Fall 2014

University of Nebraska at Omaha Biomechanics Research Building Annual Report, Fall 2014

Biomechanics Research Building
University of Nebraska at Omaha

UNIVERSITY OF NEBRASKA AT OMAHA

BRB ANNUAL REPORT

BIOMECHANICS RESEARCH BUILDING | FALL 2014

University of Nebraska Omaha

BRB Faculty, Students and Staff

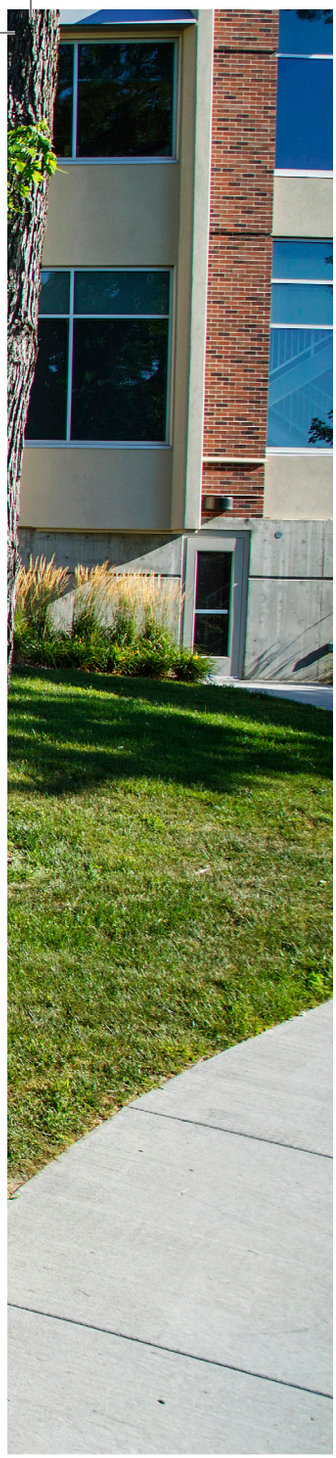
(From left to right) Front row: Momoko Yamagata, Jenny Kent, Lexie Liu, Amanda Fletcher, Bryon Applequist, Mukul Mukherjee, Molly Schieber, Natasa Kyvelidou, Jordan Grubaugh.

Second row: Jessica Fujan-Hansen, Alli Kalina, JC Chien, Troy Rand, Dan Blanke, Lauren Bowman, Chase Rock, Casey Caniglia, Adam Rosen, Joseph Siu.

Third row: Madeline Holscher, Allison Hoover, Mike Hough, Jordan Freeman, Kimi Lueders, Zane Starks, DJ Eikema, Travis Vanderheyden.

Fourth row: Nick Sakis, Kai Huang, Josh Pickhinke, Jenna Yentes, Brandon Bischoff, Andrew Arnold, Eric Pisciotta, Shane Wurdeman, Nick Reynolds, Sara Myers, Casey Wiens, Nick Stergiou, Steve Harrison, Will Denton, Jeff Kaipust.

Not pictured: Andrea Allmond, Pradeep Ambati, Jenny Becic, Cassidy Berlin, Megan Catlett, Angela Collins, John McCamley, Melanie McGrath, Patrick Meng-Frecker, Ben Senderling,



Contents

Letter from the Director

Rethink the Impossible

Not even a year being in our new building, some incredible news came our way. We received a $10.1 million, 5-year COBRE (Centers of Biomedical Research Excellence) grant to create a Center for Research in Human Movement Variability that will be housed in our Biomechanics Research Building. This is the largest research grant in our University's history, truly positioning us to achieve new heights of academic excellence in biomechanics right here in Omaha. I never thought that I would be able to go to our private donors so soon and tell them that I delivered on my promises. I felt almost like a child who goes to his parents with an excellent report card.

Our biomechanics facilities, currently the best in the world, is certainly a reason as to why we were awarded this grant. Another major reason is the scientific focus of our research in human movement variability; it has allowed greater success in terms of the acquisition of external funding capitalizing on the excellent collaborations established with the University of Nebraska Medical Center and our state's clinical research community. This focus has been infused in my research team's scientific endeavors over the years leading to studies in interventions grounded on the restoration of variability of movement that could be applied across a range of diseases.

However, the biggest reason for receiving this grant was my research team. All of them have been with me for many years, entrusting in me their scientific development and educational nourishment. They are my pillars, my children, my own family. One is from Greece, another from India, but the majority are from hard working Nebraska families. Their dedication and abilities are legendary in our building. They command respect because they are leaders in their actions and pursuits. Importantly, they all have a common ingredient. They are willing to rethink the impossible.

Thank you,

Dr. Nick Stergiou

Biomechanics Program Will Launch Biomechanics Research Center as Part of Largest Research Grant in UNO History

Charley Reed

UNO Media Relations Coordinator

In August 2014, the Biomechanics team made school history when it was announced that UNO would soon be home to the world's first Center for Research in Human Movement Variability thanks to a $10.1 million grant from the National Institutes of Health (NIH).

Under the leadership of Nick Stergiou, Ph.D., UNO's new research center will further the work of UNO biomechanical researchers in developing new treatments for patients recovering from movement-affecting disorders such as stroke and autism.

"Receiving this award means that the federal government considers UNO a research institution with doctoral level education that can produce excellent biomedical research," Stergiou explained. "It allows us to realize the potential of UNO and the Biomechanics Research Building by establishing a global reputation as an outstanding research institute in biomechanics."

The grant is part of the NIH Institutional Development Award (IDeA) program for Centers of Biomedical Research Excellence (COBRE) - one of the most competitive grant programs in the country, with less than 15 percent of applicants receiving funding.

The IDeA program builds research capacities in states that historically have had low levels of NIH funding by supporting basic, clinical and translational research; faculty development; and infrastructure improvements.

The new research center will be housed in UNO's Biomechanics Research Building, which opened just a year prior at a cost of $6 million. The grant, which nearly doubles the private investment in UNO's biomechanics program, will allow four junior faculty members to dedicate their time entirely to specific research projects tied to the treatment of movement-affecting disorders.

Specific research will address how bodies control and adjust movement patterns and how variability in movement can be tied to, cause or be symptomatic of a number of wide-ranging disorders.

Current UNO research projects planned for the grant include Sara Myers, Ph.D., who will study levels of variability in peripheral arterial disease patients; Mukul Mukherjee, Ph.D., who will study how virtual reality can assist mobility in stroke victims; Anastasia Kyvelidou, Ph.D., who will explore how variations in child posture can help detect early signs of autism; and Jenna Yentes, Ph.D., who will study how the biological coupling of breathing and walking can impact patients with chronic obstructive pulmonary disease (COPD).

Funding will be distributed over five years, with two opportunities to renew for matching funds. The total potential for funding exceeds $30 million.

"Because of this award, we anticipate that we will absolutely transform the research culture at UNO by augmenting assets within the university, thereby leading to success in several fields other than biomechanics," Stergiou said.

As part of the grant, UNO researchers will partner with scientists and doctors from the University of Nebraska Medical Center (UNMC) in order to provide real world, clinical applications for UNO research. These partnering clinicians include Iraklis Pipinos, M.D.; Pierre Fayad, M.D.; Stephen Rennard, M.D.; Wayne Fischer, M.D.; and Jason Johanning, M.D.

Funding from the grant will also allow for the hiring of several new faculty for UNO, the launching of additional pilot research programs, upgrades to equipment within the Biomechanics Research Building and recruitment of top graduate and undergraduate student candidates to come to Omaha and study biomechanics at UNO.

"Securing this COBRE grant makes biomechanics a priority not only for Omaha but for the state of Nebraska," Stergiou said. "Everyone wanting to study biomechanics will want to come here."

Our New Building

Virtual Reality Lab

One area of research that has benefitted greatly from the construction of the Biomechanics Research Building is virtual reality. In the previous location, the virtual reality was housed in a room that included student workers and other pieces of research equipment. The various pieces of equipment being used for virtual reality data collections, such as the treadmill, motion capture, and the virtual environment, were independent of each other. This required several researchers to ensure that a data collection was performed properly or the writing of custom code to sync the pieces of equipment. In the newly designed Biomechanics Research Building, an entire lab is dedicated to virtual reality research. This lab has the Bertec split-belt treadmill installed in the ground and includes the addition of the Motekforce Link virtual reality system and an 8-camera Vicon motion capture system. The Motekforce Link system is designed to integrate all of the research equipment. This allows us to control the treadmill, camera system, virtual reality, and any other add-on equipment through one program and keep everything synced perfectly. The other benefit of this system is that output from any piece of the system can immediately become input to another piece of the system. For example, the output from the motion capture markers can adjust the speed of the treadmill in order to create a self-paced treadmill. This can also be useful for providing real-time feedback on the virtual reality screens. The ease of creating virtual reality environments and performing integrated data collections has opened up many possibilities for our current and future research in the area of virtual reality, and we look forward to moving ahead in this area of research.

The Motek Medical virtual reality system projects to custom screens and allows for integration of all the research equipment. The Bertec split-belt treadmill is installed in the ground. A truss system holds an 8-camera Vicon motion analysis system. Other research equipment can be integrated into the system.

Main Motion Capture Laboratory

The new Biomechanics Research Building has given us great opportunities to advance current biomechanics projects and develop new projects using updated equipment and almost unlimited space. In our new Main Motion Capture Laboratory, the much larger space makes the possibilities for our research limitless. Since many of the subjects involved with this research are patients with peripheral arterial disease, chronic obstructive pulmonary disease, multiple sclerosis, a history of falling, or a lower limb amputation, it was important to design this space for the greatest ease and comfort for our visitors. We are able to incorporate state-of-the-art equipment and technology in one central location for the subject's convenience. The increased space has allowed us to integrate 10 force platforms allowing us to analyze multiple footfalls in one walking trial, decrease the time for data collections, and make data collections transition seamlessly. When moving into the new space, we also had the opportunity to upgrade our motion capture cameras, which has increased our resolution and accuracy with the data we obtain. Another unique feature of the lab is a treadmill that is built into the ground, which allows us to measure forces as the subject is walking on it. This could potentially lead to additional research projects as well as decreased amount of time that the subject would need to spend in the lab. In addition to these benefits to subjects, we also have been able to diversify the type of data we are able to analyze with new equipment, such as a Parks FloLab to examine vascular function, a Novel pedar device to measure in shoe dynamic pressures, and spirometry to measure lung function. All of these devices aid in making a subject's research participation more convenient since they can now come here for these evaluations rather than making a separate appointment at a hospital or their doctor's office. All of these advancements have been made possible by a generous Nebraska Research Initiative grant that allowed us to purchase $843,005 worth of state-of-the-art equipment and partial salary for the Building Manager. The Motion Capture Laboratory layout and dimensions can be found at our website http://www.unomaha.edu/college-of-education/biomechanics-core-facility/facilities/index.php.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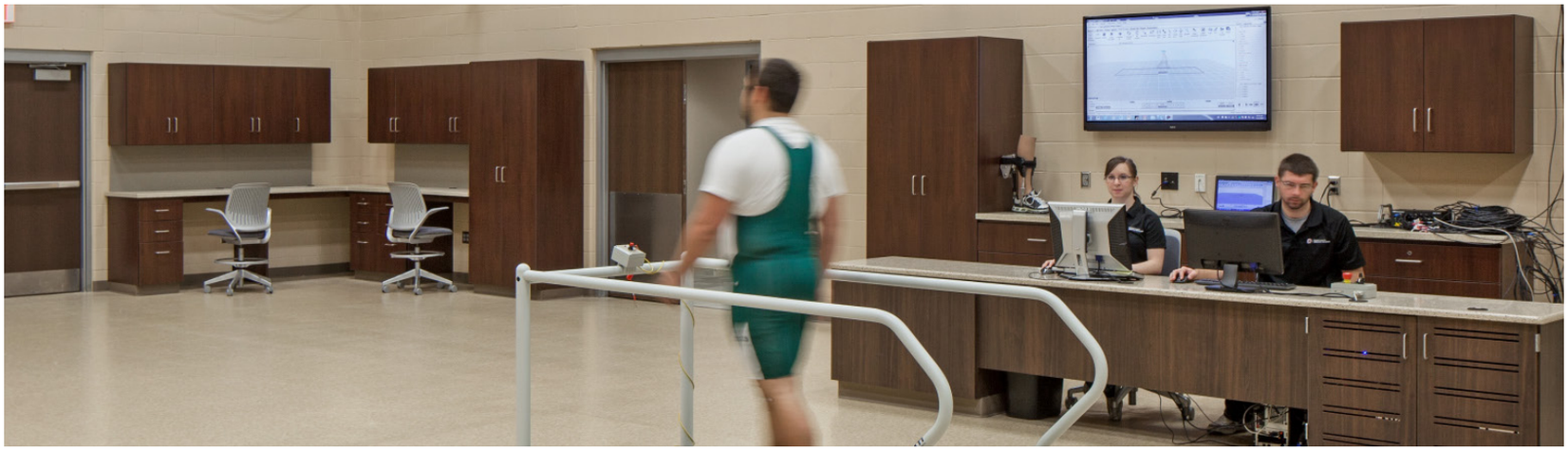


Visits/Tours

The images featured were taken during the 2013 Annual High School Athletic Training Day. Students from area high schools came to UNO to learn about athletic training and the programs UNO has to offer.

Since September 2013, the Biomechanics Research Building (BRB) has become a nucleus for scientific innovation in both the Omaha-metropolitan community and also on the global front for biomechanics. The facility is increasing biomechanics awareness and attracting interest in their current endeavors from students, researchers and professionals across the globe.

2013 By the numbers:

Tripled number of volunteers and student workers from various undergraduate programs here at UNO.

Persistent alignment to three of the five UNO Academic Strategic Priorities:

Doctoral/Graduate Research
Early Childhood/Child Welfare
Global Engagement

Increased number of interns to five who hail from nationally recognized universities from all over the world, i.e., Concordia University, Creighton University, Creighton Medical Center, the University of Nebraska Lincoln, and Hiroshima University in Japan.

Hosted over 75 tours of the facility to the University of Nebraska Provost, the University of Nebraska Board of Regents, the Blue Cross Blue Shield Leadership team, and the Executive Leaders from Quality Living, Inc.

If you, your organization or research team would like to plan a trip and tour to the Biomechanics Research Building, please contact Jeff Kaipust, jkaipust@unomaha.edu.

Moving on Up

Currently, there is a great uncertainty of employment, even after finishing college. However, that does not seem to be the case for our BRB graduates! This past year has been wonderful to our graduates in terms of new positions and careers, and we wanted to share a few of these stories with you. First let's take a look of our undergraduates. Whitney Korgan and Jessica Renz were both accepted to St. Louis University's Physical Therapy program and offered graduate assistantships. This is the #3 program in the country for physical therapy and in addition, only 6 individuals are offered an assistantship out of all 80 accepted to the program.

Bryan Arnold (2012) recently took a position at Creighton University, here in Omaha, as a research coordinator. Austin Davidson (2011), has recently moved to Jacksonville, Florida to begin working as a neurophysiology monitor technologist. After three months of intense training, he will be monitoring equipment in operating rooms to ensure the safety of patients during surgery.

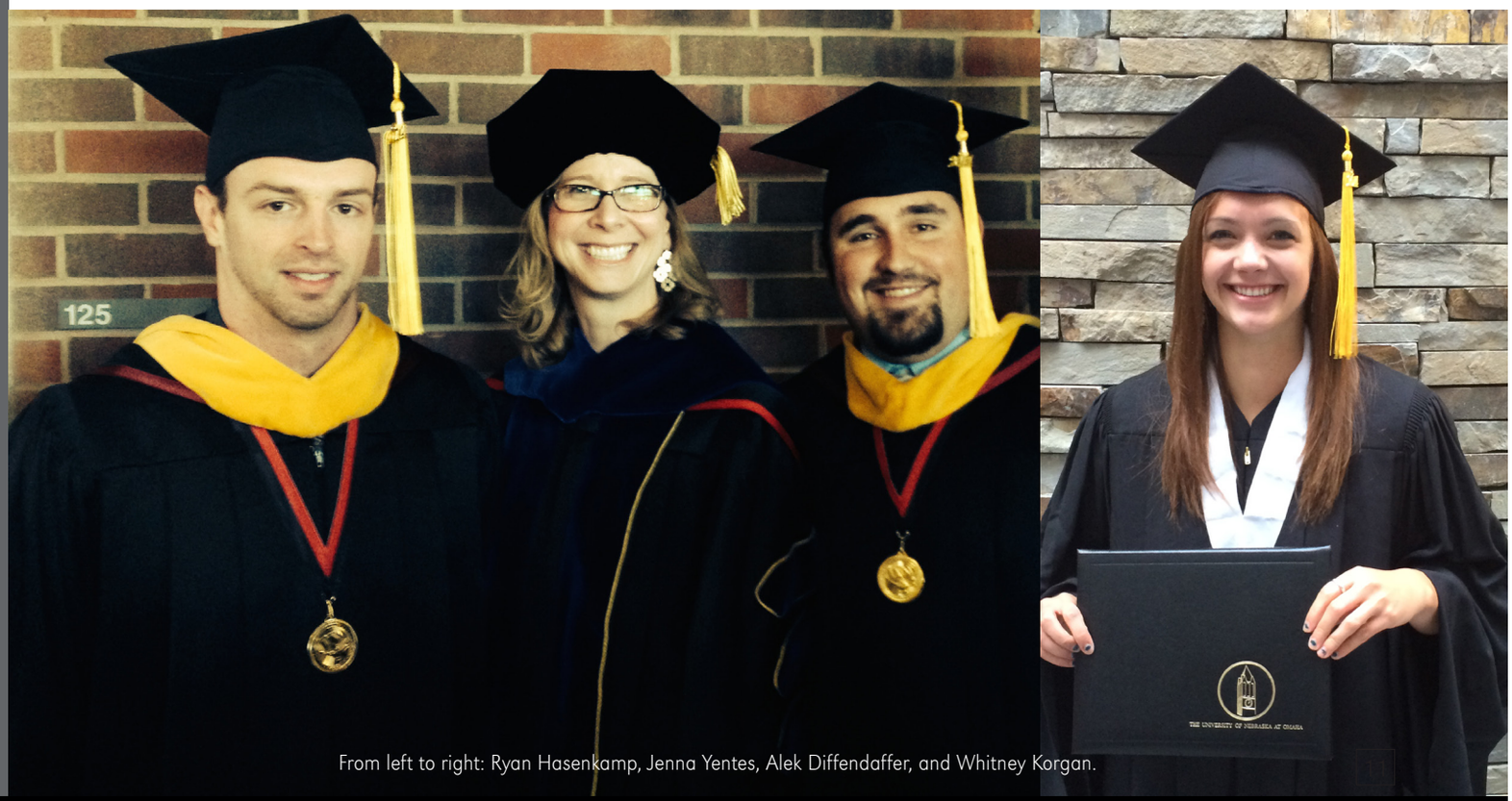
Carlee Howe (2013) is currently in the occupational therapy program at Creighton University. She will graduate from the program in 2017.

At the Master's student level, Ryan Hasenkamp finished his degree in May 2014 and accepted a research scientist position at the Center for the Intrepid/ Brooke Army Medical Center in San Antonio, Texas. Alek Diffendaffer finished his degree in August 2014 and accepted a position in Erie, Pennsylvania working at the Shriner's Hospital as a full-time biomechanist/ research coordinator. Jon Carey (2011) just finished a one-year lecturer position at Purdue University to return to Nebraska. He will be a full-time Lecturer in the Exercise Science department of the University of Nebraska, Kearney in the Fall 2014. Shane Scholten (1998) will also start as an Assistant Professor at Augustana College.

Doctoral graduates of BRB have been procuring new positions as well. Joshua Haworth (2013) is currently a postdoc at Johns Hopkins University, School of Medicine. Dimitrios Katsavelis (2011) recently accepted a position as an Assistant Professor at Creighton University in the Exercise Science Department. Shane Wurdeman (2013) is also in a new position as a Lecturer at BRB and continuing as a clinician at a local prosthetics company. Jenna Yentes (2013) has also accepted a new position as an Assistant Professor here at UNO and we have the pleasure of keeping this incredible scientist with us.

Past postdoctoral fellows of the BRB are now in new positions as well. Dr. Shi-Hyun Park is a Professor at Yuhan University in South Korea. Dr. Leslie Decker is an Assistant Professor at the University of Caen Basse in Normandy and is teaching in the Exercise Science program. Dr. Denise McGrath is an Assistant Professor at the University College of Dublin. Dr. Srikant Vallabhajosula is an Assistant Professor at Elon University in the Department of Physical Therapy.

Congrats to everyone! We are so very excited by all of the achievements of our students and alumni.



From left to right: Ryan Hasenkamp, Jenna Yentes, Alek Diffendaffer, and Whitney Korgan.

Jessica Renz and Whitney Korgan at the BRB open house

WHY CHOOSE BRB?

The Biomechanics Research Building has a reputation for excelling students into highly recognized programs in multiple areas. Two of our current undergraduate research assistants, who entered the lab over three years ago, have grown and matured in the lab, and are now not only accepted into the third ranked Doctorate of Physical Therapy Program in the nation, but also have paid assistantships in the program as well. Whitney Korgan followed her older brother Austin Korgan, who is now pursing a Ph.D. in Neuroscience in Halifax, Nova Scotia, into the BRB. As a member of the UNO Women's Swim Team, Whitney volunteered any extra hour she could find, eventually leading to a paid position at BRB where she worked under senior researchers and led her own experiment. Jessica Renz first discovered the volunteer opportunities within the lab through her previous Anatomy professor, Jon Carey. She quickly dove into a variety of different tasks working with a wide range of projects and was soon hired for a paid position. During her time in the lab, she took the lead on our running shoe recommendation service that our lab provides to the community as well as designing and carrying out her own research project. Within their time in the lab, both presented several times at national conferences including the Gait and Clinical Movement Analysis Society, the American Society of Biomechanics, and the World Congress of Biomechanics. Each one of our women received multiple research grants for undergraduate students, had the opportunity to work with a variety of patient

populations, and collaborated with scientists from around the world. Both agree that their positions within the BRB opened a large number of doors for their future and gave them confidence to pursue the education necessary to reach their professional goals. They believe they are not only better people because of their positions within the BRB but that the work they have done will allow them to be stronger practitioners and better treat their future patients.

Jessica Renz (second from left) and Whitney Korgan (middle) with other BRB alumni from left to right: Austin Davidson (2011), Carlee Howe (2013), Bryan Arnold (2012), Troy Rand (2013), and Ryan Hasenkamp (2014). What a great group of young scientists!

Why choose BRB cont.

Michael Hough

The Biomechanics Research Building prides itself on the varied backgrounds of its researchers. The staff is comprised of traditional students and career-changers who have studied everything from exercise science and engineering, to psychology and philosophy. Even so, 2nd-year Master's student Michael Hough is somewhat unique.

"I was a sixth-grade kid when 'Top Gun' came out, and I sat in the front row of the movie theater with all my friends. Every last one of us left the theater shouting, 'I want to do THAT!' But I had bad eyes and low blood pressure, which disqualified me from aviation. But I was qualified for flying in a denser medium. It turns out that a lot of submariners originally wanted to be pilots."

Mike graduated from the United States Naval Academy in 1996 with a degree in physics and served aboard the USS Batfish. He was primarily responsible for the ship's nuclear propulsion plant. "Sometimes I got to drive. Driving the ship, fighting the ship, that was great. I was less fond of the nuclear power part. When it was time to decide to stay or go, I went."

After six years on active duty, Mike was unsure of what to do next. He sold insurance, auto parts, and ammunition. He worked as a computer programmer, and taught high school before finally settling as a construction worker.

"I didn't really settle down into anything until after I got married to Emily. She wanted to go to college, and I needed to do something to support her and our kids. We moved to Omaha, and the first job I found was as a construction laborer. I had worked my way up to carpenter foreman. But it wasn't what I wanted long-term."

Mike has had a life-long interest in martial arts and made preliminary plans to open a gym. He liked teaching, training, and coaching, and felt that another career change was in order. He had been training and competing for over 30 years but felt he lacked some basic background knowledge.

Mike Hough at the US Naval Academy in 1996.

"So much of martial arts is 'do it this way because we've always done it this way.' I wanted to have satisfying answers when my students asked 'Why?' I thought an exercise science degree would help me find those answers. I looked at biomechanics as a concentration because of my physics background. What I found at the BRB was much more interesting than anything I had planned. "

Presented with the opportunity to "do science for a living," Mike accepted a position as a research assistant at the BRB. He is currently working on human movement variability projects under Dr. Nick Stergiou and Dr. Shane Wurdeman.

"These are the kinds of things I've been interested in my whole life. I never could have planned this path. Life is complex."

Mike's daughter, Paisley, as a test subject so he can practice placement of markers for his project.

Where are they now?

Dr. Jessie Huisinga

Dr. Huisinga is an alumna of the UNO Biomechanics program, completing her Master's degree in 2007 and her Doctoral degree in 2010. Dr. Stergiou will never forget interviewing her in the parking lot of Old Chicago in 2005. He decided right there to offer her a graduate assistantship. He never regretted it because Dr. Huisinga was truly amazing in the laboratory, single-handedly carrying our research work on multiple sclerosis (MS). When she left to pursue her post-doc with Dr. Horak at Portland, we knew she was destined for something really special. Currently, Dr. Huisinga is an Assistant Professor of Physical Therapy and Rehabilitation Science and Director of the Human Performance Laboratory within the Landon Center on Aging at the University of Kansas Medical Center. She is also a faculty member within the Bioengineering Department at Kansas University at Lawrence. She continued her work with MS and has focused on understanding the sensorimotor problems experienced in these patients. The promise of her work was recently materialized in a very large grant awarded to her by the National Multiple Sclerosis Society Research Grant. This project focuses on developing a system to measure gait and balance changes in persons with MS within a clinical environment and for clinical trials. She is also funded by the Junior Faculty Career Development Award (KL2) where she investigates the relationship between physiological changes happening in the brain and spinal cord and the gait and balance deficits seen in persons with MS. Her current scientific supervisor, the world renowned scientist Dr. Randy Nudo, calls her "one of the best young faculty he has ever seen." Dr. Huisinga humbly attributes her success in her foundation she received here at UNO and her hard work. This past year, Dr. Huisinga was also asked by the Greater Midwest Chapter of the National Multiple Sclerosis Society to give an interview to the local news regarding her work with MS research and to cut the ribbon at the Kansas City Walk MS event. She was also invited to give the keynote talk at the MS TREND symposium sponsored by the Greater Midwest Chapter of the National MS Society. Another big accomplishment for Dr. Huisinga was having her first Master's student from the Bioengineering program defend his thesis and graduate this year. We are so proud of Dr. Huisinga's accomplishments!

Developments with our University's Patent Office: From the Bench to the Market

Written by our Patent Officer Dr. Henry Runge.

In the future, your smartphone will be able to detect your elevated risk of Parkinson's disease, years before any conventional test reveals similar risks.

Athletes will get clear answers before returning to play after a concussion. Patients suffering from respiratory disorders will get advanced warnings of breathing difficulty.

The future will be made possible by biomechanics. It is the next big thing in medical diagnostics.

Even the most elementary functions of your body involve the coordination of incredibly complex systems. Just walking and breathing combine a sophisticated control of muscles, nerves, circulation and other systems.

When one of those systems is in the early stage of disease, it affects your biomechanics. Your gait, balance or breathing changes.

The effect is invisible without complex computer analysis, which makes biomechanics a big-data problem. The future is here due to the convergence of many technologies.

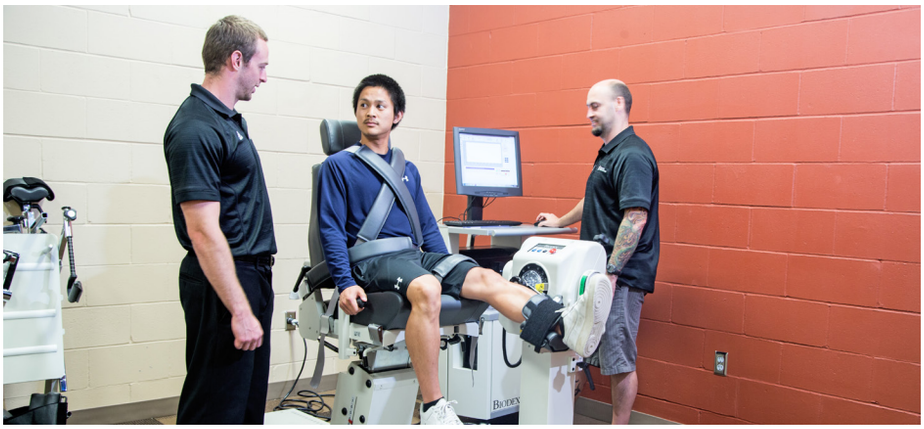
Improved sensors make it possible to accurately measure biomechanics using simple things like pedometers or cell phone cameras. More powerful computing makes it possible to analyze biomechanics with complex algorithms. The internet allows a remote sensor, like the accelerometer on your smartphone, to measure your walking and upload it to a remote server for sophisticated analysis.

Biomechanics can detect a disease in its earliest stages, before patients are otherwise symptomatic. It utilizes existing and inexpensive equipment off the shelf or already in your pocket. More than 100 peer reviewed studies have demonstrated biomechanical analysis can detect early stage diseases—neurodegenerative, cardiovascular, pulmonary and traumatic brain injury—and biomechanical analysis will become even more sensitive and specific.

Biomechanics is everything the healthcare system needs right now. A data center, connected to thousands of smartphones that measures steps, breaths and heartbeats and looks for otherwise invisible changes in those biorhythms consistent with disease.

If those changes are present then the user receives a warning or his doctor receives an alert. Biomechanics allows for extreme early diagnosis or real-time improved monitoring of diseases.

Biomechanical analysis is the 21st century healthcare: internet enabled and personalized for your smartphone. It diagnoses, stages and manages a variety of diseases inexpensively, accurately and using the existing infrastructure of the internet.



Dr. Stergiou and his team at the Biomechanics Research Building (BRB) invented multiple such platforms that UNeMed is seeking commercial partners for:

Chaotic Music for Exercise: Chaotic or fractal music is created by varying the length between beats using mathematical chaos based algorithms. BRB personnel published results showing that when patients performed physical activity in time with music that had the beats changed to become chaotic then those patients showed significant improvement in gait stability. UNeMed is currently seeking a partner to develop a chaotic music application for smartphones that utilizes BRB's custom algorithms. The application will generate chaotic music, determine a user's gait stability, and work to rehabilitate gait stability by prompting a user to move in time with the chaotic music.

Gait Analysis for Fall Risk: Gait analysis is an established field for analyzing disorders in how patients walk. Gait has enormous potential as a diagnostic tool for neurodegenerative, cardiopulmonary and other disorders. BRB personnel invented an ultra-lite, wireless gait analysis device and custom analytics to measure when gait biorhythms are pathologic. UNeMed seeks a partner willing to fund a study to test the gait analysis platform for fall detection in two settings: the fall clinic at a regional hospital and at the University of Nebraska Medical Center's Gerontology department. The system will enable a hospital-based service that can objectively measure fall risk for any patient so that they are released to the appropriate level of care.

Postural Stability for Concussion Recovery: Postural stability is the ubiquitous micro corrections healthy people make when they stand – minute changes in a person's sway. BRB personnel published results showing that biomechanical analysis of postural stability reliably detects when football players receive and recover from concussions. Postural stability shows further potential to develop additional products that analyze patients for traumatic brain injury or other neurocognitive diseases. UNeMed seeks a partner to set up a software as a service company to deliver analysis of postural stability in hospitals, sports clinics, as well as professional and amateur sports teams.

Projects

Neuroscience

Dr. Steven Harrison is performing an auditory test in our Acoustics laboratory.

Collaborative work with UNMC

We are very excited by the prospect of a major research scientist, Dr. Matthew Rizzo, recently joined UNMC as the chair of the Neurological Sciences department. Dr. Rizzo visited our research facility and demonstrated special interest in developing collaborative projects towards utilizing our technical knowhow on wearable and wireless sensors, simulation technology and acoustics for developing instrumentations for studying driver performance as affected by aging and neurological disorders. We are also working with other clinician scientists from the neurological sciences department at UNMC on several different lines of research on movement disorders. We are working with Dr. Amy Hellman and Dr. John Bertoni, on improving the gait of the elderly and patients with movement disorders through structured auditory stimulus. Our BRB team members in the project are Dr. Steven Harrison and Mr. Mike Hough.

Collaborators

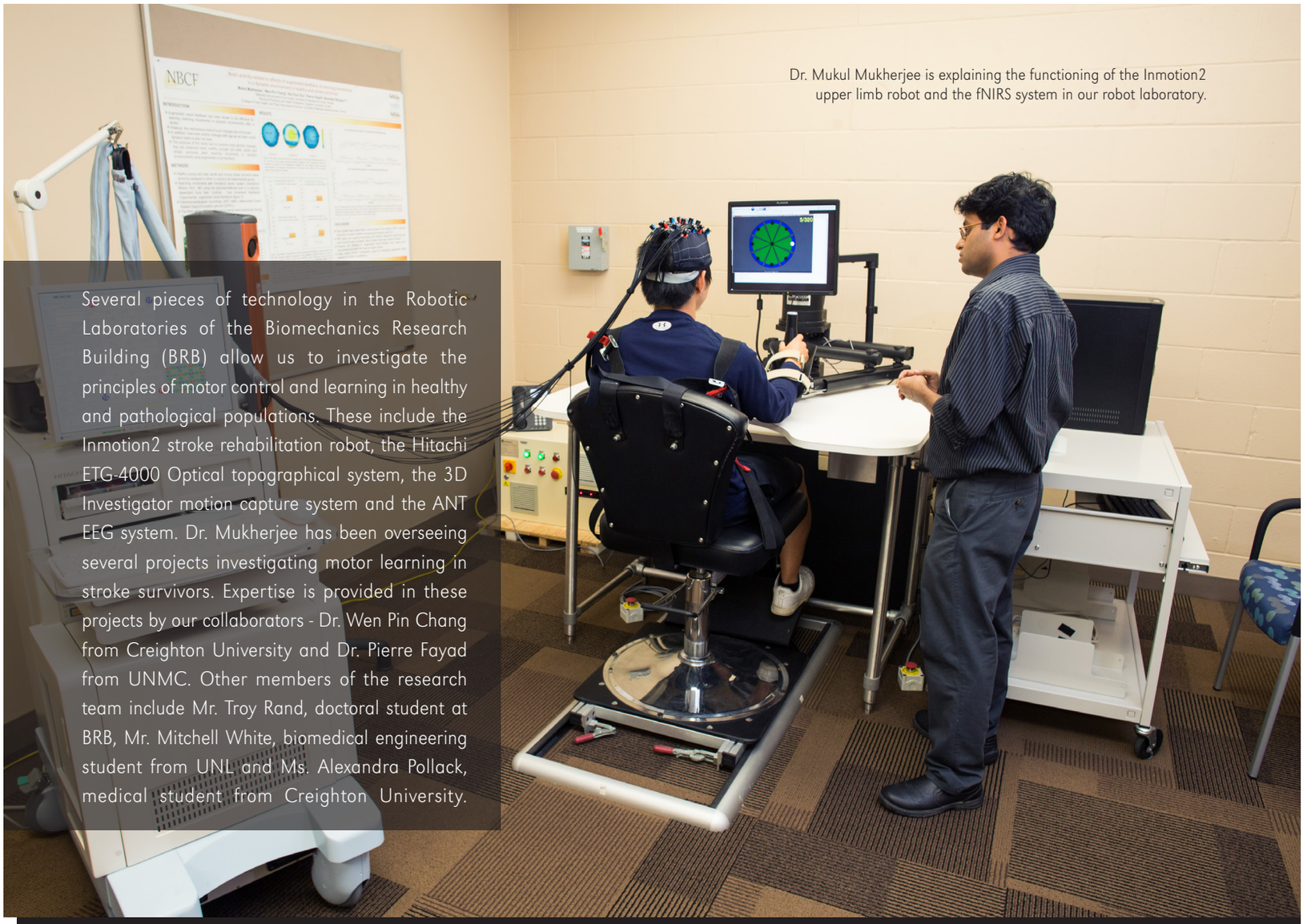
Dr. Matthew Rizzo

Dr. John Bertoni

Dr. Amy Hellman

Neuroscience Cont.

Motor Control and Learning Studies for the Upper Limb



Dr. Mukul Mukherjee is explaining the functioning of the Inmotion2 upper limb robot and the fNIRS system in our robot laboratory.

Several pieces of technology in the Robotic Laboratories of the Biomechanics Research Building (BRB) allow us to investigate the principles of motor control and learning in healthy and pathological populations. These include the Inmotion2 stroke rehabilitation robot, the Hitachi ETG-4000 Optical topographical system, the 3D Investigator motion capture system and the ANT EEG system. Dr. Mukherjee has been overseeing several projects investigating motor learning in stroke survivors. Expertise is provided in these projects by our collaborators - Dr. Wen Pin Chang from Creighton University and Dr. Pierre Fayad from UNMC. Other members of the research team include Mr. Troy Rand, doctoral student at BRB, Mr. Mitchell White, biomedical engineering student from UNL and Ms. Alexandra Pollack, medical student from Creighton University.

Collaborators

Dr. Pierre Fayad

Dr. Wen-Pin Chang

Dr. Chris Hass

Collaborative Work with the University of Florida

At a national level, we are working on collaborative neuroscience projects with Dr. Chris Hass from the University of Florida. For this project, in May of 2014, two graduate students from Dr. Hass' laboratory, Kristen Covino and Matt Terza, traveled to Omaha to learn more about our auditory stimulation research. Mr. Michael Hough, a BRB graduate student, is currently studying the use of auditory stimulation to improve gait in older adults, and our Florida collaborators hope to extend this work to populations with other movement disorders. We worked on developing data collection protocols and data analysis management.

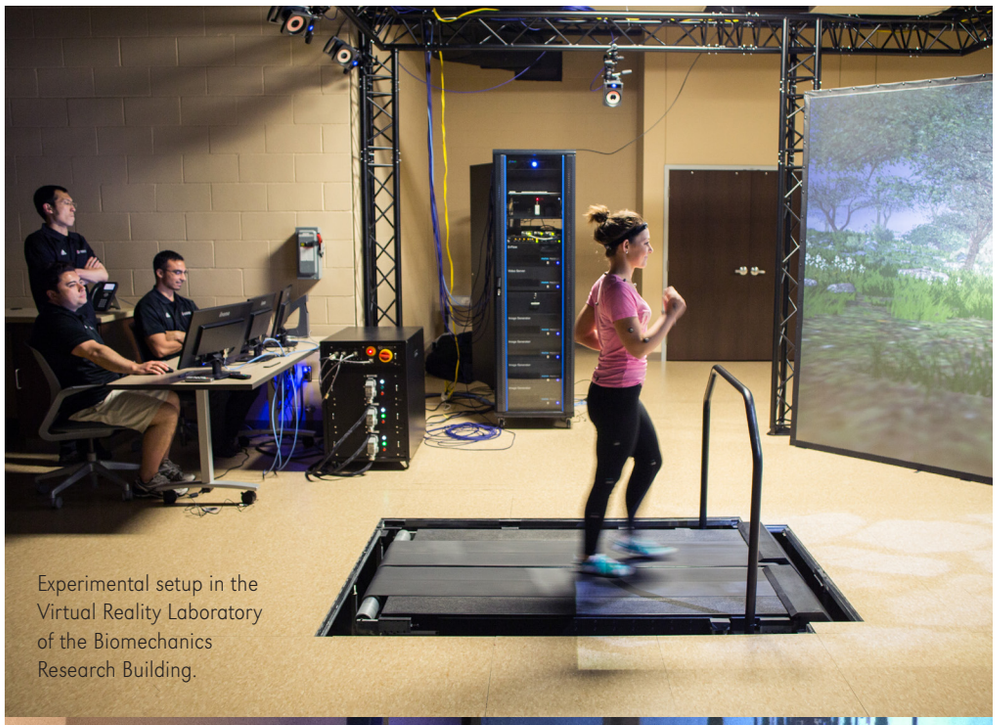
NASA

Project Update

For the past three years we have been working on a $750,000 NASA funded research project to determine the effect of stimulation to different sensory systems, specifically vision and touch, on the ability to walk. Specifically, the project is titled "The Role of Tactile Sensation on Locomotor Adaptation in Astronauts Returning from Long Duration Spaceflights". The long-term goal of the project is to develop interventions to attenuate the effects of space flight on the way we then adjust back on our planet. However, our results could also be relevant to address falls in the elderly.

Dr. Mukherjee and Dr. Myers have been supervising this project with assistance from our post-doc Dr. Eikema and our graduate student Mr. Jung Hung Chien. After completing the first two phases of the study, we performed the third phase of the study last year. The first two phases of the study were performed in the Virtual Reality laboratory of the Biomechanics Research Building. For the third and final phase of the project, Dr. Mukherjee and Mr. Chien, travelled several times to the Neuroscience Labs at the NASA Johnson Space Center (JSC), Houston to perform the final experiments. For the rest of us at BRB that stayed behind, they were our astronauts!

During their visits to JSC they have met with several NASA scientists to explore new ideas of research beyond our current grant. In addition to current collaboration with NASA scientists Dr. Jacob Bloomberg, Dr. Brian Peters, and Dr. Melissa Scott-Pandorf, over the past year we have also received the professional help and support of Dr. Ajit Mulavara and Dr. Mark Shelhammer, both at NASA Houston. Their invaluable support has strengthened our NASA collaborative network.



Experimental setup in the Virtual Reality Laboratory of the Biomechanics Research Building.

From left to right: Dr. Jacob Bloomberg, Dr. Brian Peters, Mr. Jung Chien, Dr. Melissa-Scot Pandorf and Dr. Mukul Mukherjee.

Mr. Jung Chien collecting data at the Neuroscience Labs of the Johnson Space Center.

Motor Development

Dr. Kyvelidou with a six-month old infant investigating sitting posture and looking behavior.

Research in the Motor Development Laboratory focuses on the development of postural control in typically developing children and children with developmental disabilities as well as children with autism. Dr. Anastasia Kyvelidou, who is a post-doctorate associate with us, supervises all of our work in motor development and she has put forward multiple grant applications this year through Autism Speaks and the National Institutes of Health. The main focus of her work is to investigate how early motor development affects later emotional, social and cognitive development in children that are typically developing and those at risk for developmental delays and autism. The importance of her research led to a feature video by KETV, a local news program, which received a lot of attention from parents of children with autism. She is also collaborating with Dr. Kristen Janky, the director of the Clinical Vestibular Laboratory from Boys Town National Research Hospital (Omaha, Nebraska) in investigating early postural control development in infants and children with hearing and vestibular issues. Results from these projects may lead to groundbreaking diagnostic methods, alter current therapeutic protocols, and thus improve the quality of life of the children and their families.

Variability Studies

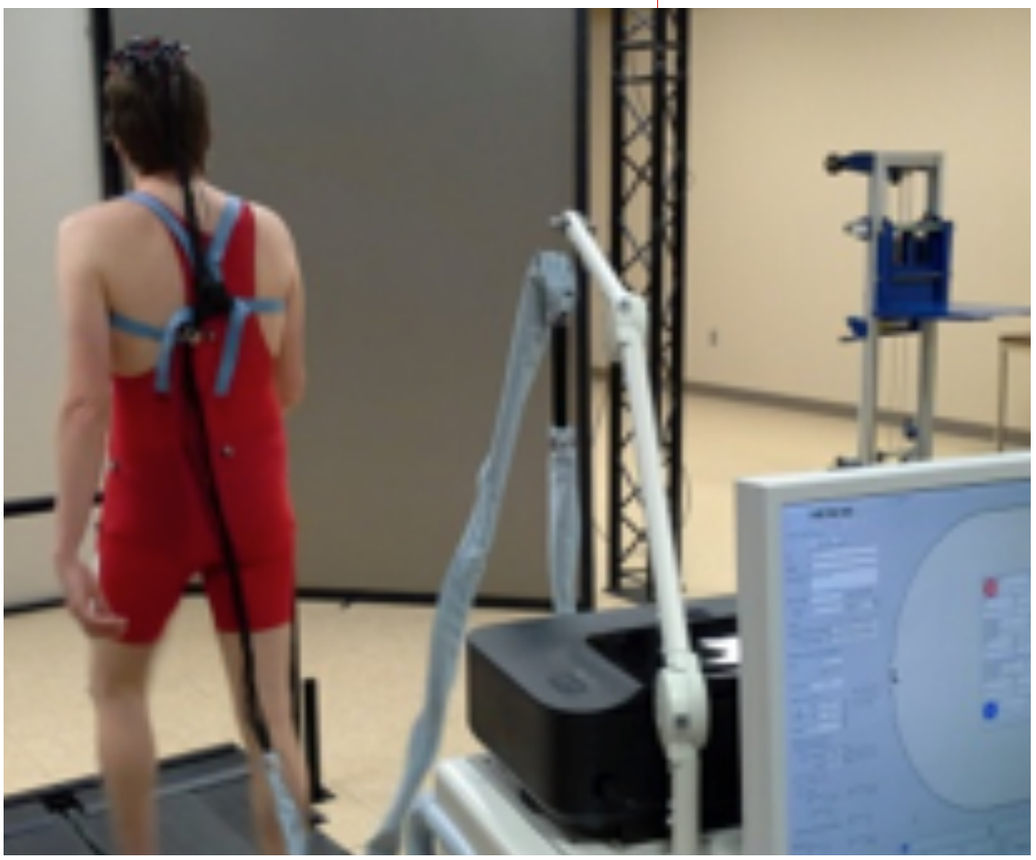
Deficits in basic motor functions (such as maintaining balance and locomotion) are associated with both advancing age and as a result of being affected by motor pathologies such as cerebral vascular accidents (i.e. strokes) and Parkinson's disease. In the past couple of decades, a lot of effort has been directed towards the improvement of walking through the provision of different types of sensory cues. Particularly rhythmic auditory cues have been used to manipulate walking patterns, with the hope of positively changing the abnormal (unhealthy) movement patterns observed in clinical populations towards those of healthy individuals, and thereby improving their quality of life.

By applying an auditory cue at consistent times, individuals with pathologically short strides such as commonly observed in those affected by stroke or old age, have been found to increase their stride length, potentially improving mobility. However, the downside of a regular driving stimulus is that the trained walking pattern is a perfectly symmetrical unchanging rhythm. The patient will increase the selected walking characteristic such as stride length or velocity yet at the same time will be losing the most important aspect of healthy locomotion: adaptability. Without adaptability in the form of stride-to-stride or step-to-step variations, the ability to accommodate changing ground conditions is diminished.

In a novel approach to cueing, we are attempting to positively affect walking using auditory stimuli that are not perfectly rhythmic. These stimuli contain variations that mirror the natural variability of human movements. Research conducted at the Biomechanics Research Building has been investigating the possibility that variable auditory stimuli generated by manipulating the spacing between beats in music can have a positive impact on gait. We have discovered that auditory stimuli containing the variations of healthy young adults can be effectively be injected into the gait pattern. Through a process of audio-motor coupling, individual footsteps are matched to a variable auditory beat. Over time, the perceptuo-motor system reorganizes in response to the auditory cue.

Looking to the future we hope to develop targeted auditory driven neuromuscular rehabilitation programs, depending on the particular locomotor deficiencies an individual displays. Walking patterns, which are too variable or not variable enough, can be pushed towards the region of optimal variability and adaptability by a simple tailor made auditory cue with the appropriate variable beat to beat structure.

Measuring Dr. Harrison's brain activity as he walks while listening to variable auditory stimuli.



Variability Cont.

Navigating the World without Sight

Most of us are aware of our use of our eyes and ears to negotiate our environment, but what about other senses? Can we use touch to perceive the lay of the land? Dr. Harrison, a Research Associate in the BRB under the mentorship of Dr. Stergiou, is fascinated by the information our bodies derive through touch. Traditionally touch – the sense concerned with stimulation of the mechanoreceptors throughout the body – was only thought to be the basis for passively knowing what the body is coming in contact with. However, Dr Harrison has been investigating the possibility that touch might be playing a far richer role in our everyday lives.

By investigating how blindfolded participants learn to traverse previously unseen environments, he has been able to understand how the physical encounters we have with the world shape our sense of where we are within it. His research has implications for understanding how the visually impaired get around in the world. It also has implications for understanding how, for all of us, our movements connect us to the world that surrounds us.

In other experiments he has studied the ability of blindfolded participants to perceive the distances they are traversing as they move, a process known as path integration. By manipulating the movement patterns people use to move through the world in his experiments, he has begun to develop a theory of how the movements of our body generate information about how far we are travelling as we move.

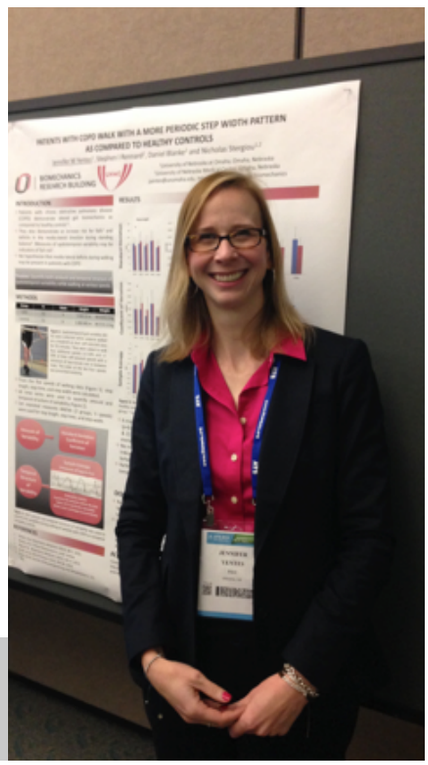
Motivated by this discovery that, like the visual system, touch seems to allow us to perceive our location in the environment, Dr. Harrison has begun to investigate how touch and vision are combined in path integration so as to give us our everyday sense of where we are.

A participant exploring an environment they have never seen before with the aid of a cane.

Chronic Obstructive Pulmonary Disease

Chronic obstructive pulmonary disease (COPD) is not just a disease of the lungs. This disease results in reduced physical activity, increased fall risk and a lower quality of life. Dr. Jenna Yentes has been working with Dr. Stephen Rennard, a pulmonologist at the University of Nebraska Medical Center, for six years on trying to understand the functional limitations associated with this disease. Dr. Yentes and Dr. Rennard have conducted studies on the biomechanical gait outcomes, the variability of gait, and even the coupling between breathing and walking in patients with COPD. This year they have presented their work at the World Congress of Biomechanics meeting in Boston as well as the American Thoracic Society Annual Meeting in San Diego. Dr. Yentes was also awarded an Abstract Scholarship Award for her submissions to the American Thoracic Society meeting.

Recent work has included Dr. Amol Patil at the University of Nebraska Medical Center. Dr. Patil and Dr. Yentes have been working on developing a device that can remotely monitor a patient in expectation that an early diagnosis of an exacerbation can be made. An exacerbation is a state of symptom worsening for patients with COPD. Currently there is no way to diagnosis them early and typically an exacerbation leads to hospitalization and disability. Drs. Patil, Yentes, Rennard and Stergiou have submitted at least one New Invention Notification for their work in this area. Dr. Yentes has also submitted grants this year to the NIH, NASA EPSCoR and the VA to fund her work in COPD.

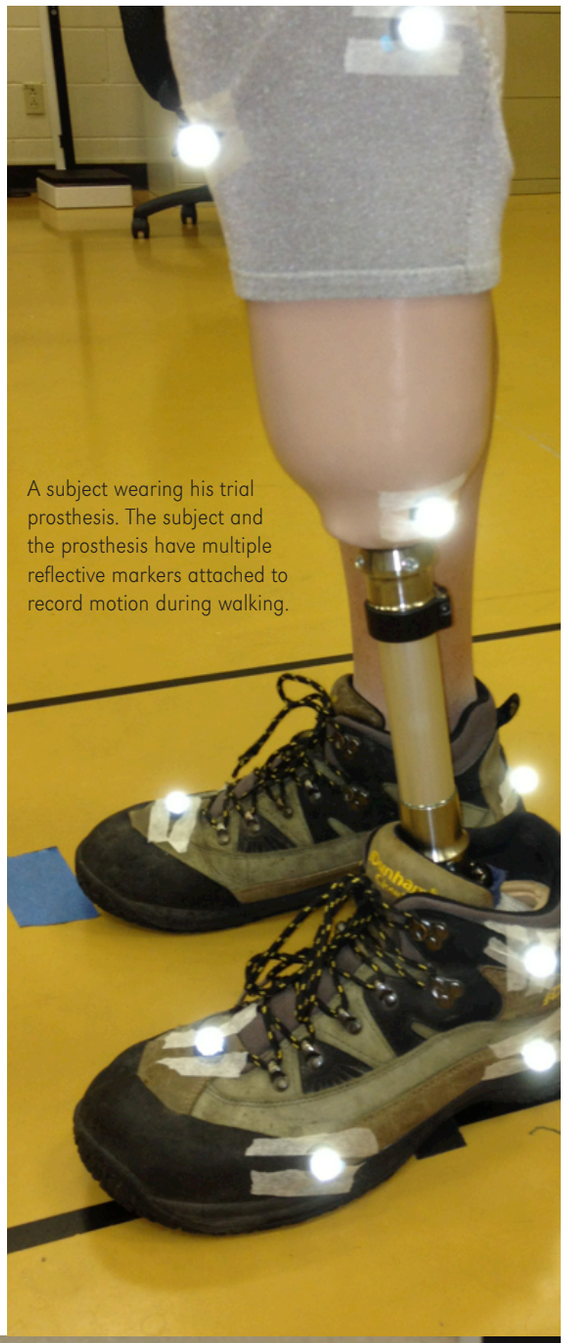


Dr. Yentes presents her poster at the Annual American Thoracic Society Meeting in San Diego, California in May 2014.

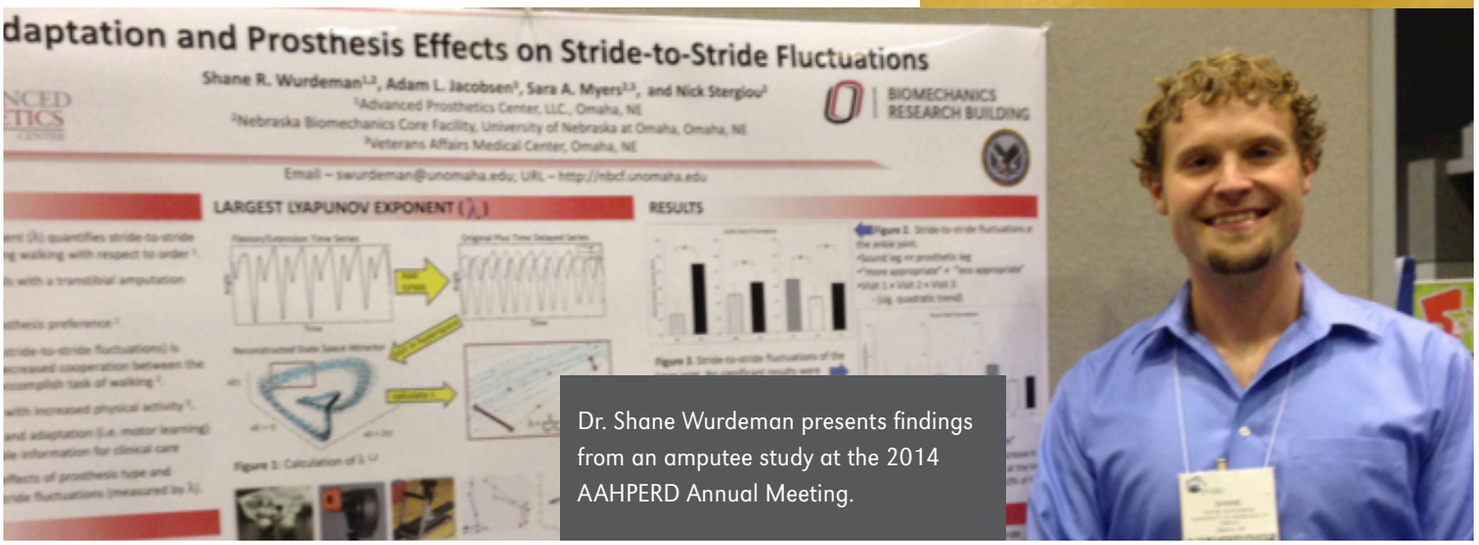
Amputee Research

There has been much progress and exciting events within the Biomechanics Research Building in the realm of amputee research. The project's leader, Dr. Shane Wurdeman, completed his Ph.D. but took no time to celebrate, immediately preparing and submitting major grants to the NIH, DOD, and VA to fund the next steps of the research, building off the findings from his dissertation. In addition, Dr. Wurdeman was presented with the Thranhardt lecture series award at the 2014 American Academy of Orthotists and Prosthetists national meeting, an award recognized by the society for best presentation. Shane and his team continue to work on studies focused on improving limb loss rehabilitation from the perspective of "how do we determine the best prosthesis for an individual?" These studies are implementing state-of-the-art analyses that are very different from traditional biomechanics. The techniques we use, which look at the walking pattern that evolves through multiple steps rather than just a single representative step, allow us to see how well the person is integrating the prosthesis into their natural walking pattern. We have shown that the Lyapunov exponent, a measure that quantifies how the walking pattern evolves through multiple steps, is improved for someone when they are wearing a prosthesis that is more appropriate for their individual activity level. Our work was also able to report that the Lyapunov exponent is the first objective measure to be related to what the patient is feeling with regards to how much they like or dislike a prosthesis. Based on our early work, we intend to develop a means to identify the prosthesis that best fits each individual's walking pattern. This is an important oversight in much of prosthetics research. It is not necessarily the best prosthesis or the best amputee that allows for the best walker, but rather the best combination of amputee and prosthesis. In addition to determining a means to identify the best prosthesis for an amputee, we are working on developing means to help amputees learn to better incorporate the prosthesis into their natural walking pattern. This is because the less you need to force the individual to adopt a different walking pattern from the one they naturally choose, the less effort and strain they must exude, which will lead to be the best outcome.

We are extremely grateful to all the individuals with a prosthesis that have volunteered to be a participant in our studies. Without them this work would not be possible. Their dedication and commitment motivates us to work harder in trying to improve amputee care.



A subject wearing his trial prosthesis. The subject and the prosthesis have multiple reflective markers attached to record motion during walking.



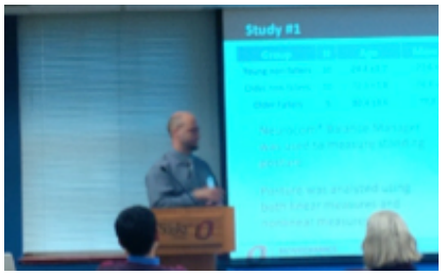
Dr. Shane Wurdeman presents findings from an amputee study at the 2014 AAHPERD Annual Meeting.

Peripheral Arterial Disease and Aging

Patients with peripheral arterial disease have blockages in the leg arteries that prevent enough blood from getting to the muscles in the legs and leads to pain that forces patients to stop walking. This project has been ongoing in the BRB for nine years and is currently supported by grants from the NIH and the VA. Study findings so far point to the ankle as the joint that limits movement most in these patients. The improvements in walking ability after receiving the standard treatment of either supervised exercise therapy or surgery are being investigated as part of the NIH project.

The VA project is comparing two different types of surgery to see which is most effective in improving blood flow, quality of life, and leg function after one year. There are also assistive technologies for rehabilitation being developed to improve function in patients with peripheral arterial disease. The study results so far will get this technology development by targeting the ankle. Right now pilot work is investigating several potential devices that could be worn all of the time or just during rehabilitation sessions. The project continues to work on new rehabilitations and ways for the patients to become more physically active and be able to complete the tasks they would like. We would not be able to complete this project without the help of our collaborators, Dr. Iraklis Pipinos and Dr. Jason Johanning. These physicians recruit patients for our study, teach and mentor our researchers to understand the clinical problems, and work with us to develop better treatments for these patients.

In addition, we are at an exciting point in many of our projects that seek to improve mobility and function in older individuals and those dealing with pathologies, especially those with peripheral arterial disease. The progress from many of these projects were on display during the *Aging with Passion and Purpose: Aging well in the Age of Technology* biannual conference, hosted by the University of Nebraska at Omaha Department of Gerontology in October 2013. Dr. Kyvelidou, Dr. Wurdeman, Dr. Myers, Troy Rand, and Ryan Hasenkamp all presented their work on how technology is helping to diagnose individuals at risk of falls and monitor mobility. Additionally, Dr. Stergiou served as a keynote speaker at the conference and Dr. Myers was on the Planning Committee. A one-hour open house with demonstrations also showcased our new building to aging researchers from across the nation and to local professionals involved in aging care in the Omaha area.



Troy Rand presenting at the Aging with Passion and Purpose, held in Omaha, NE in October 2013.

Dr. Myers presenting her work on peripheral arterial disease at the Aging with Passion and Purpose conference in Omaha.

A subject with peripheral arterial disease walks across the force platforms in our new gait laboratory. The small reflective markers on his joints allow us to know where is body is in space.

The projects presented included novel methods for identifying balance difficulties, mobile monitoring of gait for the purposes of fall detection and functional assessment, and assistive technologies under development to help aging and pathological individuals. The work we are doing with older individuals in the Biomechanics Research Building was highlighted in *New Horizons Newspaper* in September 2013. *New Horizons* is a publication of the Eastern Nebraska Office on Aging that is distributed free of charge to individuals over 60 years of age in Douglas, Sarpy, Dodge, Washington, and Cass counties.

A subject with peripheral arterial disease walks on our instrumented treadmill. This treadmill has two force platforms that allow us to monitor the amount of force that the patient generates when walking. Using a treadmill allows us to see how this force changes over time.

Master's student, Ryan Hasenkamp; and Doctoral student, Troy Rand; work with a subject to test his lower leg muscular strength.

Beyond our Borders

Greece

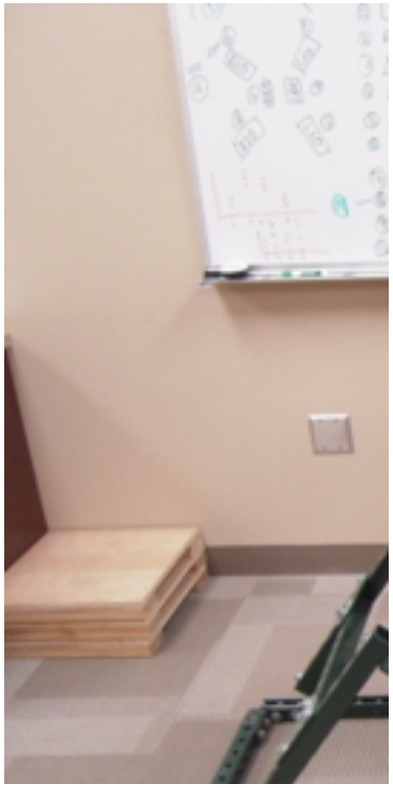
Funding through the Faculty Research International award program at UNO (2013-2014) has allowed Dr. Stergiou to establish a collaboration with Dr. Vasilia Hatzitaki from the Aristotle University of Thessaloniki, Greece. Dr. Hatzitaki has visited our laboratory for two weeks in August and September 2013, while we were organizing the American Society of Biomechanics annual conference. They investigated how specific visual and auditory information from the environment can be used to guide control of standing posture and balance. This research is important in order to understand the balance related problems that are present in various pathological populations (i.e. multiple sclerosis, Parkinson's disease) as well as in the elderly. Dr. Kyvelidou is also involved in this work, and initial data that have been collected in Greece have been analyzed in Omaha and presented at the International Society for Posture and Gait Research in Vancouver, Canada in June 2014. In addition, we submitted a National Science Foundation grant aiming at expanding and promoting this collaboration.

Dr. Kyvelidou and Dr. Hatzitaki examining data from their project, which is a collaboration between Greece and USA.

Dr. Klugarova and Dr. Stergiou when they met at the 2013 American Society of Biomechanics in Omaha.

Czech Republic

Dr. Stergiou received an award through the University of Nebraska at Omaha (Faculty Research International Award) to develop a research partnership with the Czech Republic during the 2014-2015 academic year. This will develop a collaboration with the Czech Republic (Middle European) Center for Evidence-Based Health Care of the Department of Social Medicine and Health Policy at the Palacký University Olomouc (PUO). Our partners from the Czech Republic are Dr. Jitka Klugarova and Dr. Miloslav Klugar from PUO. Our research will focus on the biomechanics of gait on a variety of foot-related abnormalities. The award will allow trips from our Czech partners to come to Omaha and for Dr. Stergiou to go to Olomouc.

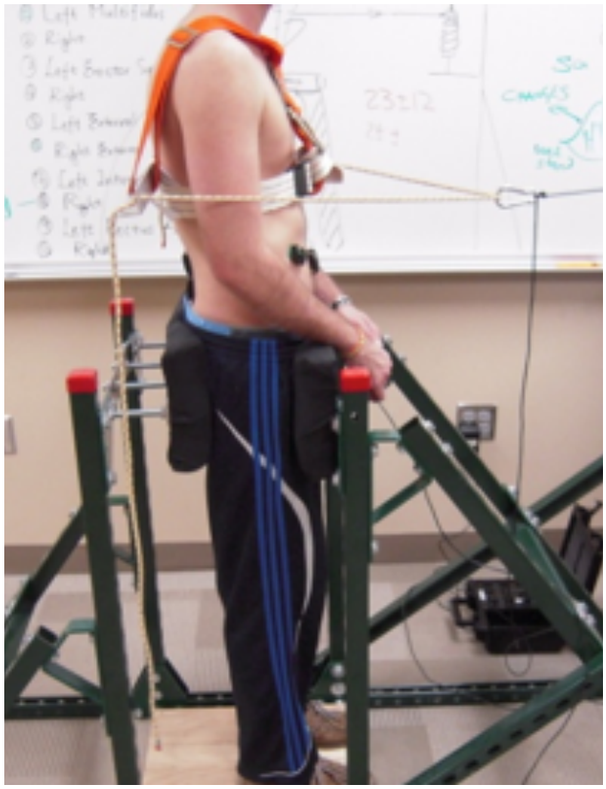


Ireland

We continue to maintain a strong collaboration with Dr. Denise McGrath who has recently taken up a new position as an Assistant Professor at Ireland's largest University, the University College Dublin. Denise undertook postdoctoral research at our laboratory in 2011-2012, and we have since developed a number of projects around the analysis of the biomechanics of walking in the elderly while exposed to musical rhythms. Denise's involvement with the "Connected Health" program at the University College Dublin provides a useful platform to capture movement data in the real world using wearable and ambient sensor technologies.

This year Dr. Mukherjee received a Faculty Research International award (through UNO for 2014-2015) for travelling to Ireland to enhance our collaborative projects with research scientists in Ireland. This Faculty Research International award is targeted towards fostering a USA-Ireland partnership to promote research in the area of physical activity in stroke survivors. The award also provides for a similar travel arrangement: Dr. McGrath to visit the Biomechanics Research Building to develop new lines of research. Our ongoing projects with Ireland have resulted in several collaborative federal grant applications in the area of biomechanics and physical activity in aging.

Dr. McGrath with Dr. Sara Myers at the World Congress of Biomechanics meeting in Boston, MA in July 2014.



Creighton University

Low back pain research: For a number of years we have been collaborating in low back pain research with Dr. Deborah Givens, the Chair of Creighton University's Department of Physical Therapy. Dr. Givens and our post-doc Dr. Diderik-Jan Eikema have continued here in Nebraska the work of the late Dr. Kevin Granata that involves the development of a device, the Trunk Reflex Examination Device (TRED). This device will allow for a better diagnosis and possible treatment of low back pain. TRED applies mechanical "pulls" to the subject's torso and measures the delay and magnitude of low back muscle reflexes in healthy persons and in individuals with low back pain. In our study, we had both healthy and patients with low back pain that came in for multiple sessions spread out over multiple days. We found that patients afflicted with low back pain display delayed and attenuated reflex responses. These weakened and delayed reflexes increase the likelihood of future low back injuries, resulting in a cycle of secondary injuries. To this day, the only tools for measuring low back pain are based on pain questionnaires; not a very reliable measurement method at all. A true objective instrument to measure low back pain could change the way it is treated in clinics and evaluated by insurance companies.

Inside the TRED and in the resting position as shown here, the body is upright. During cable pulls, the body will try to remain in this position. As the cable rapidly pulls on the harness, the person moves forward. The nervous system tries to counteract this movement by activating the muscles of the lower back.

Journal Club

Dr. Richard Casaburi

Dr. Richard Casaburi, Professor at the Department of Medicine, Professor and Associate Chief of Research of the Division of Respiratory and Critical Care Physiology & Medicine at the University of California at Los Angeles – 11/06/2013 "Dynamic forcings in exercise science: how I came to love the sine wave".

Dr. Mahbubul Majumber

Dr. Mahbubul Majumder, Assistant Professor at the Department of Mathematics at the University of Nebraska at Omaha – 11/01/2013 "Visual statistical inference".

Dr. Vasillia Hatzitaki

Dr. Vasillia Hatzitaki, Associate Professor in Motor Control at the Aristotle University of Thessaloniki, Greece – 08/30/2013 "Interpersonal coordination dynamics in dancers and non-dancers: contrasting timing and haptic cues".

Dr. Amy Hellman

Dr. Amy Hellman, Assistant Professor at the Department of Neurological Sciences at the University of Nebraska Medical Center – 02/28/2013 "Continuous non-invasive arterial pressure monitoring to detect covert autonomic dysfunction in Parkinson's disease".

Ms. Marisol Rodriguez

Ms. Marisol Rodriquez, SBIR/STTR consultant at the Business Development Center of the University of Nebraska at Omaha – 11/22/2013 "Grants for innovation and business."

Dr. Carol Pullen

Dr. Carol Pullen, Professor at the College of Nursing of the University of Nebraska Medical Center – 12/13/2013 "Collaborations between nursing and biomechanics".

Dr. Ozgur Araz

Dr. Ozgur Araz, Assistant Professor at the Department of Health Promotion, Social and Behavioral Health at the University of Nebraska Medical Center – 10/04/2013 "Predicting influenza hospitalizations for public health decision making".

Dr. Barbara Ainsworth

Dr. Barbara Ainsworth, Associate Director and Professor at the School of Nutrition and Health Promotion at Arizona State University – 10/11/2013 "Physical activity assessment – lessons learned".

Dr. Mark Grabiner

Dr. Mark Grabiner, Professor at the Department of Kinesiology and Nutrition, and the Department of Bioengineering and Director of the Clinical Biomechanics and Rehabilitation Laboratory of the University of Illinois at Chicago – 11/15/2013 "An evidence-based approach to the design of a task-specific fall prevention intervention".

Dr. Danae Dinkel

Dr. Danae Dinkel, Assistant Professor at the School of Health, Physical Activity and Recreation at the University of Nebraska at Omaha – 02/14/2013 "Getting girls active: exploring how to increase girls' physical activity after school".

Dr. Jung-Min Lee

Dr. Jung-Min Lee, Assistant Professor at the School of Health, Physical Activity and Recreation at the University of Nebraska at Omaha – 02/21/2013 "Feasibility for calibration of built-in accelerometers in smartphones".

Dr. Ann Fruhling

Dr. Ann Fruhling, Associate Professor in the Information Systems and Quantitative Analysis Department at the University of Nebraska at Omaha – 04/25/2013 "Human computer interaction: user interface design and evaluation studies".

Awards

Troy Rand performing a data collection on the Neurocom system.

Troy Rand

In November of 2013, Mr. Troy Rand was awarded the Elton S. Carter award for excellence in a master's thesis for his thesis titled "An investigation into the nonlinear dynamics of center of pressure and fall risk in the elderly." This award is given out once a year for the best thesis campus wide and it is the first such award received in the College of Education. In February of 2014, Troy who is now a doctoral student, received a grant from the University Committee on Research and Creative Activity for $500 to further fund his research investigating how sensory input affects center of pressure during standing. In March of 2014, Troy also received a grant from Graduate Research and Creative Activity for $5000 to support his research investigating the effect of using virtual reality to improve the gait symmetry in stroke survivors. The above awards will be used to purchase equipment in the virtual reality lab as well as provide stipends to the participants in the research.

Bryon Applequist

Our doctoral student, Mr. Bryon Applequist, was awarded a $5000 Graduate Research and Creative Activity (GRACA) grant from UNO's Office of Research and Creative Activity. The study, "A comparison of baseline lower extremity muscle function differences in patients with PAD and healthy controls," is part of Bryon's dissertation research and the funds will further support his efforts. Bryon was also awarded an American Society of Biomechanics Student Travel Award of $250 to present his abstract titled "Gait biomechanics are not improved following supervised treadmill exercise in patients with peripheral arterial disease", at the 7th World Congress of Biomechanics in Boston, MA. In addition, Bryon was recently awarded the $2500 Great Lake National Scholarship Award.

Mike Hough

Our Master's student, Mr. Mike Hough, was awarded a $5000 Graduate Research and Creative Activity (GRACA) grant from UNO's Office of Research and Creative Activity to investigate the learning and retention effects of audio stimuli on elderly gait. His research aims to develop interventions to address falls in the elderly. Mike presented results from his study, "Improving Elderly Gait with a Structured Auditory Stimulus," at UNO's 6th annual Student Research and Creative Activity Fair, for which he was awarded "Meritorious Graduate Poster."

Mike Hough placing an fNIRS cap on a subject in preparation for a data collection.

Josh Pickhinke

Our Master's student, Mr. Josh Pickhinke, was awarded a Graduate Research and Creative Activity (GRACA) grant from UNO's Office of Research and Creative Activity. This $5000 grant will support his research on how the visual system contributes to movement variability and balance control during walking. In addition, Josh received a $500 grant from the University Committee on Research and Creative Activity to provide a stipend for the research participants of his research. Also, Josh received a $500 travel award from the office of Graduate Studies which allowed him to present his project, "Varying the Speed of Perceived Self-Motion Affects Postural Control During Locomotion" at Medicine Meets Virtual Reality 21 in Manhattan Beach, CA.

Eric Pisciotta

Eric placing reflective markers on a subject during a data collection for his Master's thesis.

Mr. Eric Pisciotta is a recipient of the UNO Advantage scholarship and the Regent's tuition waiver. He was also awarded grants from the Graduate Research and Creative Activity (GRACA) and University Committee on Research and Creative Activity (UCRCA) for his study of plantar pressure distribution patterns in aging. Eric received an American Society of Biomechanics Student Travel Award to present research entitled "A comparison of gait parameters between patients with peripheral arteriole disease and patients with chronic obstructive pulmonary disease" at the 7th World Congress of Biomechanics in Boston, MA.

Faculty Travels

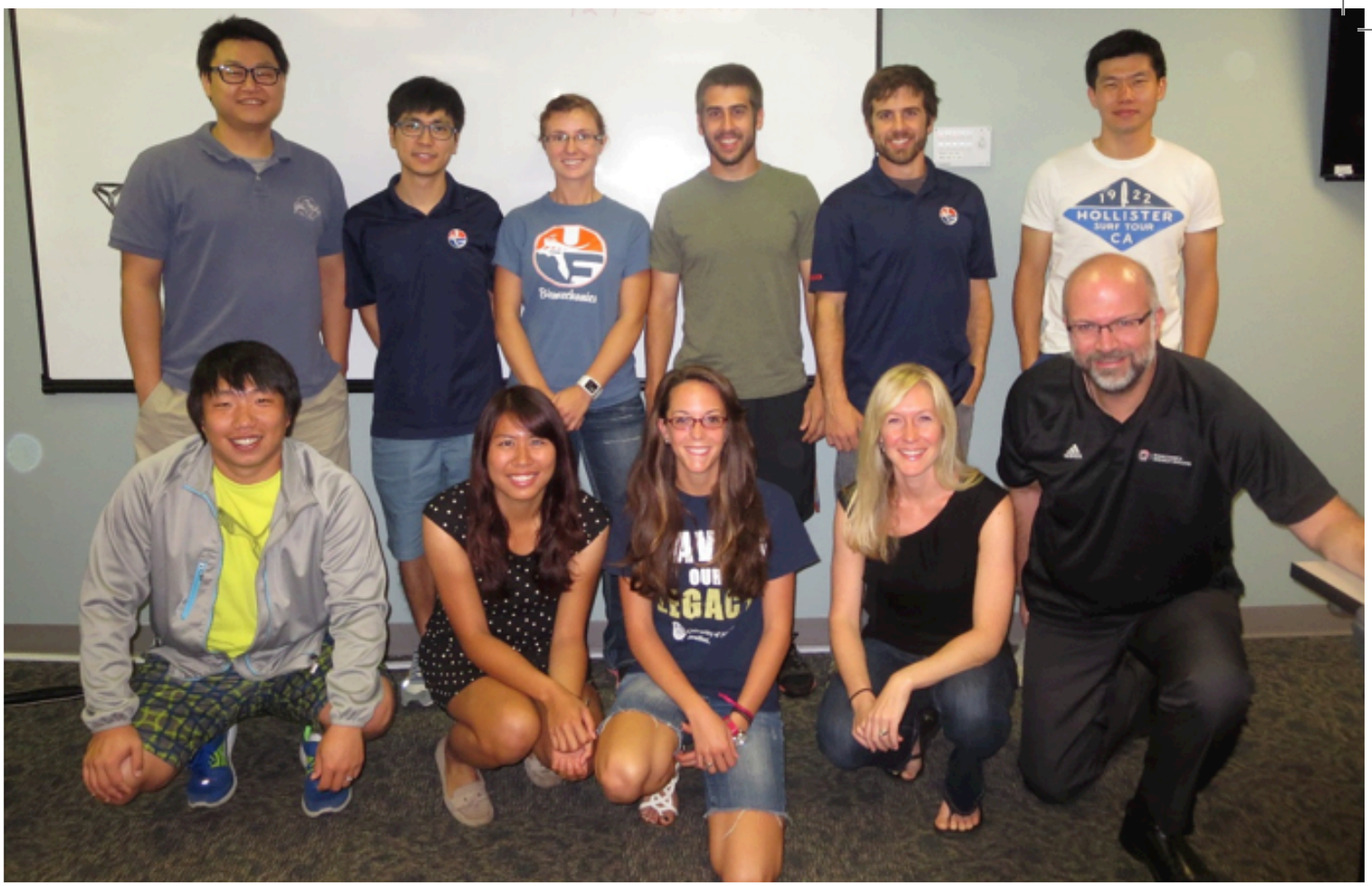
Dr. Stergiou

This last spring semester, Dr. Stergiou was awarded a Research Leave from our University and he decided to spend his time mostly at the University of Florida. The Kinesiology Department at Gainesville is one of the best in the country and the experiences were in abundance. Dr. Stergiou even taught a course (see far right photo) with a subject "Human Movement Variability", attended various college level meetings to get administrative experiences (bottom right photo), attended several seminars and gave lectures at several departments, but most importantly spent significant time having fun and discussing research with his good friends, Dr. Evangelos Christou, Dr. David Vaillancourt, Dr. Steve Coombes, and Dr. Chris Hass (see photos). After four months at Gainesville, he travelled around Europe visiting different laboratories and spending most of his time with Dr. Vassilia Hatzitaki at the Aristotle University of Thessaloniki.

Dr. Christou at his laboratory showing his driving simulator to Dr. Stergiou.

Dr. Christou at his office working with Dr. Stergiou.

Dr. Stergiou and his Gator brothers, Drs. Christou, Vaillancourt, and Hass. What a great group of scientific minds!



Dr. Stergiou and his class at the University of Florida. What a great group of graduate students!

Dr. Stergiou sporting a Gators shirt at a College level meeting with the Associate Dean for Academic and Student Affairs Dr. Chris Janelle (first from the left), Chair Dr. Steve Todd, Chair Dr. Tom Clanton, Business Manager Tracey Phillips, Associate Dean of Research Dr. Jim Cauraugh, and Chair Dr. Mike Sagas (standing).

Conferences

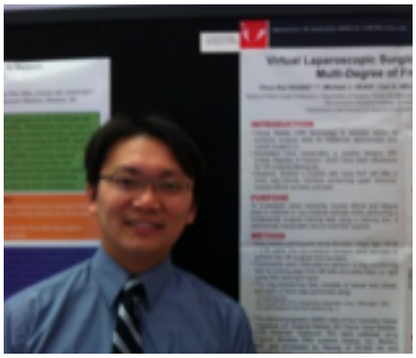
2014 Combined Sections Meeting of American Physical Therapy Association: February 4-6, 2014, Las Vegas, NV

BRB faculty Dr. Joseph Ka-Chun Siu and doctoral student Kai attended the CSM 2014 where more than 11,300 attendees and 2,000 exhibitions gathered in Las Vegas. Joseph and Kai have a physical therapy background, and presented their current research work from BRB.

Kai (left) and Joseph (right) stood in front of their poster entitled "A Conceptual Model for Gait Maintenance in Patients with Diabetes".

Kai and Joseph had a fun night-walk along the strip in Vegas.

Medicine Meets Virtual Reality (MMVR21) Conference: February 19-22, 2014, Manhattan Beach, CA



Kai presented his ongoing robotic project "Virtual Laparoscopic Surgical Skills Practice Using a Multi-Degree of Freedom Joystick" in MMVR 2014.

Josh (left) and Kai visited Manhattan Beach pier and the Roundhouse Aquarium after their presentation in MMVR.

BRB graduate students Kai and Josh attended the 2014 MMVR conference held in Southern California in February. They had the great opportunity to meet with and talk to researchers interested in virtual reality and human movement sciences. Josh was awarded travel funding through UNO Graduate Studies to attend this annual conference. Kai received $750 through the UNMC School of Allied Health Professionals Student Travel Award to attend.

Council for Undergraduate Research: June 26-28, 2014, Washington, DC

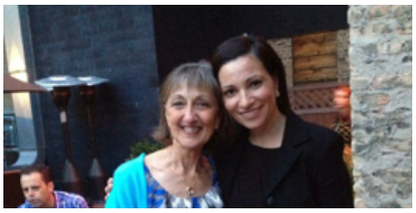
In June of 2014, Dr. Sara Myers attended the CUR (The Council on Undergraduate Research) Annual Business Meeting in Washington, DC as part of her duties as a CUR Councilor. CUR is a national organization with the mission to support and promote high-quality undergraduate student-faculty collaborative research and scholarship. While at the meeting, Dr. Myers was elected to the task force on Student Activities. The task force brainstormed ways that student research could further be promoted under the mission of CUR, which is designed to develop faculty. Activities to promote mentor development were the focus including how to prepare students for the next step in their careers (professional or graduate school), manuscript development with students, and beginning a mentoring program at the National Conference for Undergraduate Research conference.

Dr. Myers at the CUR conference.

Aging, the Central Nervous System, and Mobility in Older Adults: November 19-20, 2013, New Orleans, LA

Dr. Jenna Yentes attended this workshop that focused on the mechanisms underlying impairments in older age. Roughly 50 attendees examined potential biological and physiological mechanisms related to central nervous system alterations that could be associated with mobility impairments. During this two-day conference, Dr. Yentes had the opportunity to attend lectures and participate in small group discussions with the goal of identifying precursors of disability that may serve as targets for future interventions.

NASPSPA

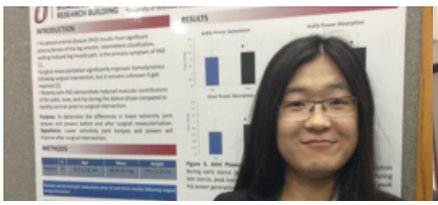


Dr. Ulrich and Dr. Kyvelidou at NASPSPA.

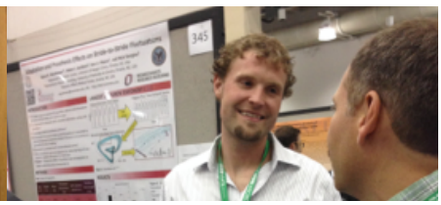
Dr. Kyvelidou and Dr. Eikema attended the 2014 conference of the North American Society for the Psychology of Sport and Physical Activity at Minneapolis, MN. One of the conference highlights was the award of Distinguished Scholar of Dr. Beverly Ulrich, a close collaborator of ours, and the reception in her honor. Both of our post-doctoral fellows presented their research at the conference in abstract or oral presentation form and received valuable feedback from scientists from the US as well as Europe, Canada and Australia.

World Congress of Biomechanics: July 6-11, 2014, Boston, MA

From left to right: Alek Diffendaffer, Bryon Applequist and Josh Pickhinke at WCB.



Lexie Liu at her poster at WCB.

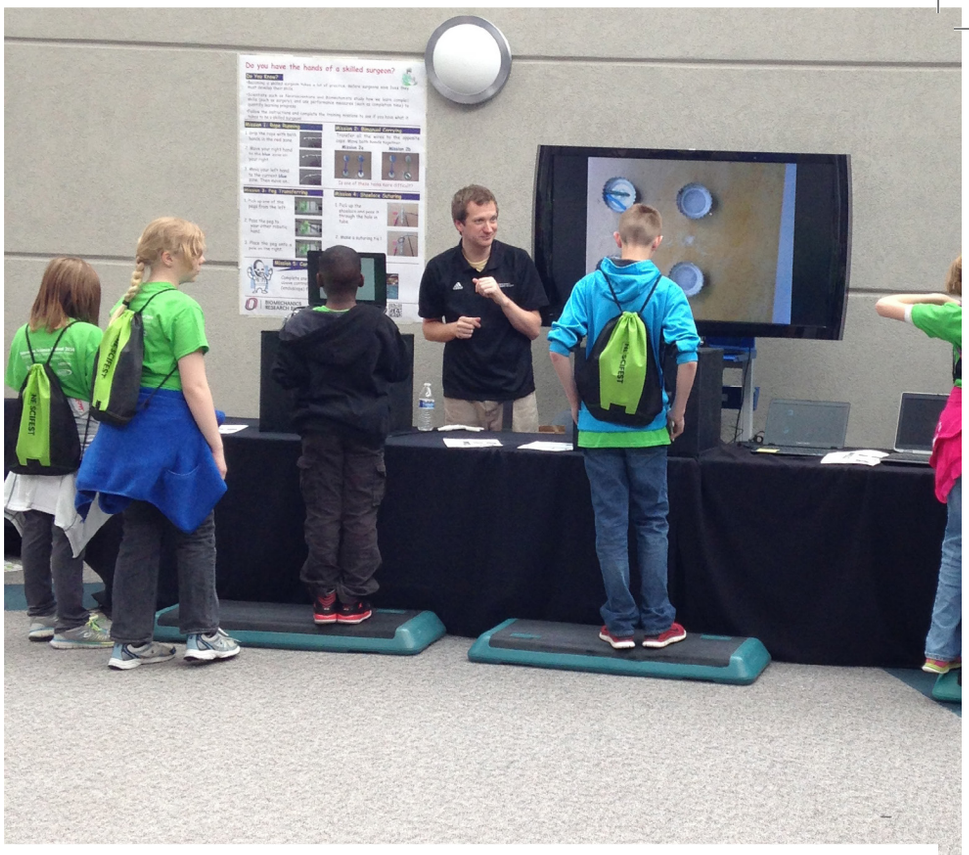


Dr. Shane Wurdeman presenting his poster.

Drs Myers and Srikant Vallabhajosula at WCB.

In July 2014, the BRB sent a delegation of nearly 10 individuals to Boston for the World Congress of Biomechanics meeting to present 13 poster presentations. This meeting happens once every four years and in 2014 served as the combined meeting of seven individual societies including the American Society of Biomechanics. This 5-day meeting was attended by over 4,000 biomechanists from all over the world. Students Bryon Applequist, Ryan Hasenkamp and Eric Pisciotta received travel awards from the American Society of Biomechanics to attend this meeting. In addition, Bryon Applequist and Alek Diffendaffer were awarded travel awards through the Force & Motion Foundation to attend.

NE Science Fest



On April 24-25, 2014, the BRB participated in the Nebraska Science Fest. This annual event exposes children ages 6-18 years old to STEM projects and experiments. Dr. Steven Harrison, along with doctoral students Troy Rand, Bryon Applequist, and Kai Huang, developed three hands-on experiments for students to try at our booth. These experiments focused on motor control and the manipulation of visual or haptic feedback to complete the tasks.


The Science of Movement
Motor Learning


Biomechanics
Research Building

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For more than 25 years, the revolutionary work of the Biomechanics Research Building (BRB) at UNO has led to a new understanding of human movement; such as how people stand, walk and physically interact with their environment. The facility has earned an international reputation for excellence in basic and clinical research.

Our research in cerebral palsy and peripheral arterial disease, for example, has influenced the treatment and therapy options available to persons living with these disabilities. The facility has patented the wireless Gait-O-Gram, a biomedical instrument designed to measure an individual's walking parameters. Currently research efforts are also focused on robotic assisted surgery, chronic obstructive pulmonary disease, Autism, stroke and elderly populations.

These achievements bring opportunities to advance our program. But this growth requires funding beyond allocations provided by the state. Charitable gifts to the Nebraska Biomechanics Excellence Fund are needed to help advance the critical work occurring at the BRB. This funding will support new equipment, a facility addition, student scholarships and faculty support. We feel so strongly about our facility and the work that we do that every one of our students, faculty and staff have contributed to the fund. The BRB was the first entity in the University of Nebraska system to procure 100% support internally. Join us in our efforts by making a gift today.

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