification enzymes, and protects cardiomyocytes from oxidant induced apoptosis. **METHODS:** HL-1 cardiomyocytes were treated with Protandim and activation of Nrf2 was assessed by immunofluorescence and by immunoblot analysis of protein expression. Induction of phase II enzymes was investigated by immunoblotting. Protection against oxidant stress was assessed by determining percent apoptotic nuclei using the TUNEL assay. **RESULTS:** In cultured cardiomyocytes, treatment with Protandim was associated with activation of Nrf2 and a significant induction of phase II enzymes. Protandim supplemented cells were protected against hydrogen peroxide-induced apoptosis (35% apoptotic in untreated vs. 5% apoptotic in Protandim treated). **CONCLUSIONS:** These findings support the use of Protandim as a potential treatment to increase antioxidant defenses and protection of heart cells against an oxidative challenge. Future studies will focus on optimizing phytochemical induction of Nrf2-mediated antioxidant defenses in relevant *in vivo* models of CVD.

This project is supported by a grant from the U.S. Dept. of Agriculture, Colorado State Agricultural Experiment Station.

Category A

Mentor: Karyn Hamilton, PhD

37. METABOLIC RATE AND COST OF TRANSPORT IN OBESE AND NON-OBESE ADULTS DURING LEVEL AND GRADIENT WALKING.

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Walking is a popular and convenient form of physical activity and can play an important role in the treatment and prevention of obesity. During level walking, obese adults are reported to have a greater net metabolic rate (W/kg) but a similar metabolic cost (J/kg/m) compared to non-obese adults. Individuals routinely walk up or down grades, but the metabolic response to gradient walking in obese individuals is not well understood. **PURPOSE:** To quantify metabolic rate and metabolic cost during level and gradient walking in obese and non-obese adults. **METHODS:** Twenty-six obese (16 female, mass = 102.3 (15.8) kg, BMI = 34.96 (4.5) kg/m^2, mean (SD)) and eighteen non-obese (10 female, mass = 64.4 (10.6) kg, BMI = 21.6 (2.0) kg/m^2) volunteers participated in this study. We measured oxygen consumption while subjects stood and walked on a dual-belt force measuring treadmill at eleven speed/grade combinations ranging from 0.50 m/s to 1.75 m/s and -3° to 9°. We calculated gross and net (gross-stand) metabolic rate and metabolic cost (metabolic rate/speed) for each condition. A two-factor repeated measures ANOVA determined how group (obese vs. non-obese) and speed/grade affected metabolic rate/cost. **RESULTS:** Net metabolic rate increased with walking speed and grade, ranging from 2.1 (0.06) W/kg at 1.25 m/s, -3° to 5.8 (0.06) W/kg at 1.50 m/s, 3°, (mean (SE)). Obese individuals walked with a smaller net metabolic rate (p=0.031), gross metabolic cost (p<0.001) and net metabolic cost (p=0.016) compared to non-obese adults. **CONCLUSIONS:** The smaller metabolic cost in obese adults suggests these individuals have greater economy when walking on level or uphill/downhill grades. The mechanism by which economy is improved in obese adults has yet to be discovered.

	Gross Metabolic Cost (J/kg/m)		Net Metabolic Cost (J/kg/m)	
Speed, Grade	Obese	Non-Obese	Obese	Non-Obese
1.25 m/s, -3°	2.46 (0.06)	2.95 (0.10)*	1.52 (0.05)	1.71 (0.09)
1.25 m/s, 0°	3.13 (0.07)	3.57 (0.07)*	2.22 (0.06)	2.33 (0.07)
1.50 m/s, 0°	3.26 (0.08)	3.41 (0.13)	2.49 (0.07)	2.38 (0.14)
1.75 m/s, 0°	3.56 (0.08)	3.83 (0.10)*	2.89 (0.08)	2.94 (0.09)
1.00 m/s, 3°	4.57 (0.08)	5.31 (0.12)*	3.44 (0.07)	3.78 (0.13)*
1.25 m/s, 3°	4.41 (0.06)	4.96 (0.09)*	3.39 (0.06)	3.73 (0.09)
1.50 m/s, 3°	4.52 (0.08)	4.97 (0.08)*	3.76 (0.08)	3.94 (0.09)
0.75 m/s, 6°	6.75 (0.09)	7.52 (0.13)*	5.22 (0.08)	5.48 (0.12)*
1.00 m/s, 6°	6.29 (0.10)	7.09 (0.10)*	5.15 (0.09)	5.54 (0.11)*
0.50 m/s, 9°	9.72 (0.13)	10.93 (0.21)*	7.41 (0.14)	7.82 (0.18)*
0.75 m/s, 9°	8.60 (0.14)	9.44 (0.16)	7.08 (0.13)	7.39 (0.17)*

Mean (SE), *Significant difference obese vs. non-obese

Supported by NIH Grant R03AR059264
Category A: Ray Browning, PhD

38. Skeletal Muscle DNA and Mixed Muscle Protein Synthesis Rates with Endurance Training in Aging Humans

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Decreased rates of synthesis in skeletal muscle may contribute to loss of muscle mass with age. Acute studies show that resistance exercise can increase mixed muscle protein synthesis, an effect that is enhanced with protein consumption. However, less is known about the ability of endurance exercise training and protein consumption to promote synthetic processes. Deuterium oxide (D_2O) consumption allows measurement of multiple synthetic processes and provides insight into skeletal muscle adaptations over extended periods. **Purpose:** The purpose of our study was to use D_2O to determine long-term rates of protein, DNA and membrane phospholipid synthesis in skeletal muscle during endurance exercise training. **Methods:** Sixteen healthy adult males and females (Age: 50±8 yrs, BMI: 25.3±4.1 kg/m^2, $VO_{2\ max}$: 28.3±6.4 ml/kg/min) participated in 6-weeks of endurance exercise training and were randomized to consume either carbohydrate (CHO) or an iso-caloric drink with 20-grams protein (PRO) following each session. Each participant also consumed D_2O daily to determine the synthesis rate of proteins (MPS), DNA (DNA%F) and membrane phospholipid glycerol (GLY). $VO_{2\ max}$ and muscle biopsies were performed pre and post training. Total muscle proteins, DNA and GLY were extracted from muscle biopsy samples and analyzed for deuterium enrichment using gas or liquid chromatography and mass spectrometry. **Results:** The increase in $VO_{2\ max}$ with training was greater in PRO compared to CHO (PRO=+12.8±6.2% vs. CHO=+2.8±8.7%, p=0.033). MPS was not different between PRO and CHO (PRO=0.05±0.01 vs. CHO=0.06±0.01 %/hr). DNA%F was not different between PRO and CHO (PRO=3.3±2.6 vs. CHO=5.3±2.8 % new in 6-weeks). MPS and DNA%F were correlated (r^2=0.26, p=0.055). The synthesis of GLY was not different between PRO and CHO (PRO=37.6±11.9 vs. CHO=42.2±11.2 % new in 6-weeks). **Conclusion:** Our results suggest that protein consumption following each session of endurance exercise training can lead to long-term changes in aerobic capacity. MPS, DNA%F, or GLY had similar responses to training between PRO and CHO groups. The mean DNA%F of ~4% is a novel measure of skeletal muscle DNA synthesis and cannot be accounted for by mitochondrial DNA turnover. These results may indicate satellite cell activation during endurance exercise training in aging adults.

Category A

Mentor: Benjamin F Miller, PhD

39. RESTING METABOLIC RESPONSES TO A SINGLE BOUT OF SPRINT-INTERVAL TRAINING IN YOUNG MEN

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Currently over two-thirds of US citizens are overweight or obese. This reflects a chronic bias in the energy balance equation such that dietary intake exceeds energy expenditure. Regular endurance exercise is an effective way to increase total daily energy expenditure and each of its components, including resting metabolic rate (RMR: the single largest component of total daily energy expenditure). However, many adults fail to initiate or maintain a program of regular exercise due to the perceived significant time commitment. Sprint-interval training is becoming increasingly accepted as a time-efficient alternative to endurance exercise. **PURPOSE:** The purpose of this study was to investigate the hypothesis that a single bout of sprint-interval training would increase RMR. **METHODS:** RMR (ventilated hood, indirect calorimetry) was determined on four separate occasions in 16 recreationally active men (age 23 ± 1 years, % body fat 17.1 ± 1.4, peak oxygen uptake 47.5 ± 1.7 ml·kg^{-1}·min^{-1} (mean ± SE)). Measurements were performed over two pairs of consecutive mornings; each pair was separated by 7-days. Immediately following either the first or third RMR measurement (randomly assigned) subjects completed 4 x 30-

second bouts of very high-intensity cycle ergometer exercise. **RESULTS:** The RMR measurement was highly reproducible (typical error: 3.7 %; mean values: 7365 ± 214, 7337 ± 246 & 7086 ± 203 $kJ \cdot day^{-1}$). A single bout of sprint-interval training did not increase RMR (7305 ± 233 $kJ \cdot day^{-1}$; $P = 0.06$). Similarly, a single bout of sprint-interval training did not influence respiratory exchange ratio (0.86 ± 0.01, 0.86 ± 0.01 & 0.85 ± 0.01 *vs*. 0.85 ± 0.01; $P = 0.91$) or circulating concentrations of insulin (25.2 ± 4.6, 26.3 ± 3.8 & 23.7 ± 3.7 *vs*. 24.7 ± 3.3 $pmol \cdot L^{-1}$; $P = 0.85$), glucose (5.00 ± 0.11, 5.04 ± 0.13 & 5.04 ± 0.10 *vs*. 4.98 ± 0.12 $mmol \cdot L^{-1}$; $P = 0.89$) or free triiodothyronine (3.00 ± 0.14, 3.05 ± 0.13 & 3.02 ± 0.17 *vs*. 2.96 ± 0.13 $pg \cdot mL^{-1}$; $P = 0.94$). **CONCLUSIONS:** Previously it has been suggested that an increase in daily energy expenditure of ~ 200 $kJ \cdot day^{-1}$ would be sufficient to prevent weight gain in the vast majority of adults. These preliminary data indicate that a single bout of sprint-interval training does not affect RMR; the influence on total daily energy expenditure remains to be determined.

Category A

Mentor: C Bell, PhD

40. ROLE OF PLAYGROUND ENVIRONMENT AND WEIGHT STATUS ON LEVELS OF PHYSICAL ACTIVITY IN LOW SOCIOECONOMIC ELEMENTARY SCHOOL STUDENTS

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Recess periods during the school day offer opportunities for children to be active, yet the influence of the playground environment on levels of physical activity (PA) has not been well established. PURPOSE: The purpose of this study was to determine the role of renovated (Learning Landscapes, LL) vs. non-renovated playgrounds on levels of recess PA in elementary school children. The data collected serve as baseline for the Intervention of PhysicaL Activity in Youth (IPLAY) Study. METHODS: We measured height, weight and 5-6 days of free-living PA via wrist-mounted Actical accelerometers in 271 elementary school children. These students were enrolled in schools serving low socioeconomic status families (77% free and reduced lunch) in metropolitan Denver, CO. Overweight status was defined as > 85^{th} percentile BMI-for-age. We summed total accelerometry counts during recess and divided by the total number of recess minutes to quantify the average activity counts per minute of recess. Univariate ANOVA was conducted to determine between-subject effects of weight status, presence of LL and sex on average recess PA. RESULTS: A significant interaction was observed between LL and sex (p=.003), demonstrating that boys with LL are markedly more active than girls with LL compared to their non-LL counterparts. An additional interaction was observed between LL and weight status (p=.019), indicating that normal weight children with LL had even greater levels of PA than overweight children with LL. CONCLUSIONS: These data demonstrate that in LL schools, normal weight girls and all boys have greater levels of recess PA. However, overweight girls are not affected by LL, signifying the need for additional approaches to encourage them to be more active.

Supported by NICHD/NCI/NIDDK R01HD057229

Category A
Mentor: R. Browning, Ph.D.

41. EFFECT OF STANCE WIDTH, VISION, AND TRIAL DURATION ON STANDING WEIGHT-BEARING ASYMMETRIES

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Standing weight-bearing asymmetry may be indicative of leg-length inequality, diagnostic when examining risk for low back pain, and included in assessment of balance and fall risk. However, the effect of stance width on the expression of weight-bearing asymmetries is not well understood. **PURPOSE:** To examine the effect of stance width on weight-bearing asymmetries in young healthy adults along with the potential influences of trial duration, vision, and repeatability. **METHODS:** 18 healthy young adults volunteered (9 men, 9 women; mean +/- standard deviation: age = 23.5 +/- 1.7 yrs; mass = 74.3 +/- 14.0 kg; height = 173.4 +/- 9.6 cm). Participants completed 16 randomized, 60 second trials, standing still and relaxed with arms by their sides. Eight trials were performed with a narrow stance (NS) with medial malleoli touching and eight were with a wide stance (WS) at shoulder width. Half the trials within each stance were conducted with either eyes open (EO), the rest with eyes closed (EC). Asymmetries were calculated as the absolute percent difference between mean right and left vertical ground reaction forces. To examine the effect of trial duration, successive 20 second epochs were created. Seven subjects returned on a separate day to verify repeatability. **RESULTS:** Weight-bearing asymmetries were significantly greater with a narrow stance and not affected by vision ($p = 0.008$: NS EO = 4.3 ± 4.3%, NS EC = 4.3 ± 4.5%, WS EO = 1.8 ± 1.7%, WS EC: 1.8 ± 1.7%). The only effect of trial duration was observed with WS EC where subjects were more symmetric during the 1st 20 seconds compared to the middle and last epochs ($p = 0.002$: epoch 1 = 1.5 ± 1.6%, epoch 2 = 2.0 ± 1.8%, epoch 3 = 1.9 ± 1.7%). High correlations only existed within the same stance between EO and EC ($r \geq 0.792$ within, $r \leq 0.459$ otherwise). Day-to-day repeatability was high in all conditions ($ICCr \geq 0.738$). **CONCLUSION**: Vision and trial duration do not appear to have a major influence on standing weight-bearing asymmetries. However, stance width has an effect, with asymmetries increasing as base of support decreases. While both stances are highly repeatable, they are not highly correlated. At present it is unclear as to why these differences exist, suggesting further exploration is needed before recommending a particular stance width when assessing weight-bearing asymmetries.

Category: A
Mentor: RF Reiser II FACSMa

42. Order of Presentation of Visual Feedback Does Not Affect the Impaired Force Steadiness Exhibited by Older Adults During Visuomotor Processing

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The greater motor variability of older adults is physiologically interesting and functionally relevant. We have reported, in various muscles, greater force variability for older adults when the gain of visual force feedback is high (VIS) and vision is important, suggesting impaired visuomotor processing. These data were from experiments where VIS was presented and then removed during a trial. **PURPOSE:** The purpose was to determine if the order of presentation of VIS to the older adults contributed to the greater force variability during visuomotor processing. **METHODS:** Healthy young (N=26, 22 ± 7 years) and older adults (N=14, 72 ± 9 years) performed isometric index finger abduction at 2.5% of maximal voluntary contraction (MVC) force. Each trial consisted of 10s of VIS followed by 10s without VIS (NOVIS). A second group of older adults (N=14, 75 ± 5 yrs) performed index finger abduction at similar forces (1-3% MVC, mean 1.97 ± 0.69% MVC). This second group performed discrete 10s trials of VIS and NOVIS, presented in random order. For both groups and types of trials, the mean, SD, and coefficient of variation (CV, SD/mean force *100) of force was calculated similarly for the VIS and NOVIS segments. **RESULTS:** For the older adults in the first group the CV of force was greater for VIS than NOVIS for 2.5% MVC (7.1 ± 2.9% vs. 4.5 ±

1.8%, P< 0.0001). There was no difference between VIS and NOVIS for young adults. The difference between VIS and NOVIS was greater for older adults than young adults (agegroup x vision, P=0.002). Similarly, for the older adults in the second group, the CV of force was greater for VIS than NOVIS (6.04 ± 4.7% vs. 3.81 ± 2.7%, P=0.012). The magnitude of the increase in CV of force in VIS was similar for the first group (57.7%) and second group (58.5%). **CONCLUSION:** Regardless of the order of presentation of VIS, force fluctuations during steady contractions by older adults are greater when VIS is an important contributor to the task. These results suggest that the visual feedback effects on steadiness that we have consistently observed for older adults are not due to the order of presentation of VIS during the trial. Rather, the results indicate that for older adults the increase in force variability with visual feedback can be attributed to an impaired ability to employ online visuomotor correction of force.
Supported by NIH AG027262.

Category A
Mentor: Brian L. Tracy, Ph.D.

43. DEVELOPMENT AND ACCURACY OF SELF-REPORTED WEIGHT IN ELEMENTARY SCHOOL STUDENTS

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Self-reported measures are important tools in large-scale obesity prevention/treatment interventions, yet the ability of elementary school children to correctly self-report weight is unknown. PURPOSE: To determine elementary school students' ability to accurately self-report their weight. METHODS: Self-reported and measured weight was recorded for first, third, and fifth grade students (N = 277) in Denver in May 2010. Self-reported values between the 3rd-99th percentiles of body weight-for-age were deemed "reasonable" and included in analysis. We compared mean measured and self-reported weight and the correlation between these variables for each grade level. Linear regression using weight-for-age z-score and the difference between measured and self-report determined if weight status influenced self-report accuracy. RESULTS: A reasonable value for self-reported weight was provided by 36, 71 and 87% of first, third, and fifth graders, respectively. All three grades significantly underreported weight. Mean values in kg (S.D.) for measured versus self-reported weight were 27.3 (5) vs. 24.6 (5.6), 34.8 (9.1) vs. 31.3 (6.1) and 43.9 (11) vs. 40.6 (9.8) for first, third and fifth graders, respectively. The correlation coefficient between measured and self-reported weight was 0.42, 0.72 and 0.93 in first, third and fifth graders, respectively, demonstrating improvement with age. In third and fifth graders, as weight-for-age z-score increased, self-reported accuracy decreased (r^2 of 0.183 and 0.09, respectively). CONCLUSIONS: Self-reported weight is not an appropriate assessment in first grade students; should be interpreted cautiously in third grade students; and is acceptable in fifth grade students.

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Category A
Mentor: R. Browning, Ph.D.

44. THE RELATIONSHIP BETWEEN OWNER STEP COUNTS AND OBJECTIVELY MEASURED CANINE PHYSICAL ACTIVITY

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The prevalence of human and canine obesity continues to increase and is due, in part, to inadequate levels of physical activity. While dog ownership has been shown to result in greater levels of physical activity, no studies have quantified physical activity in owners and their pets at the same time. **PURPOSE:** To quantify free-living physical activity levels of healthy dogs, as it relates to owner facilitated activity (i.e. walks), using a hip mounted pedometer for owners and a collar-mounted accelerometer for dogs. We hypothesized that greater pedometer counts in owners would correlate with greater daily accelerometry counts in their dogs. **METHODS:** We recorded four consecutive days of step counts in 49 owners and free-living physical activity via a collar-mounted accelerometer (Actiband) in 54 dogs. Owners were instructed to wear a hip-mounted pedometer while walking their dog and record the number of counts following each walk. One-minute accelerometer count epochs were summed to generate a measure of hourly and total daily physical activity levels for each dog. We used linear regression to determine the relationship between pedometer counts and daily accelerometer counts. **RESULTS:** 169 days were analyzed. Mean (SE) step counts and accelerometer counts were 3676±201.6 and 210096±7697 respectively. There was a significant positive relationship between step counts and accelerometry counts ($p<0.001$). **CONCLUSIONS:** These data suggest that owner facilitated activity, i.e. daily walks, significantly increases physical activity in free-living dogs. Our results support the literature suggesting positive human health benefits of dog ownership and highlight the importance of owner-initiated physical activity for optimum canine health.

Category A
Mentor: RC. Browning

45. NORMALIZATION OF CARDIOVASCULAR FITNESS IN CANCER SURVIVORS FOLLOWING AN EXERCISE INTERVENTION

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Research has consistently shown that exercise improves cardiovascular function in cancer survivors. However, this improvement has yet to be compared against the general population. **PURPOSE:** To evaluate cardiovascular fitness pre and post exercise intervention in cancer survivors against the normative data for a cancer population and the general US population. A secondary purpose was to compare the percent change in cardiovascular fitness in cancer survivors to that of an apparently healthy population. **METHODS:** Exercise treadmill test performance was evaluated in a cancer population of 543 subjects. Subjects ranged in age from 19 – 70+ years with 79% representing females. Normal distributions for VO_2 peak and treadmill time (Bruce protocol) were created for the cancer population at baseline (intake) and following a 3 or 6-month exercise intervention. Cardiovascular values for ten age and gender groups were compared against the normative classifications of a cancer population and the general US population according to ACSM norms. **RESULTS:** Four age groups improved in cardiovascular classification (from very poor to poor) when evaluated with the US population norms. All but one age group improved its cardiovascular classification (5 groups: average to above average; 3 groups: average to excellent; 1 group: above average to excellent) when evaluated with cancer population norms. Average VO_2 peak values improved from 21.6 ± 6.3 mL · kg^{-1} ·min^{-1} to 24.84 ± 6.18 mL · kg^{-1} ·min^{-1}. This 15% improvement mirrored the increase in aerobic capacity seen in healthy individuals following a similar exercise intervention. Mean treadmill time improved from 5:52 ± 2:38 minutes to 7:09 ± 2.22 minutes. Prior to the exercise intervention, distinctive peaks in the treadmill time distribution occurred at stage changes at 3:00 and 6:00 minutes. The 3:00 minute peak was not present following the intervention, while 6:00 and 9:00 minute peaks were observed. **CONCLUSION:** Although all age groups remained in a "very poor or poor" classification based upon US norms, when evaluated using cancer specific norms the data indicated substantial improvement. These

improvements parallel the response seen in healthy individuals. This emphasizes the importance of cancer specific normative data.

Category A
Mentor: CM Schneider, PhD

46. THE EFFECT OF OSCILLATING MENTSTRUAL-CYCLE HORMONES ON POSTURAL SWAY: A PILOT STUDY

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Women suffer more Anterior Cruciate Ligament (ACL) tears than men (Arendt et al., 1995). Variations in balance linked to sex-hormone oscillations may indirectly predispose women to ACL injury. **PURPOSE:** To increase the understanding of why females suffer more ACL tears than their male counterparts. This pilot project sought to establish whether fluctuations in female reproductive hormones may indirectly account for this difference due to a direct effect on balance. **METHODS:** 7 women performed 3 randomly selected yoga poses on a two-axis PASCO PS-2142 PASPort force platform. The women were between 20 and 26 years of age; none of the women were using any form of hormone-based birth control. Menstrual phase was estimated by identifying the mid-point of the menstrual cycle using information reported by each subject. The degree of postural sway was defined by the frequency of parallel force spikes that lay outside of two standard deviations of the mean for any given pose. **RESULTS:** The incidence of both anterior-posterior and medial-lateral sway was higher during the follicular phase than during the luteal phase for most subjects. However, this trend only proved significant (P=0.006) in the medial-lateral direction while the subjects were standing on one foot. **CONCLUSIONS:** The results of this pilot study suggested that sex hormones may alter the ability to control postural sway. This concept must be investigated further with more sensitive measures to reduce experimental error to determine if the normal oscillation of sex-hormones puts women at higher risk of off-balance landings and consequently influences the rate of ACL injuries.

Category A

Mentors: RD Sears and SN Drum

47. ANTHROPOMETRIC MEASUREMENTS OF OBESITY AND THEIR LINK TO LIFESTYLE & CARDIOVASCULAR RISK IN COLORADO FIREFIGHTERS

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Cardiovascular disease (CVD) is the leading cause of death in firefighters as it is in the general population. Despite data promoting Colorado as the leanest state in the nation and the image of firefighters as healthy and physically fit, obesity is evident in Colorado firefighters and continues to be an important CVD risk factor. **PURPOSE:** To determine obesity prevalence, depending on measurement and classification, and its association with lifestyle factors and cardiovascular (CV) risk in a cohort of Colorado firefighters. **METHODS:** Analysis was conducted on data from 1,248 Colorado firefighters (112 females; 1,136 males). Using standard classification cut-points, rates of obesity were determined using body mass index (BMI), waist circumference (WC), sagittal abdominal diameter (SAD), and percent body fat (%BF) from skin fold and hydrodensiometry measurements. Lifestyle factors used in the analysis included diet, physical

activity, sleep, and stress. Lipids, C-reactive protein (CRP) levels, predicted maximal oxygen consumption and strength measures were also included. CV risk was assessed using the Cooper Risk Profile. Correlation statistics were run for each anthropometric measure with the above variables. **RESULTS:** Obesity prevalence varied by measurement: BMI=3.6% females; 18.4% males, WC=9.0% females; 17.5% males, SAD=23.0% females; 46.1% males, %BF=23.3% females; 30.6% males. In both sexes, anthropometric measures were positively correlated with triglycerides and CRP but inversely associated with high-density lipoprotein cholesterol, sit & reach, left grip strength, leg strength, push-ups, curl-ups and estimated maximal oxygen consumption (p_0.05). All anthropometric measures were significantly correlated with CV risk except WHR in females. The strongest predictor of CV risk was %BF. **CONCLUSIONS:** The rate of obesity in Colorado firefighters varies depending on the measure used. There are significant associations between obesity and lifestyle factors that should be further explored. Percent BF is the strongest predictor of CV risk in this population and may be appropriate in assessing CV risk in populations of similar demographics.

Category A
Mentor: T Nelson, Ph.D., M.P.H.

48. THE PHYSIOLOGICAL EFFECTS OF CYCLING CADENCE ON ELITE MOUNTAIN BIKERS – PILOT STUDY

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Cycling cadence is a highly researched area in the exercise science field with the purpose of providing more knowledge to better coach cyclists. However, the research to date has used either professional road or amateur cyclists. There is a lack of cadence research in the sport of elite mountain biking. **PURPOSE:** This purpose of this pilot study was to look at the effects of cycling cadence on certain physiological variables (O^2 consumption, substrate utilization, and lactate accumulation) in elite mountain bikers. **METHODS:** For this study each subject performed three ten minute cycling bouts at 10% above measured lactate threshold at different cadences (low (50-60rpm), moderate (80-90 rpm) or high (100-110 rpm)). Data was collected using an Accutrend lactate monitor and a Parvomedics gas analysis cart. **RESULTS:** Data collected shows the largest change with increased cadence was an increase in the percentage of carbohydrates (CHO) used for energy production with the high cadence using ~19% more CHO than the low cadence; this observation is further backed up by a p-value of .001. O^2 consumption and lactate accumulation showed little or no change. **CONCLUSIONS:** This study suggests that cyclists and their coaches need to take the aspect of substrate utilization into account when deciding to use a specific cadence for a race or training session in order to meet the demands of the event and maximize performance. The results of this study show that a lower cadence may be beneficial in a longer duration event due to the observed increase in fat utilization at the lower cadence range. However, the limited size of this study does not allow the authors to make any firm conclusions on the observed changes but it does suggest paths to pursue in future studies. Further research in this area can confirm the results observed in this pilot study.

Category A

49. LONG TERM AMPK ACTIVATION LIMITS OBESITY INDUCED MUSCLE ATROPHY

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Obesity and its comorbidities have significant impacts on skeletal muscle function that affect an individual's activities of daily living. This decrease in function is due to muscle atrophy induced by obesity. **PURPOSE**: The aim of this study was to identify obesity-induced alterations in regulatory mechanisms of skeletal muscle mass and how they would be altered with long term (8 weeks) AMP kinase (AMPK)-agonist treatment. **METHODS**: Eight week old male, lean (L) wild type [body weight (BW) = 26.9 g] and ob/ob (O) [BW = 46.2 g] mice were fed an AMPK activator, β-Guanidinopropionic acid (β-GPA) (F), mixed at a 1% concentration within their food or normal chow as control (C) for 8 wks. Following an overnight (12 hr) fast, all mice were sacrificed and the gastrocnemius complex was excised for analysis. **RESULTS**: Whole body mass was reduced in LF and OF ($p<0.05$) (OF similar to LC) at the end of the treatment period. Muscle mass was lower in the OC (121.08 ± 9.3 mg) versus LC mice (158.4 ± 5.6 mg ($p<0.05$)). This corresponded with decreases in raptor associated with mTOR ($p<0.05$) in the OC. Following treatment, western analysis of OF muscle lysates displayed increased AMPK and acetyl-CoA carboxylase phosphorylation compared with LC and OC mice ($p<0.05$). OC mice displayed higher activation of mammalian Target of Rapamycin (mTOR)-regulated signaling (S6K1, 4E-BP1, and GSK3), which was reciprocally altered after 8 wks of β-GPA feeding ($p<0.05$). **CONCLUSIONS**: These data show that long term (8 wk) AMPK-agonist treatment can augment obesity-induced alterations in regulatory mechanisms of skeletal muscle mass through the normalization to lean levels of mTOR signaling.

Category A

Mentor: BF Miller PhD

CATEGORY B

50. HUMAN FACTORS ASSOCIATED WITH ODDS OF SUCCESSFULLY COMPLETING A HIGH-ALTITUDE ULTRA-ENDURANCE MOUNTAIN BIKE RACE

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BACKGROUND: The Leadville 100 Mountain Bike Race is an ultra-endurance high altitude race in Colorado. The course ranges in altitude from 2804m to 3840m. **PURPOSE:** To determine the human factors associated with finishing this ultra-endurance race. **METHODS:** All participants received either electronic or paper surveys before the race. Major variables included information regarding prior race completion, height, weight, age, gender, training patterns, residing and training altitudes. Note that the information regarding cyclists' age, gender, and race time is also available to the public on-line. **RESULTS:** Out of 1337 competitors who started the race, 1207 responded (90.3%) to the survey. Average age was 43.2 (range 21-74) years. Average height, weight, BMI, resident and training altitude were 178.9cm, 75.7kg, 23.6kg/m^2, 924m, and 981m respectively. Most participants (89.5%) were male. Only a few (n=15, 1.1%) needed to be referred to the local emergency room or transferred to an outside hospital. The majority of racers (n=913, 68.3%) finished the race under the cut-off time of 12 hours. More than half (815, 61%) had never previously finished this race. Male gender ($p < 0.001$), lower BMI ($p < 0.001$), prior race completion ($p < 0.001$), younger age ($p < 0.01$), and training at higher altitude ($p < 0.05$) correlated with completing the race. Residing at higher altitude, height, and duration and intensity of training were not associated with successfully completing the race under the 12-hour cut-off time. **CONCLUSION:** In this high-altitude event, the injury rate was low. Male gender, lower BMI, prior race completion, younger age, and training at higher altitude correlated with successfully finishing the race. Reported training duration and intensity, height independent of BMI, and residing at higher altitude were not correlated with successfully completing the race. **SIGNIFICANCE:** This study provides insight into human factors associated with successfully completing a high-altitude ultra-endurance mountain bike race.

Category B (Mentor: Morteza Khodaee, MD, MPH)

51. PELVIC INJURY: DIRT BIKE RACING

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History: Fifteen year old male presents 3 days after crashing his dirt bike. He was going about sixty miles per hour and crashed with subsequent loss of consciousness. He was wearing a helmet. Patient was unable to recall anything before the crash and was likely unconscious for approximately 1 minute. Upon regaining consciousness, he had severe pain in his right leg and right low back and was unable to bear weight on his right leg. Patient also had a headache, but this resolved quickly. He had no other neurologic symptoms or vomiting.

He was seen in the ER the day of the crash and found to have negative focused assessment sonography of trauma (FAST) scan and urinalysis. X-rays of lumbar spine and pelvis were read as negative for fracture/dislocation. Head CT was not performed. He was given pain medicine and crutches and told to follow up with his primary care physician.

In clinic, he still complains of severe pain in right leg and right low back and is unable to bear weight on his right leg. He has no headache or neurologic symptoms.

Physical exam: Pelvis was stable with compression. Tenderness to palpation on right lumbar region, sacrum, and right iliac crest. Decreased lumbar range of motion with flexion and extension because of pain. Decreased internal and external hip

range of motion with pain elicited by flexion, extension, internal rotation, external rotation, adduction, and abduction. No tenderness to palpation over pubic symphysis. Unable to bear weight on right leg.

Differential diagnosis:

1. Acetabular fracture
2. Sacral fracture
3. Lumbar fracture
4. Iliac crest fracture
5. Pubic ramus fracture
6. Hip contusion
7. Acetabular labral tear
8. Renal contusion

Tests and Results:

1. X-rays of hip/pelvis: Widening of pubic symphysis and bilateral sacroiliac joints suspicious for pelvic trauma and diastasis. Questionable fracture vs. normal physis through medial wall of right acetabulum.
2. CT of pelvis: Anterior column fracture of right acetabulum with nondisplaced fracture of right inferior pubic ramus. Comminuted right sacral ala fracture with mild to moderate diastasis of right sacroiliac joint.

Final/working diagnosis: Right acetabular fracture, right inferior pubic ramus fracture, comminuted right sacral ala fracture, and concussion.

Treatment:

1. Patient was provided pain medicine, made non weight bearing with crutches, and referred urgently to pediatric orthopedic trauma surgeon.
2. Second pelvic x-ray and CT one week later showed no displacement or instability, and patient was continued on non weight bearing status with crutches.
3. Repeat x-rays one month later showed healed pelvic ring fracture, and patient was weaned off crutches to be weight bearing as tolerated and referred to physical therapy.
4. Concussion symptoms were monitored but resolved rather quickly.
5. Return to full activity at 3 months.

Category B (Mentor: Morteza Khodaee, MD, MPH)

CATEGORY C

52. DECREASING VASCULAR PERMEABILITY DOES NOT IMPROVE VOLUNTARY PHYSICAL ACTIVITY IN A MODEL OF ACUTE MOUNTAIN SICKNESS

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Acute mountain sickness (AMS) affects > 60% of individuals ascending to altitude, yet the etiology is unclear. Symptoms include lethargy, inactivity, headache, and in severe cases pulmonary or cerebral edema. Current treatments for AMS are targeted at vasodilation, enhancing fluid clearance, and increasing ventilation. **Hypothesis**: We postulated that decreasing the vascular permeability that gives rise to pulmonary and cerebral edema would

result in a return of physical activity (PA) to normoxic levels. **Methods**: Adult male SD rats were acclimated to voluntary PA for a minimum of one wk using running wheels. Rats were then exposed to 48 hrs of 14,000ft simulated altitude and treated with combinations of compounds to decrease vascular leak including endothelin receptor (ETr) antagonists, Nrf2 activators, carbonic anhydrase (CA) inhibitors, Ca++ channel blockers, and phosphodiesterase (PDE) inhibitors. PA was continuously monitored during exposure to simulated altitude while pulmonary and cerebral vascular leak were evaluated at the end of 48 hrs. **Results**: Treatment with ETr antagonists, Nrf2 activators, CA inhibitors, and Ca++ channel blockers significantly decreased vascular leak, without increasing physical activity. Conversely, treatment with a PDE inhibitor significantly increased PA without decreasing permeability. **Conclusion**: In our model, decreasing vascular permeability does not result in improvement in voluntary PA in hypoxia. While it is possible to attenuate hypoxia- induced increases in vascular permeability it is not the only mechanism by which PA is diminished.

Category C