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## Human Performance Lab Newsletter, March 2013

St. Cloud State University

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# Human Performance Lab

## News & Views

Department of Kinesiology, Health and Physical Education

March 2013

### Kelly's Corner

David Bacharach

Hello to everyone from the HPL. It is with a heavy heart that I inform you of the loss of a very dear member of our HPL family this year. Doris Kelly, life partner of our founder Jack passed away this January. We have always viewed everyone that comes through our doors as family; however, the passing of Doris who impacted so many of us is a vivid reminder of how precious life is for all of us.

A friend recently shared a different story with me about walking away from a near certain deadly plane crash. In both instances, I was struck by our vulnerability facing death and life if you will. The lessons we might take away from such events are sobering; but, they should also be uplifting. We are still alive and we should strive to make the most of every day.

From these events, I'd like to share these tidbits or food for thought:

**1.) Life is short** – I'm sure we have all said it, yet we disregard our own feelings. It is only when we lose someone close to us that we reflect on this statement. Maybe we change for awhile, but as time distances us from our loss, we often revert back to the mentality that it can't happen to us. It can and it will. It's just a simple matter of time.

**2.) Its all relative** – Oftentimes we get upset over details that for the most part are simply "small details." Keep things in perspective. Spend your time loving family, friends and things that matter most to you. Take time to enjoy each day for what it can bring.

**3.) Don't judge** – Judging someone else's behavior or appearance is wasted time. If you find yourself thinking about how to change someone else, look into a mirror and ask yourself what you can do to become a better person.

**4.) Forgive and forget** – Hindsight is 20/20. We must not dwell on our mistakes or those of others. We should acknowledge our mistakes, learn from them, forgive mistakes of others and then forget them. That is easy to say; yet, hard to do. Do it anyway. You'll love yourself more for doing so.

**5.) Reprioritize your life** – reflect on your life and ask yourself if you have given your best in all you do. Ask yourself what would be remembered about me if I died today? Did I do all I could for my family, my friends, my neighbors, my community, strangers who needed help and for my own health?

It is common for humans to put others first; a noble cause. But we can serve others most effectively if we, ourselves are healthy. We have known these things for years and it only confirms what the HPL set out to do 40+ years ago: watch out for the welfare of others, but at the same time take care of ourselves, live the best we can and be thankful for all that we can do.

### Decompression Sickness

Alumni Feature by Dennis Madden

It's hard to believe a week prior to writing this I was giving orders to our test subjects in Croatian while operating a piece of equipment that costs as much as a German sports car. About a year ago, I was finishing the final paperwork necessary to complete my graduate experience at SCSU and was beginning to panic about my next step. I had applied for many of my "dream jobs" only to receive responses along the lines of "we're sorry, we don't have the money to fund new people in this economy." Whether it was true or not, it at least helped heal a wounded ego! Fortunately, the alumni network provided me with a unique opportunity. The position was a 3-year research grant funded by the European Union to research decompression sickness (DCS). The research was being conducted by a newly formed organization called the PHYPODE project (PHYsioPathology Of DEcompression) with laboratories located on three continents.

Despite the differences in equipment and the intents of recreational and professional diving, the same laws of physics must be obeyed. The recommended depth limit for breathing compressed air is approximately 120 feet, although physically it is possible to go as deep as 220 feet. At these depths, an increase in pressure is created which drives nitrogen into the body tissues. During ascension, the decrease in pressure causes the nitrogen to leak back into the blood as bubbles. Additionally, the longer the dive, the more time nitrogen has to be absorbed by the tissue which is why a maximum of one hour is typically recommended for recreational diving. (cont. on page 4)





## First Year Graduate Students

Jill Gromberg (center), a 1994 alumni of our graduate program, teaches nutrition and other health related classes at Anoka Ramsey Community College. Jill took a sabbatical leave from Anoka this past fall (2012) and elected to spend her time in the Human Performance Lab. During her sabbatical, Jill team-taught an undergraduate anatomy course and mentored the first year students in their first two graduate courses; 620 Seminar and 626 Laboratory Techniques in Exercise Science. We were all blessed by Jill's presence and her valuable contributions.



Becca McCoy (left) comes from La Crescent, MN, and did her undergraduate degree at St. Mary's University. She plans to pursue orthopedics upon completion of her master's degree in exercise science at St. Cloud. She is looking forward to her internship this coming summer, in which she will be working with a general surgeon.

Kasara Mahlmeister (right) is from Eyota, MN, and completed her undergraduate degree at Minnesota State University, Mankato. She is pursuing a degree in exercise science, and ultimately hopes to attend medical school with a focus in cardiology. She did six years with the Army and hopes to return to the military after all her schooling.

## Upcoming 2013 National ACSM Presentations, Indianapolis, IN

- ◆ Kyle Miller, Emily Willaert, Steve Milkovich, Kelley Holmes, Glenn Street & David Bacharach, Cost of Positive and Negative Work on a Cycle Ergometer
- ◆ Kelley Holmes & David Bacharach, Perceived Importance of Strength and Conditioning Relative to Sports Orientation in Junior Alpine Ski Racers.

### **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 2012:

Kathryn Kaufmann  
Mary Mauer





# Speed Walking: A Superior Alternative to Recreational Running/Jogging?

By: Kyle Miller



According to the National Sporting Goods Association's (NSGA) 2011 sports participation survey<sup>1</sup>, of the nearly 281 million U.S. citizens ages 7 and up, an estimated 38.7 million people consider running/jogging as their primary form of exercise. However, it is not unreasonable to assume that less than 1% of those 38.7 million, probably realize that they would burn more calories and incur fewer injuries if they switched to speed walking instead of their usual running/jogging. This, of course, begs the question: If speed walking is vastly superior to running/jogging, then why are so few people aware of this fact? There are two main reasons: first, there is no formal definition of speed-walking, and second, there has been relatively little scientific research comparing walking and running/jogging across a range of overlapping velocities.

As you can imagine, finding information about the benefits of speed walking when the term technically doesn't exist can be quite difficult. To remedy this lack of definition, a master's study, to be completed May 2013, has defined speed walking as: walking at a velocity equal to or in excess of 5.0 mph ( $\sim 2.24 \text{ m}\cdot\text{s}^{-1}$ ) by means of any walking gait (normal, racewalking, or hybrid). Now that we know what speed-walking is, we can approach the few studies that have directly compared walking to running/jogging knowing what to look for.

Perhaps the first study to compare the metabolic cost of walking to running/jogging, across overlapping velocities, was conducted in 1968 by the plucky research team of Menier and Pugh<sup>2</sup>. Using four Olympic racewalkers as their subjects (because they did not believe civilians could walk faster than 5.0 mph) the researchers discovered that at 5.0 mph the

metabolic cost of walking and jogging was the same, and from that speed forward the cost of walking increased at twice the rate of equally paced running! Sixteen years later, the research team of Hagberg and Coyle<sup>3</sup> made similar findings, using eight competitive racewalkers as their subjects. Even when 15, non-racewalking, females were selected for Greiwe and Kohrt's<sup>4</sup> study, the results remained effectively the same. Therefore, two things seem undeniable: you can't research the metabolic cost of walking versus running or jogging unless you have a two person research team, and you will burn significantly more calories walking at speeds > 5.0 mph than if you were to run or jog at an equal pace.

With the calorie burning superiority of speed walking well established, let us move on to the topic of injuries. Do you really have a reduced risk of injury speed walking, as opposed to running/jogging? You better believe it! There is plenty of research out there illuminating the fact that habitual running<sup>5-7</sup> has a much higher incidence of injury than walking<sup>8</sup> or race-walking<sup>9</sup>; however, one only needs to picture the two movements in one's head to come to the same conclusion. After all, a movement that revolves around bounding through the air and crashing down on one foot is clearly going to produce greater impact forces than one in which ground contact is always maintained.

The superiority of speed walking to running/jogging, in terms of capacity to burn calories and injury prevalence is obvious, but is it actually a *viable* alternative to running/jogging? It goes without saying that speed walking can only be considered a viable alternative if people are willing to make the switch, and people aren't likely to voluntarily choose a more difficult task. Sadly, research into the perceived exertion of walking versus running/jogging strongly indicates that people find speed-walking far more taxing than equally paced running<sup>3,4</sup>. In fact, in the latter of the two studies, subjects found walking at 4.5 mph significantly more difficult than jogging at the same pace despite the fact that all of their physiological markers of exertion were equal to or lower than jogging!

Why walking feels so much harder is anyone's guess, but it has been suggested that people's lack of familiarity with walking at high speeds is a major factor. To investigate this claim, a month long study, conducted in St. Cloud State University's Human Performance Lab, will seek to de-

termine if individuals can become accustomed to speed walking; thereby, reducing their perceived exertion and making speed walking not only a viable alternative to running/jogging, but a superior one as well! ☀



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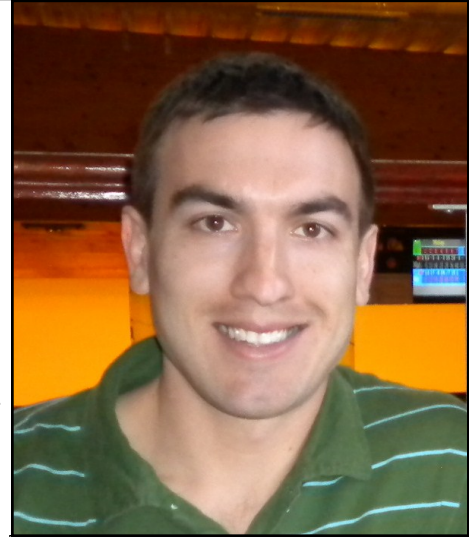
## Physiology of Decompression Sickness *(cont. from page 1)*

While these are not the absolute limits of diving, the risk of oxygen toxicity (resulting in convulsions and potential death) and nitrogen narcosis (feeling of alcohol intoxication) increase. By altering the breathing gas mixture, this risk can be mitigated. Divers may breathe lower oxygen (hypoxic) mixtures with inert gases like helium, argon, or neon. However, these mixtures are only used by professionals due to the cost (a diver could breathe \$10,000 worth of air in a single dive) and the dangers associated with this type of diving. These divers have reached depths of over 1000 feet. In these situations, decompression may take multiple days as opposed to a few minutes for a recreational dive. Therefore, divers may spend several weeks living underwater in diving bells and/or dive in shifts until the job is completed. Sounds expensive and crazy right? However, these divers play many crucial roles in our society such as the maintenance and installation of the intercontinental cables that make the Internet a worldwide web.

DCS or “the bends” is a condition associated with rapid decompression while resurfacing. It was previously thought the cause was bubbles in the blood. The bubbles would circulate throughout the body and get lodged in the joints, the spinal column, the brain, or the lungs causing pain, convulsions and death. But it’s never that simple. Several years ago, divers were observed handling large loads of bubbles in their circulation with no negative effects. In fact, some career divers experienced these conditions for years without ever reporting DCS-like symptoms. Newer research indicates microparticles (fragments of broken cells) that travel throughout the body may be more problematic than bubbles. In fact, recent research has taken microparticles from mice after an aggressive dive (in a tiny little hyperbaric chamber) and injected them into non-diving mice. The result? The non-diving mice experienced DCS. Nevertheless, bubbles may still play a role in DCS; bubbles seem to interact with the microparticles enlarging them and giving them a rough and hardened shell making them more dangerous. This interaction is not yet understood and is the focus of my research in Croatia.

Currently, we are exploring the use of high intensity exercise to stimulate microparticle and platelet release. Understanding how the body handles and clears them from circulation may provide useful information for divers. In addition, exercise is a great model for acclimation because it appears divers are capable of handling more dangerous dives after a history of diving. By combining this type of exercise with diving, we will hopefully get a better idea of how these bubbles interact with microparticles.

One of the goals of this project is to make current diving procedures safer. Currently, most diving protocols are based purely on math and the probability of developing DCS given certain parameters. By understanding the physiology, new procedures can be developed which will increase safety for career, military, and recreational divers. So far, this quest has taken me to Croatia, Belgium, Italy and Egypt (Yes, diving is huge in Egypt! The Red Sea is a diving mecca.) in search of subjects and answers.



Dennis Madden

2011 Graduate: Exercise Physiology

### Of Note

Pearl diving has an extensive history particularly in the Persian Gulf, India and Japan. This was a common method of harvesting pearls prior to the discovery of cultured pearls in the 1930’s. Pearl diving was a financially risky endeavor for a family to undertake because they would have to rent a boat and supplies on credit at the beginning of a season and hope to find the scarce pearls (on average only 3 or 4 perfect pearls would be found per 1 ton of oysters). One poor season could mean a lifetime of debt for a family. It was also physically dangerous for the divers. They would need to reach depths of approximately 120 feet without diving equipment in order to access the oyster beds. The divers manually removed oysters from the ocean floor and checked them for pearls. Due to the depths and the low probability of finding a pearl, divers would need to remain underwater for approximately a minute and a half for each dive and make about 30 dives per day. Drowning was common due to passing out while attempting to resurface. Today, pearl divers are still active and have remained submerged for up to 3 minutes. However, since the cultured pearl industry has taken over, these divers primarily are utilized to entertain tourists.

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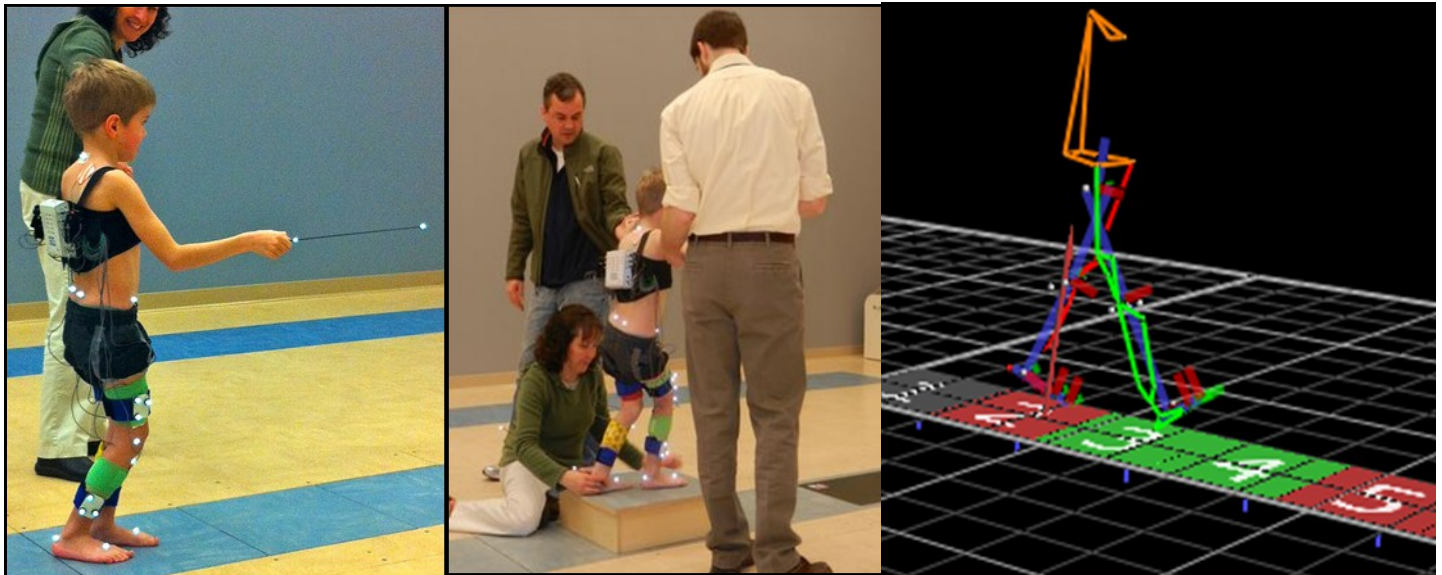
# Gait Analysis Laboratory *by Emily Willaert*



I am currently interning at Gillette Children's Hospital in the Gait and Motion Analysis Laboratory. The facility is used to determine the cause of abnormal walking patterns in patients prior to orthopedic surgery through the use of 3-dimensional filming and physical examination. The patients are typically children with cerebral palsy, but amputees or individuals with skeletal deformities are also seen. The collected data is used to assist the surgeons in deciding which surgeries would be most beneficial for the patient.

Gillette Children's Hospital also conducts extensive research in several areas. In one particular study, after receiving a local anesthetic, pins were screwed into the bones of the lower back (lumbar vertebrae) and extended through the skin. They then used 3-D filming to track lumbar movement during walking. This data was sent to prosthetic companies to create artificial lumbar vertebrae, which mimic normal spinal movement during walking. The long term goal of this research is to replace disk fusion with a vertebrae transplant which will maintain normal mobility. Another interesting project is determining the differences between over ground walking and running patterns compared to on a treadmill. The aim of this study is to provide surgeons with a more complete picture of patients' walking and running ability to make better treatment decisions. Another goal is determining differences between laboratory tests and actual training, which can improve the application of laboratory tests to outdoor training in athletes.

Thus far, I have assisted in collecting and processing the 3D motion data of the patients. I have participated in the presentation of data to the orthopedic surgeon and observed orthopedic surgery. I am currently helping with the project that is comparing over ground and treadmill locomotion. Finally, I am working on my thesis whose purpose is to determine which variables best predict the patients that will develop crouch gait. Crouch gait is a debilitating walking abnormality that eventually leaves the individual unable to walk if untreated. However, the cause of crouch gait and the protocol for successful treatment is currently undetermined. Hopefully, this study will provide clinicians with a better picture of crouch gait.



## Second Year Graduate Students

Kelley Holmes spent her summer interning at the St. Cloud YMCA working with members as a fitness coach and helping with Camp C.H.A.D. which aims to engage kids in physical activity. She is currently working on her thesis "Influence of an educational intervention on hydration behaviors in collegiate swimmers" and will be collecting and analyzing data this spring. She will graduate with a degree in Special Studies with an emphasis in Cardiac Rehabilitation and is hoping to continue her studies in a doctoral program.

Kara Mason completed her internship this past summer at the St. Cloud Heart and Vascular Center in the Cardiac Rehabilitation Department. She is currently working on her starred paper "Biofeedback and heart rate variability in a geriatric population." She will be graduating this spring with her master's in Special Studies with an emphasis in Cardiac Rehabilitation. Kara hopes to work in cardiac rehabilitation or a stress lab in a hospital setting.

Steven Milkovich completed his internship this past summer with HealthSource Solutions at the Medtronic facility in Fridley, MN. He will be conducting research for his thesis this spring on the differences between barefoot and shod triple jumping. He continues to coach with the SCSU track and field team and hopes to continue his education next year in a doctoral program.



## Nutrition from a Pill? By Jill Gromberg, MS, RD

You may remember the “space age” cartoon from the 1960s, *The Jetsons*. In one episode, George Jetson is shown leaving for work as he hurriedly eats breakfast; which happens to be a pill he tosses into his mouth. More recently, a popular multi-vitamin and mineral supplement promises to be “balanced and complete... from A to Zinc.” Wouldn’t it be great if we could get all of our nutritional needs met by a pill?

While the importance of a healthy diet was recognized a millennia ago by Hippocrates (“Let thy food be thy medicine, and thy medicine be thy food.”<sup>1</sup>), our understanding of the scientific basis for nutrition began much more recently. The first Nobel Prizes for the discovery of various vitamins were awarded less than 100 years ago.<sup>2</sup> Presently, 13 vitamins and 16 minerals are identified as essential for health,<sup>3,4</sup> but an increasing body of evidence suggests that many other substances in foods serve to maintain and promote our physical health and well-being.

Among these health-promoting compounds are phytochemicals, the “plant chemicals” that provide the vivid colors and distinct aromas in fruits, vegetables, grains and other plant-based foods.<sup>5</sup> These compounds put the “blue” in blueberries and provide the pleasing scents of onions and garlic, or their pungent odors depending on your personal view. Here are a few examples of these chemicals and their possible effects:

- Anthocyanin, which makes blueberries blue, is one of several flavonoid compounds that appear to reduce inflammation, decrease plaque buildup in arteries and interfere with potential carcinogens. Other flavonoids are found in whole grains, nuts, dark chocolate and red wine.<sup>5</sup>

- Allicin, the aromatic compound in onions and garlic, appears to decrease cholesterol production in the liver and may interfere with certain cancer-causing chemicals.<sup>5</sup> Allicin also appears to interfere with clot formation, although it is unclear at this time if supplementing with garlic or onions can lower one’s risk for heart disease.<sup>6</sup>
- Carotenoids, the orange, yellow and red pigments in many fruits and vegetables, include compounds such as beta carotene (found in carrots, cantaloupe, and sweet potatoes, among others), lycopene (tomatoes and watermelon), and lutein (corn and dark green, leafy vegetables). These compounds may serve as antioxidants thought to lower the risk for certain cancers, strengthen the immune system, and reduce the risk for age-related eye disorders, such as macular degeneration.<sup>5,6</sup>

Since the discovery of phytochemicals, much of the research has focused on isolating specific compounds for use as supplements. This approach may be misguided, however. Smokers who were given beta carotene supplements to see if their antioxidant properties could prevent lung cancer actually experienced higher rates of lung cancer, although beta carotene from food did not have the same effect.<sup>7</sup> The American Cancer Society, the American Heart Association and other health authorities recommend eating a balanced diet that includes a variety of fruits, vegetables and other food-based sources of phytochemicals rather than taking antioxidant supplements.<sup>7,8,9</sup>

Someday, we just might eat our meals in pill form like George Jetson. Before that can happen, we’ll need a better understanding of what “balanced and complete” nutrition really means.

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# In Memory of



Doris D. Kelly 77

St. Cloud

Feb 20, 1935--Jan 26, 2013

Doris passed away at home, holding the hand of her best friend and loving husband of 52 years. She was surrounded by her family, comforting them as much as they comforted her.

Doris was raised in Midway PA and was the valedictorian of her high school class in 1953. From there, she went to Slippery Rock State College where she met Jack. She starred in basketball and field hockey, majored in health and physical education, and graduated in 1957. Doris began teaching high school health and on Aug. 6, 1960 she married Jack. In 1969, Doris and her family moved to St. Cloud where Jack taught at St. Cloud State University and Doris became a realtor. More recently, Doris and Jack have enjoyed the "snow bird" lifestyle playing golf, walking, biking, and playing tennis in Jekyll Island, Georgia. At every stop, Doris made lifelong friends and always shared her laughter and generous spirit. She never tired of adventure or new challenges and her single greatest joy was watching her children and grandchildren grow. The family is heartbroken over their loss, but due to the values instilled by Doris, the family is able to find deep comfort in each other.

Doris was preceded in death by her parents (Walter and Clemence Dawson) and her brothers (Walter Jr. and Robert). She is survived by her husband, Jack Kelly; son John (married to Linda) Kelly; daughter Kathy (married to Dave) Heine; son Bill (married to Mabella) Kelly; and 11 grandchildren: Lauren, Natalie, Daria, Ryan, Jenna, Nick, Carly, Joseph, Rafael, Jack, and Heather.

The Kelly family would like to send a heartfelt thank you to their dear friends who have loved and supported them throughout this past year and extend a special thanks to Reeney and Margie of Heartland Hospice who comforted Doris and her family in the last hours of her life.

In honor of Doris's youngest granddaughter, Heather, memorials are preferred to the Shriners Hospital for Children, 2025 E River Pkwy, Minneapolis, MN 55414. If you care to send letters of encouragement to Jack Kelly, please send to 908 Riverside Drive SE, St. Cloud, MN 56304.



## Increasing Hydration Knowledge *by Kelley Holmes*

As a former competitive swimmer, I was unaware of how dehydration could affect training or performance until I woke up with a fluid IV in my arm after passing out from swim training. Many people believe that because swimmers are in the pool they remain better hydrated; not true. For my thesis, I hope to determine whether collegiate swimmers will stay better hydrated after being instructed how to do so. The American College of Sports Medicine and the National Athletic Training Association provided hydration guidelines for athletes, several of which are listed below. These guidelines are not only helpful for athletes, but anyone interested in staying hydrated and healthy.

- **The common 8 by 8 rule (8-8oz cups of water per day) is a fair estimate,** but no scientific data suggests it is optimal. Fluid intake depends on many factors including environmental conditions, other foods one eats and of course activity.
- **Be smart and establish a hydration plan** that takes into account environmental factors, rest breaks, fluid availability, exercise duration, exercise intensity, sweat rate and personal preferences.
- **Begin all exercise sessions well hydrated.** Enough said.
- **Fluid replacement should be approximately the same as sweat loss.** After exercise, more than a 2% reduction in body weight (~2-6 lbs) would indicate dehydration. Drink 20 oz of fluids for every pound lost during activity.
- **Drink water to rehydrate.** Most individuals exercising at moderate rates for less than 60 minutes are fine with just water.
- **Add some carbs if exercise is > 60 minutes.** Some individuals exercising at higher intensities longer than 60 minutes will benefit from fluids and carbohydrates. Ingesting 40-80 grams of carbs per hour will help maintain performance and hydration.
- **Recognize the signs and symptoms of dehydration:** Increased thirst, headaches, general discomfort, dry mouth, weakness/fatigue or dizziness, racing heart, and/or nausea.
- **Check your urine color:** Clear to light yellow is good, while dark urine with a strong odor can indicate dehydration.







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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 2012.

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Carol Shaw, David Bacharach