Kyle. J. Hackney, PhD, CSCS, CCD
Associate Professor & Graduate Coordinator

The Aims of the Muscle, Metabolism, and Ergogenics Workgroup are to:

1) understand how exercise, nutrition, and environmental stimuli interact to produce phenotype changes (examples- skeletal hypertrophy, strength gain, fatigue resistance); 2) develop exercise-nutrition interventions for a variety populations (recreational exercisers, elite athletes, aging adults, individuals with disabilities, or other specialized populations) that may benefit. In this capacity, faculty, undergraduate, and graduate students work within the scope of three research areas:

- Muscle Health with Aging
- Countermeasures to Inactivity or Musculoskeletal Disuse
- Human Performance and Ergogenic Aids

Click here to see where we are publishing our work!

Below are some selected publications by students.

Blood flow restriction exercise stimulates mobilization of hematopoietic stem/progenitor cells and increases the circulating ACE2 levels in healthy adults

S Joshi, S Mahoney, J Jahan, L Pitts, KJ Hackney, YPR Jarajapu

Journal of Applied Physiology 128 (5), 1423-1431

Contribution of Protein Intake and Concurrent Exercise to Skeletal Muscle Quality with Aging

ND Dicks, CJ Kotarsky, KA Trautman, AM Barry, JF Keith, S Mitchell, ...

The Journal of Frailty & Aging, 1-6

Endothelial, Cardiovascular, and Performance Responses to L-Arginine Intake and Resistance Exercise

DM Streeter, KA Trautman, TW Bennett, LE McIntosh, JW Grier, ...

International journal of exercise science 12 (2), 701

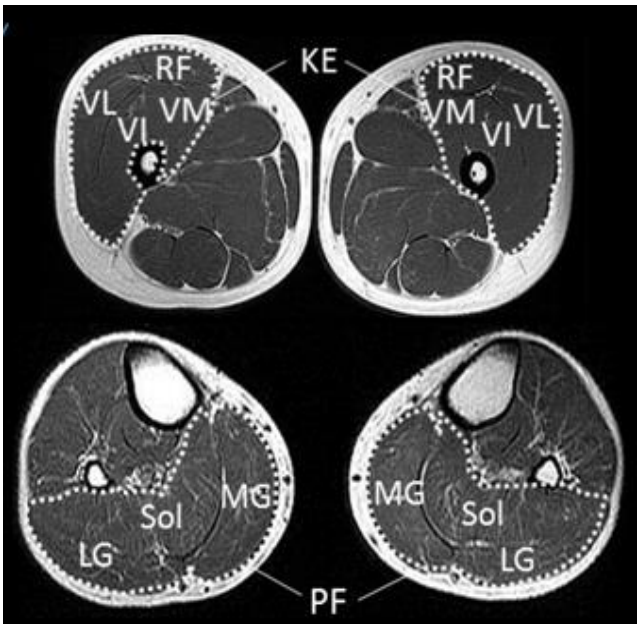
Simulated Casualty Evacuation Performance Is Augmented by Deadlift Peak Force

WM Poser, KA Trautman, ND Dicks, BK Christensen, KJ Lyman, ...

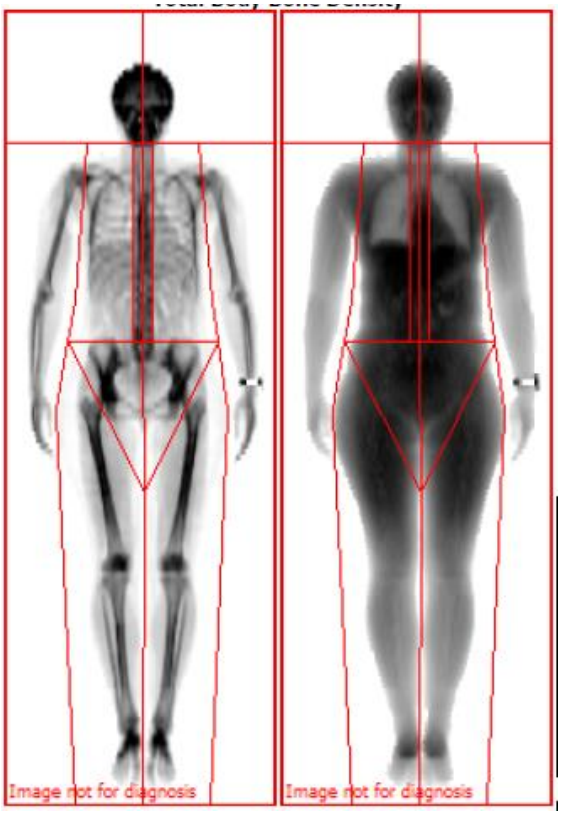
Military medicine

Research Area 1) Muscle Health with Aging.

In the United States individuals over the age of 65 years is the fast growing segment of the population. In North Dakota the population is expected to increase by 50% by 2025 (from 98,595 to 148,060). Unfortunately, the fifth decade of life is associated with an age related reduction in muscle mass (sacropenia) and strength (dynapenia). The fundamental question being asked in this research area is *"What exercise and nutrition interventions may be the most effective in prolonging the negative effects of sarcopenia, dynapenia, and the loss of functional independence as we age?* We seek to 1) observe changes in muscle morphology using gold-standard analysis techniques such magnetic resonance imaging (MRI) and dual energy x-ray absorptiometry (DEXA); and diagnostic ultrasound including an innovate new technique called MuscleSound. 2) explore strength/endurance and steadiness using Biodex; 3) examine neural drive using the interpolated twitch technique; and 4) evaluate real world changes in task performance and function (example- ability to complete activities of daily living).

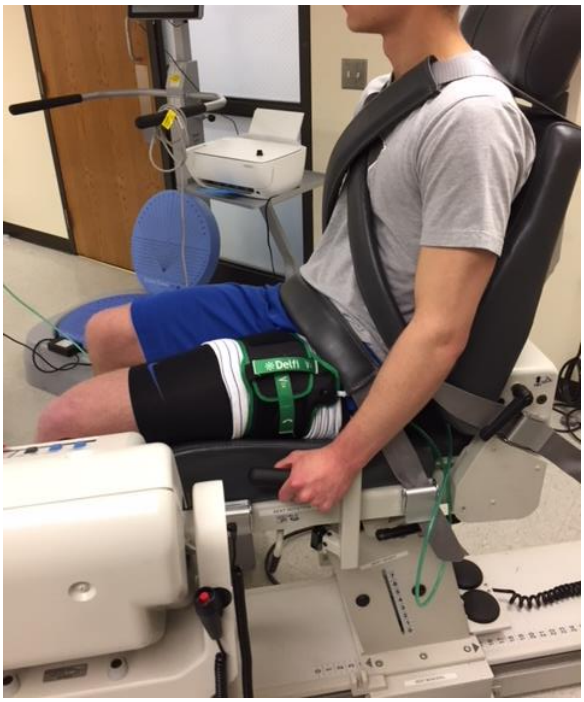


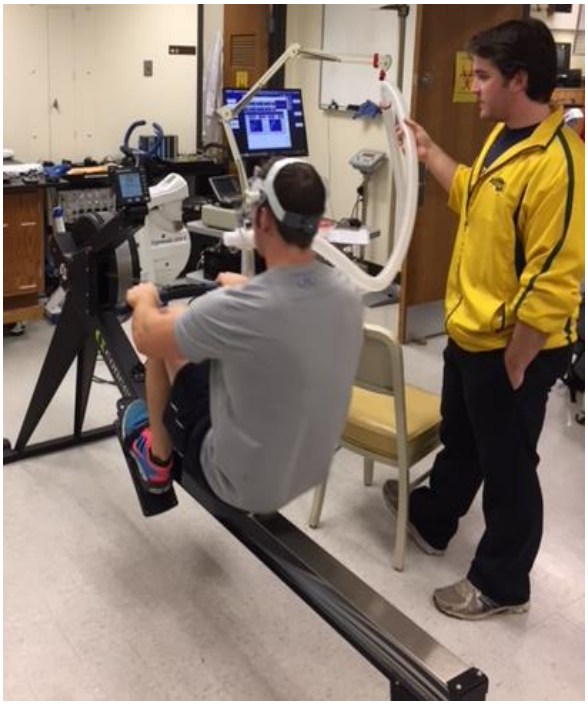
Example MRI scan of upper (KE= knee extensors) and lower (PF=plantar flexors) limbs.



Research Area: 2) Countermeasures to Muscle and Strength Loss During Inactivity/Disuse or Injury.

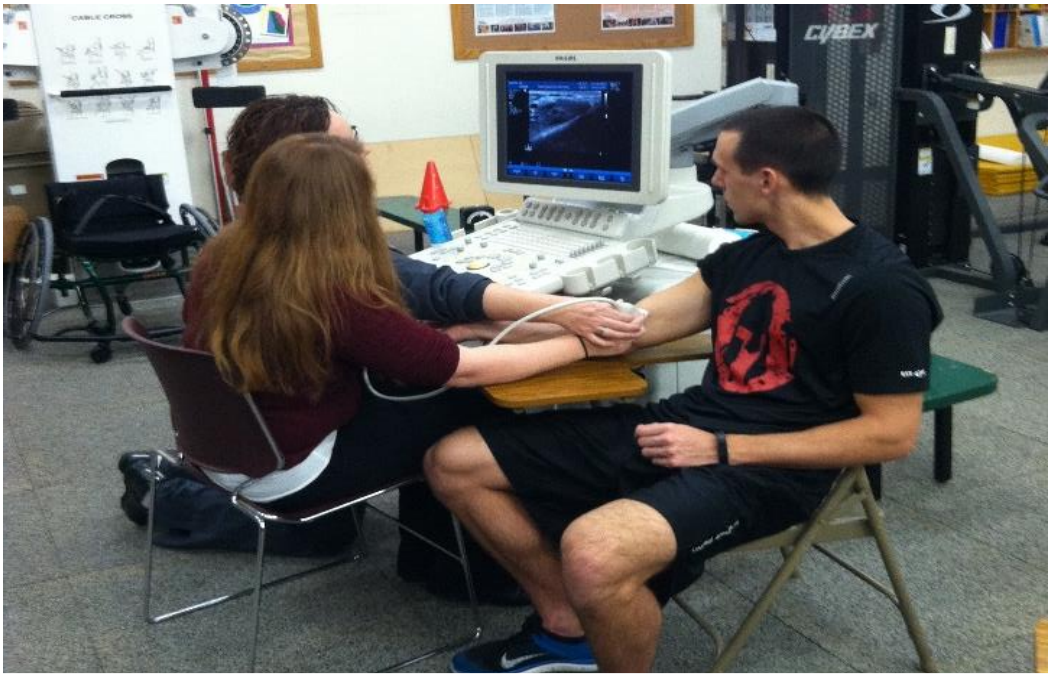
The fundamental question being asked in this research area is *"can exercise prescription, nutritional intake, or a combination of exercise and nutrition overcome the negative effects of inactivity/disuse or enhance recovery from injury?"* Changes in muscle morphology, metabolism, and function are a well-known consequences of inactivity or disuse. This may occur from: 1) an accumulation of small events such as sitting 8 hours each day; 5 days per week at a sedentary job, 2) extended immobilization following injury, surgery, or hospitalization; or 3) a very complex endeavor such as prolonged exposure to microgravity via spaceflight. In this focus, we strive to explore these adaptations using multiple analogs (examples- unilateral limb suspension, boot walking, etc).Our goal is to explore novel interventions such as leucine, L-argine, and/or creatine supplementation, compression exercise, or combination of both nutritional supplementation and exercise to combat the negative consequences of deconditioning from inactivity/disuse or injury. Further, we within this area we seek to answer the question, "*What is the acceptable level of fitness loss for an astronaut during long duration spaceflight*?" Muscle mass, strength, and endurance losses are an unwelcomed reality once gravitational loading is removed. Our initial research in this area has a used a weighted suit model in attempt to understand fitness and performance thresholds that could help NASA define fitness for duty requirements.





Research Area: 3) Human Performance and Ergogenic Aids.

The fundamental question being asked in this research area is *"can athletic or occupational performance be optimized through exercise training and nutrition?* Exercise training is highly variable and specific to the sport or occupational tasks required; therefore; in this research area we strive to make meaningful contributions to a science that is rapidly evolving and adapting. Many outcome variables in this research area are considered classic (example- VO_2 max, lactate threshold, one repetition max, vertical jump, agility timing); while others are highly innovative (example- blood flow and muscle cross-sectional area assessment via ultrasound). Nutritional modulation can occur in a variety of ways and may include: 1) alterations in total energy intake, macronutrient percentages, and the amount of water consumed; 2) moderate increases in specific foods or dietary supplements (examples vitamins, carbohydrate, caffeine, and phosphocreatine); or 3) complex changes in dietary habits (removal casein, gluten, or dairy).

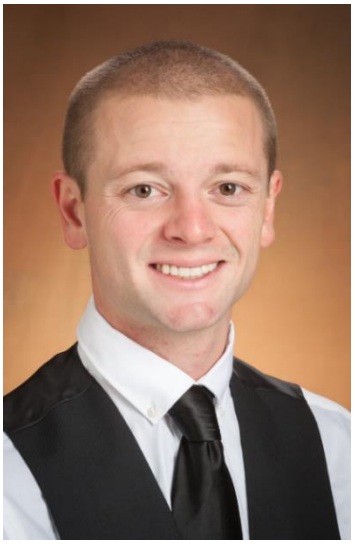


Example-Brachial artery blood flow assessment in collaboration with dietary supplement and exercise intake.

Primary Student Advisor:

Current Doctoral Students-

Sean Mahoney, MS is a third year doctoral student in the Health, Nutrition, and Exercise Sciences program at NDSU. He completed his master's degree at NDSU as well, focusing on blood flow restriction during rowing exercise as a supplemental exercise intervention for microgravity-induced deconditioning. His research interests are broad and range from focusing on developing methods of assessment and intervention for astronauts during long-duration spaceflight to identifying physical activity patterns and strategies in elementary-aged students.



Logan Pitts, BS is a third year doctoral student working towards his degree in Exercise Science and Nutrition. He completed his undergraduate degree in Kinesiology - Health and Human Performance at Saint Mary's College of California in 2015. Logan is a Certified Strength and Conditioning Specialist (CSCS) through the National Strength and Conditioning Association (NSCA) and worked as a personal trainer and strength and conditioning coach prior to his move to Fargo. Despite continued curiosity in athletic performance improvement, Logan's research interests are centered around exercise programming for individuals with type 2 diabetes.

Adam Bradley, MS is a second year doctoral student after joining NDSU in August 2019. His research interests include athletic performance, hypertrophy, and microgravity countermeasures. Bradley previously served in strength and conditioning roles at the University of Louisiana, the University of Texas, and Iowa State University. He earned a bachelor's degree in Kinesiology from Iowa State University in 2017. Bradley competed in football for the Cyclones, playing on the defensive line. He completed his master's degree in Kinesiology from the University of Louisiana in 2018. Bradley holds his CSCS through the National Strength and Conditioning Association, his SCCC through the Collegiate Strength & Conditioning Coaches association, and is certified as a Level 1 Sports Performance Coach through USA Weightlifting.

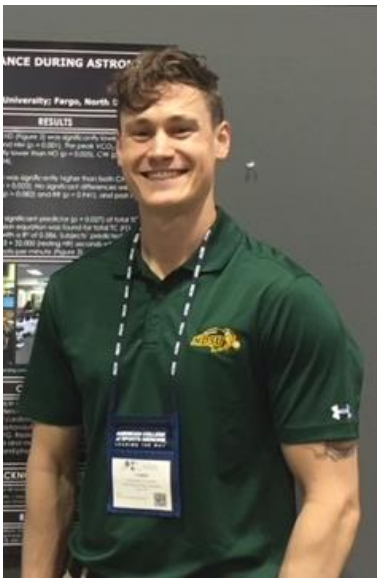
Current Masters Students

Miranda Ripplinger, BS. Miranda is a second-year master's student and National Strength and Conditioning Association Certified Personal Trainer. She completed her undergraduate degree at NDSU with a Clinical Exercise Physiologist internship at Duke University in Durham, North Carolina. Her main research interests involve cardiovascular health and aging. Her goal following the completion of the master's program is to begin work in a clinical setting and eventually earn a doctoral degree. In her free-time, Miranda loves to bow and rifle hunt, fish, lift weights, and travel.

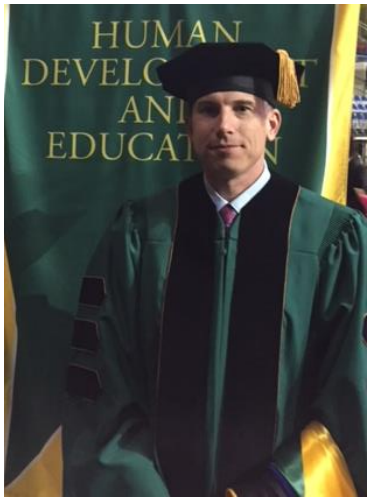
Kelly Csernica, BS. Kelly is a first year her master's degree in Exercise and Nutrition Science. She completed her undergraduate degree at Ithaca College in Health Sciences with concentrations in Nutrition and Exercise Science. Her research interests include maximizing cardiovascular performance through nutrition interventions and stemmed from undergraduate experience rowing varsity crew. Her career goals include continuing academic research or working with competitive athletes to apply findings.

MME Lab Alumni

Kara Trautman, PhD- 2020; Assistant Professor, Gustavus Adolphus College, St Peter, Minnesota.



Chris Kotarsky, PhD-2020; Visiting Assistant Professor, Skidmore College, Saratoga Springs, New York.



Nathan Dicks, PhD- 2019-Assistant Professor, Concordia College, Moorhead, Minnesota.

Validity of Critical Velocity Regression Equation to Estimate Weighted Sprint Performance: 2968 Board# 251 June 1 3

ND Dicks, TV Joe, KJ Hackney, RW Pettitt

Medicine & Science in Sports & Exercise 50 (5S), 736-737

Validity of Critical Velocity Concept for Weighted Sprinting Performance

ND Dicks, TV Joe, KJ Hackney, RW Pettitt

International journal of exercise science 11 (4), 900

Thomas Lillquist, BS ,MS-2020

Sean Mahoney, BS, MS

Dan Streeter, BA, MS

Whitney Poser, BS, MS

Chris Kotarsky, BS, MS