3-2011

# Human Performance Lab Newsletter, March 2011

St. Cloud State University

# Human Performance Lab News & Views

Department of Health, Physical Education, Recreation, and Sport Science

**March 2011**

## KELLY'S CORNER

**David Bacharach**

Hello to everyone from the HPL. It has been an exciting year for us. Both Prof. Glenn Street and I were granted sabbaticals for the full academic year. It took a bit of wrangling to convince our own department chair and college dean that we could continue to run the lab as normal in spite of our other tasks. My plans included serving as a guest professor at the University of Salzburg during the fall semester while Glenn's main objective is to author a book on prosthetics. So in my absence, Glenn took charge of the Adult Fitness Program. Since he was trained by our founder (Jack Kelly, although we won't say what years those were) everything ran as smooth as silk. In Austria, my primary role was to lecture (in English) in two different classes. One was global perspectives of physical fitness and the second a laboratory techniques course. Relative to fitness, Europe is unfortunately on the same fast track for chronic disease as we are, just 10 years behind. What appears more alarming is the younger generation may be at greater risk than the older folks because they are the ones that are quick to adopt Western culture. An elementary school teacher explained to me (in German) that for her students, a weekend wasn't "fun" unless it involved a trip to McDonald's. Diet is clearly becoming an issue even for an agrarian country like Austria. Refined foods with their long shelf life are replacing whole foods that may spoil more quickly. But that also means important nutrients are diminishing in their diet and replaced by empty calorie foods. Technology is also a large factor as it is truly a double edged sword: more technology, less physical labor. Much of Europe is captivated by technology yet still deaf to the warnings of inactivity demonstrated by our country. Keys for optimal fitness and independent living include a sound diet plentiful in vegetables and fruit for a healthy body mass index (BMI), and being physically active on a daily basis. No new secrets, only confirmation that what the HPL set out to do 40+ years ago still holds true: live the best we can, stay active, eat well, take care of ourselves and be thankful for all that we can do.

## Socket Wall Texture

**Janna Miron**

Movement inside a prosthetic socket is seldom a good thing. It creates the potential for discomfort and damage to the residual limb, as well as leaving the amputee with less control of the prosthesis. Vacuum suspension was developed in 2001 to eliminate movement in the socket. The vacuum system can be explained using a syringe analogy. The body of the syringe is the socket and the plunger is the residual limb. If the hole at the bottom of the syringe is plugged it is difficult to pull the plunger out; however, when the hole is not plugged the plunger is free to slide. This is similar to how the vacuum system works in that when it is sealed it is difficult to move, which gives the amputee more control over their prosthetic limb, and provides a better environment for the residual limb. Although vacuum suspension is currently the best system available, some individuals still experience movement in the socket. Carl Caspers, amputee and inventor of the vacuum technology, is experimenting with texturing the inside of socket walls to increase friction and improve the limb's connection to the socket. For my thesis project, I'm measuring the frictions of the various textures in hopes of identifying the one that provides the amputee with the best connection and healthiest environment.

# Second Year Graduate Students

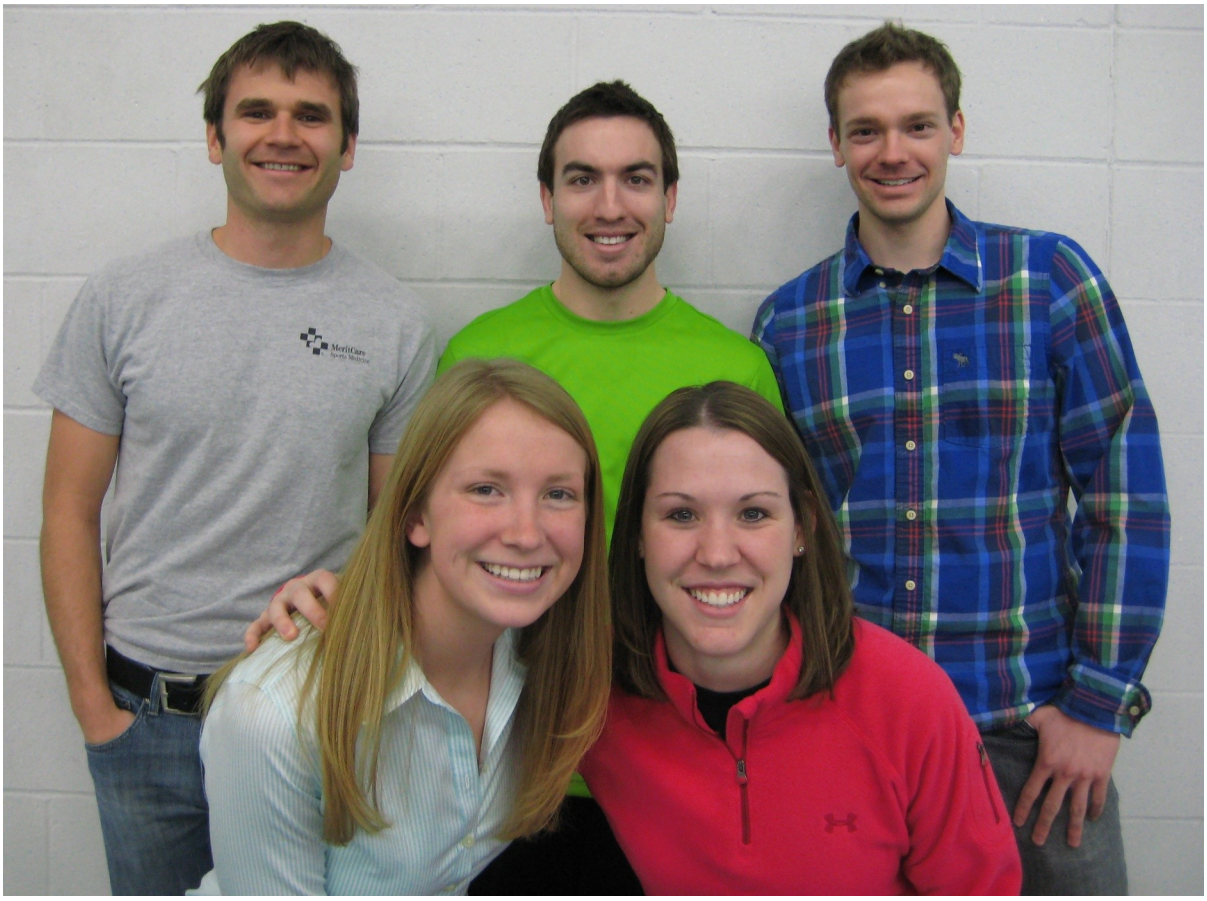
**Dennis Madden** spent last summer interning at the Institute for Exercise Medicine and Prevention in St. Paul. He is studying high-intensity training in cycling for his thesis. He hopes to work with elite endurance athletes and will be completing his first ironman in August.

**Ashley Davenport** spent last summer interning at the ExMed Center at the University of Minnesota. She is currently a volunteer coach for the College of St. Benedict women's hockey team and is working on her final research project. Ashley was accepted to medical school and will begin her studies this coming fall at Des Moines University.

**Chad Johnson** spent the summer interning at Sanford Health in Fargo, North Dakota training athletes in knee rehabilitation programs. He is currently working on his thesis involving ischemic training and is planning to graduate with a Master of Science degree in Exercise Science this summer/fall. In addition to working on his thesis, Chad recently accepted a position with the YMCA as the Health and Wellness Director here in St. Cloud. He will unfortunately be leaving his position in the lab early, but it is a great opportunity for him to go out into the community and create wellness programs to positively impact others' lives.

**Kate Kaufmann** spent her summer interning with Summit Orthopedics. The combination of her experiences with orthopedic surgeries at Summit and time spent in the St. Cloud Hospital Emergency Trauma Center has led her to pursue a career as a physician assistant. She plans on entering a PA program in the fall. Her thesis looks at which starting block angle results in the most effective swim start which is quantified by power production.

**Eric Wright** plans on obtaining an internship this summer related to pulmonary or cardiovascular physiology. Upon graduating, he hopes to work at a clinic gaining further knowledge and experience in either of these fields. His thesis involves testing the efficacy of a fifteen minute refractory period used to reduce the severity of exercise induced asthma following its initial onset.



Left to right, back row: Chad Johnson, Dennis Madden, Eric Wright. Front row: Kate Kaufmann, Ashley Davenport

# Don't Lose the Big Picture: Insights for Training

**Dennis Madden**

Many times in the sporting world training methods and techniques are pioneered in the field only later to be explained by science. Endurance sports are certainly no exception to this. Over the past century, through trial and error, certain techniques have stood the test of time to become the staples of any endurance program. As enthusiasts, athletes, or researchers we turn to studies to explain why these work and hopefully refine our technique to bring about better performance. When we get excited about a new idea our vision of the big picture tends to narrow as we learn about it. Topics come in and out of vogue; lactate threshold, interval training, core temperature, sports drinks and glycogen, to name a few, have all at one time been labeled as the ultimate determinate of performance in the press. As athletes we get excited that new information will lead to a paradigm shift that will bring about new levels of performance. If you look at many websites and blogs, it just so happens that these shifts involve less work and departs from what has been proven in the field in the past. When we get too focused on one performance marker, such as lactate threshold, we sometimes forget that it is just one piece of the puzzle. Some of these parameters correlate well with performance, but they do not act alone. Only recently has the brain's role in performance had its turn in the spotlight. It seems intuitive that if all these individual measures were analyzed and managed by something in the body it would be the brain. Over the past 15 years an increasing amount of attention has been given to the brain and its role in endurance performance. Studying a central regulator that combines all of the above topics and even more variables might help bring the interest of athletes and enthusiasts back to truly proven techniques instead of looking for the next revolution.


# Upcoming 2011 National ACSM Presentations
# Denver, Colorado

- Chad Johnson, Ashley Davenport, and David W. Bacharach. *Pre-Competition Hydration Status of High School Athletes Participating in Alpine Skiing*.
- Kate Kaufmann and Glenn Street. *Influence of Block Angle on Take-off Velocity in Swim Starts.*
- Dennis Madden, Eric Wright and Glenn Street. *A Comparison of Absolute and Relative Upper Body Power with Roller Skiskating Performance*

***CONGRATULATIONS!!***

The faculty and staff of the Human Performance Laboratory would like to acknowledge and congratulate the following students who completed their master's degrees in 2010:

Ashlee Ford
April Kuschke
John Schapman

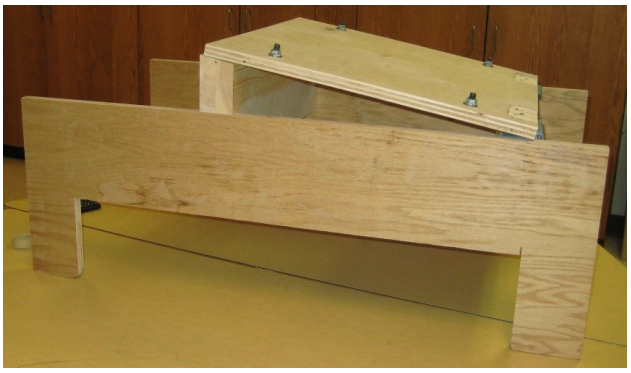
# Block Angle in Swim Starts

**Kate Kaufmann**

As a former competitive swimmer, I have always had trouble with starts. Between the various starting positions and different start blocks, there seemed to be many variables that affect a start. Last year in Laboratory Techniques, I started to explore these variables. Now, almost a year later, Dr. Street and I have built a hinged start block to adjust the starting block angle. I am making final preparations and plan to start testing swimmers for my thesis project.

The purpose of this study is to determine the optimal start block angle during a swim start. An effective swim start would include the shortest time spent on the start block while still generating a high take-off velocity. These two variables are used to calculate power, and for that reason, their product is a great indicator of start effectiveness. Power has surprisingly been underused as an indicator of start effectiveness in previous studies.

I plan to use swimmers on the SCSU swim team and will calculate the power from their starts at three different angles: 0, 10, and 20 degrees. Guidelines state that start blocks must be between 0-10 degrees, a fairly large range. I'm interested in seeing if there is a difference in power between the two extreme regulation angles and an even greater angle.



# Ischemic Strength Training

**Chad Johnson**

With the proper administration, strength training at an appropriate intensity can improve athletic performance, overall health of the general public, and injury rehabilitation. The general consensus of the necessary intensity for strength development is currently being challenged by a method called ischemic strength training. This type of training involves exercising at lower intensities than normally recommended during which blood flow is either fully or partially restricted using a blood pressure cuff. It has been proven that using intensities as low as 20% of a one repetition max with this method can result in significant adaptations in skeletal muscle.

In fact, it appears that similar physiological adaptations occur with ischemic training compared to those of traditional high intensity strength training. Reported average rates of hypertrophy during ischemic training range from 0.04% to 0.22% per day in the quadriceps muscle. This is similar to the range of 0.03% to 0.26% for conventional strength training. This method is ideal for injured, diseased, or aging populations because they are unable to exercise at the higher intensities traditionally used for gains in strength or muscle size.

There have been a wide variety of cuff pressures used in ischemic training studies. To date there are no studies reporting whether there is a relationship between muscle adaptations and the amount of external pressure applied. I will be examining this relationship and hope to gain a better understanding of the principles that make ischemic strength training effective.

## Happy 40th Anniversary to the Adult Fitness Program!

Remember, we are able to test many aspects of your health right here in the HPL! Assessments highlight cardiovascular fitness by monitoring heart rate, blood pressure, and electrocardiographic (EKG) responses to exercise in addition to body composition, pulmonary function, cholesterol, dietary profile and more. Contact Carol for **50% off** Adult Fitness Evaluation through May 1!

**Call: 320-308-3105 or email: HPL@stcloudstate.edu**

# HPL Alumni Feature
## Dr. Bruce Johnson, 1983

Wow, it has been a long time since I set foot on the SCSU campus. As I recall, in 1981, after being turned down for graduate school at the University of Minnesota, I made the long drive up to St. Cloud to meet with Dr. Kelly. The goal was to discuss the possibility of getting into the evolving program in Exercise Science. My grades were average and my GRE's were not much better. Luckily I had my cross country skis with me and after making sure my talents on the trails were not quite as good as Dr. Kelly's, "I was in." The program was outstanding; I had great peers to learn with, and it opened many doors going forward.

From SCSU days, I went on to work with the Department of Defense (altitude physiology), pursued a PhD at the University of Wisconsin in Respiratory Physiology and a post doctoral fellowship at Mayo Clinic, Rochester, MN in muscle physiology. My path evolved into a clinical position in the Division of Cardiovascular Diseases at Mayo, but over time, my drive to chase science and question accepted dogma got the better of me and I began writing grants and pursuing primarily a research career. This path has taken our lab to the extremes of the earth to better understand the limits of human performance and adaptation.

One of our more recent adventures, funded by the National Science Foundation, was studying the scientists and support personnel that work at the South Pole. Each year during our winter months (their summer) hundreds of individuals make their way to McMurdo Station (on the coast of Antarctica) to the South Pole Station. Many of the personnel have been involved in building a large neutrino detector that is embedded in the ice of the South Pole (Operation Ice Cube). Antarctica is the highest, driest, coldest and least populated continent on Earth. Most do not realize that the South Pole sits on almost two miles of ice that is slowly moving and changing. Also, due to the cold and spin of the earth, the barometric pressure at the South Pole is lower than typical, resulting in a high altitude exposure. The humidity is immeasurable and temperatures are typically in the –30 to –40 range (at the warmest). Personnel are typically flown from the coast to the South Pole in a little over 3 hours, resulting in a sudden exposure to the extreme conditions. Thus there is a high rate of acute mountain sickness (AMS) from the low inspired oxygen levels (Hypoxia). In addition there is risk of more severe altitude related illnesses such as high altitude pulmonary edema (HAPE) and high altitude cerebral edema (HACE).

Since there is typically a large population that is transferred to the South Pole, and since personnel are transferred in a very uniform fashion, it offers a unique setting to understand the epidemiology of altitude illness. Our goal therefore was to quantify the incidence of altitude illness, understand better the risk factors for altitude sickness and to develop algorithms that predict risk. This type of work has broad implications for the public traveling to high altitude as well as the military where personnel are often transported rapidly to high altitude and are subsequently exposed to dangerous conditions that require both physical and mental acuity.

The study required that myself and members of our laboratory travel to New Zealand, McMurdo Station and on to the South Pole twice for a 6-8 week window of time over the course of 2 years. Weather conditions made travel unpredictable and thus on both expeditions, portions of our group were trapped for weeks at the South Pole awaiting temperatures to rise or visual conditions to improve. Planes can land at the South Pole, but cannot stay for long or the hydraulics can freeze. In addition, the South Pole is essentially like an ice desert and when the winds blow, there is nothing to stop them.

The U.S. has built a new station on stilts at the South Pole, which is where we set up a laboratory. However, many of the support staff slept in heated tents surrounding the station and worked out-

doors for long hours each day. We collected blood samples, DNA, measured lung function, autonomic and cardiovascular function, gene expression and evaluated their sleep physiology.

The study was very successful from a recruitment and data collection standpoint and we are just now submitting manuscripts for publication. We expect to learn a great deal from these data, not only about healthy humans adapting to extreme environments but also about clinical conditions where hypoxia is part of the pathophysiology of the disease, such as heart failure and lung disease.

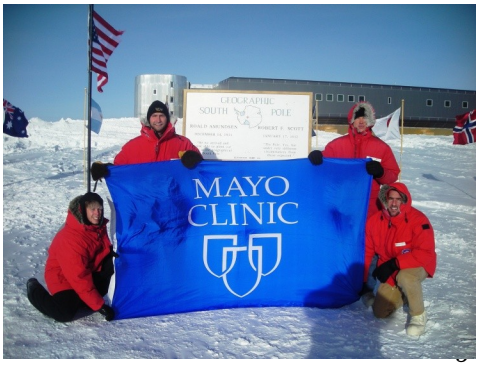
*-Research/news Web Links.*

http://mayoresearch.mayo.edu/mayo/research/Staff/johnson_bd.cfm

http://mayoresearch.mayo.edu/mayo/research/asap/

http://newsblog.mayoclinic.org/2010/01/15/mayo-clinic-takes-extreme-medicine-to-argentina/

http://www.prnewswire.com/news-releases/vivometrics-lifeshirt-going-to-south-pole-to-uncover-clues-to-high-altitude-illness-58472672.html



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## Thank you, Thank you, Thank you!!!!

The staff and students at the HPL greatly appreciate the financial support so many of you have provided over the years. We are always so gratified to know that you believe in our work enough to personally invest in it. We thank the following people who made contributions to the Adult Fitness Program in 2010.

Dave and Nancy Bacharach
Ray and Phyllis Collins
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James and Marcella Gammell
Curtis and Betty Ghylin
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John Pike
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Timothy Schuchard
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Suzette E. Sutherland, MD and
D. Bradford Neary
Stephen and Elaine Thrune

Should you be in a position to make a contribution to the HPL, please make checks payable to:

SCSU Foundation-Adult Fitness
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HPL Staff (L to R): Glenn Street, Carol Shaw, David Bacharach