Fall 2013

BRB Newsletter, Fall 2013

Biomechanics Research Building
University of Nebraska at Omaha

UNIVERSITY OF NEBRASKA AT OMAHA

BRB NEWSLETTER

BIOMECHANICS RESEARCH BUILDING | FALL 2013

University of Nebraska Omaha

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Letter from the Director

Rethink the impossible.

On August 15th 2013 we moved into our new 23,00-square-foot Biomechanics Research Building and on September 5th 2013 we will have our official Grand Opening. So, as we got ready to move into our new building I reflected back to the time when I started working at UNO in 1996, when I was hired as a young man from Greece to be an assistant professor. My laboratory was a 500-square-foot room, my teaching load was three courses a semester and I had two teaching assistants. Through tremendous hard work, immense determination and the incredible generosity of Bill and Ruth Scott's family, we are moving into a new building that is going to be the home of biomechanics research in Nebraska.

This was a marvelous trip in science for myself and my students, as we navigated in areas previously unknown for UNO. We have faced Cyclops and Laestrygonians but as the Ulysses of the old, we have arrived at Ithaca. There were so many firsts but to actually have the first building exclusively dedicated to research at our University and the first building exclusively dedicated to biomechanics research in the world is unfathomable. I am so proud of our trip. I am also so thankful to the Scott family, who as goddess Athena helped Ulysses, they have helped us to achieve our dream. My staff of thirty, composed of young faculty, technicians, postdocs, graduate and undergraduate students, is ecstatic with our arrival at Ithaca. Our collaborators from UNMC, UNL, Creighton, all over the USA, and around the globe are elated. Our federal, state, and private funding sources are delighted with their investment in biomechanics research in Nebraska. I am overjoyed that I have seen an impossible dream come true.

But this is not the end; we will continue and strive for even greater heights since we believe that nothing is impossible. As I walk through our building, I imagine a scientific sanctuary where exceptional scientists and clinicians are working in harmony to perform innovative research in biomechanics and where a workforce is molded to meet the scientific needs of our nation. I imagine travelers from around the globe as they come to the source of biomechanical knowledge and to be exposed to the latest discoveries. I imagine how these discoveries shape the future of health care by improving quality of life through the development of new diagnostic and treatment strategies. I see us giving more than we take from this life. This is how I see our future and I ask you to do the same. I ask you to rethink the impossible because this building is a testimony that anything is possible. I ask you to help us with our continuous needs in funds for equipment, professorships, studentships, and patient participation. I ask you to embark with us on a marvelous trip to human advancement with biomechanics as the vehicle overcoming the despotism of tradition.

Thank you,

Nick Stergiou, Ph.D.

Featured Story

Our New Home

We are so ecstatic to share with you our new home. In August 2013, we moved into a glorious new building, dedicated solely to biomechanics research.

The Biomechanics Research Building was made possible through a generous donation from the Ruth and Bill Scott family and we are forever grateful for their gift. This building houses both the Nebraska Biomechanics Core Facility and the Center for Biomechanics Research in Nebraska.

The mission of the Biomechanics Research Building will be to serve not only UNO but the entire University of Nebraska system and the state of Nebraska by educating and developing a dynamic workforce and by enhancing economic growth through development of biotechnology and biomechanical intellectual property. Our mission will be fulfilled through our four research divisions: Neurophysiology of Gait, Neuromuscular Control of Balance and Posture, Robotics Rehabilitation and Training, and Neuromuscular and Sensory Systems Assessment and Rehabilitation. The research in these divisions will be supported by our six state-of-the-art laboratories: Main Motion Analysis, Virtual Reality, Acoustics, Balance and Strength, Motor Development, and Robotics.

The Main Motion Analysis Laboratory will be the primary data collection space of the building. Equipped with 3D motion capture systems and force measuring devices, this state-of-the-art lab supports projects on mobility in patients with peripheral arterial disease, chronic obstructive pulmonary disease, multiple sclerosis,

falls in the elderly and lower limb amputation. The Virtual Reality Laboratory houses specialized equipment that creates virtual reality environments to study variability in human movement. By manipulating these environments our researchers can examine walking patterns related to reduced stability. The lab also supports pioneering work helping patients with a stroke, amputation, Parkinson's disease, and even astronauts recovering from space missions. The Acoustics Laboratory is designed to collect speech and cognitive data on human subjects. The lab is used for several projects investigating dual-task situations, such as walking and talking, to record and analyze interplay between motor skills and cognitive function. The Balance and Strength Laboratory supports researchers studying balance and postural control. Work in this lab determines the level of contribution of different sensory systems to postural control by manipulating vision and surface conditions. The lab also is used to continue highly acclaimed work with traumatic brain injury, concussion, and falls in the elderly. The Motor Development Laboratory supports research on the development of postural control in typically developing children and children with developmental disabilities as well as children with autism. This work is leading to the creation of tools to assess delays in movement development and develop treatments and interventions. The Robotics Laboratory includes the Upper Extremity Robotics Lab and the Surgical Robotics Lab. The first houses robots and brain imaging devices used to evaluate and train individuals with problems controlling movements of their upper limbs due to stroke or other diseases. The second lab is used to develop and refine surgical robot simulators for evaluating and training medical students and surgeons on robotic surgery techniques.

To better equip all of the new laboratory spaces, we were awarded a grant from the Nebraska Research Initiative totaling $843,005.00. This enabled us to add on our existing arsenal of biomechanics equipment to furnish the new laboratories. The requested equipment directly impacts our students' learning and research that come from a variety of academic programs (e.g., Neuroscience, Biotechnology, Biomechanics, Exercise Science). The new equipment allows for independent setup for each laboratory and allows simultaneous data collections in multiple areas. Additionally this strengthens our recruiting efforts to bring the best students and continue establishing excellent collaborations from around the world. Attracting the best scientists is a vital step in being able to be more competitive for obtaining external funding.

In addition, our building is open for tours, meetings and seminars. Please inquire about these opportunities. Nothing makes our day more than giving a tour to a group of children and seeing their eyes light up when they see three dimensional motion capture happening live! One of our greatest joys is inspiring students to pursue STEM education. If you are ever in the area, please let us know! We would love to show you around. ■

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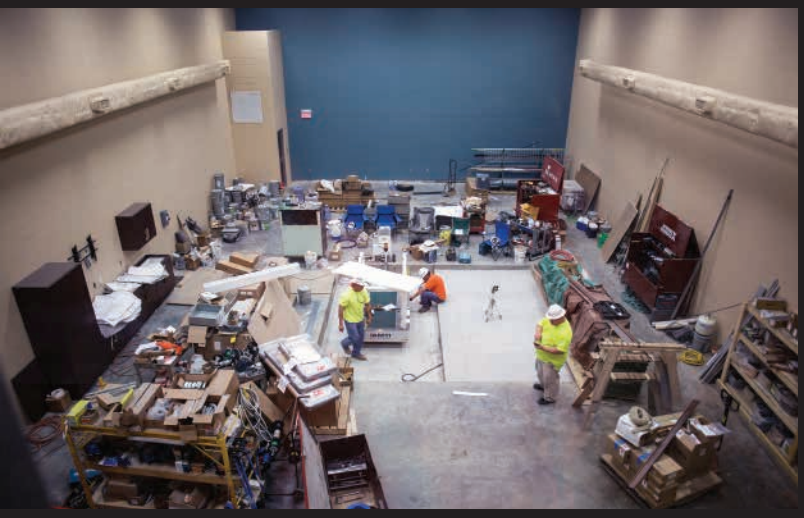


American Society of Biomechanics Meeting

The NBCF would like to extend a warm welcome to over 600 scientists, professors, engineers, biomechanists, and students that arrived in Omaha for the American Society of Biomechanics meeting. Omaha was selected three years ago to host this national scientific conference, the first scientific meeting of this scale to be hosted in this fine city. For the past two years, faculty from four institutions have worked together to bring this amazing four-day scientific conference to fruition. From September 4-7, 2013, attendees participated in tutorials, lab tours, poster sessions, attended keynote and podium sessions. Dr. Rakié Cham and Dr. April Chambers from University of Pittsburgh thoughtfully selected the program and organized the scientific content. Together with the faculty in Omaha, all attendees had a very successful meeting. Highlights from the meeting included tutorials on using robots for STEM education, the banquet dinner at the Zoo, and the NU Foundation's invitation to an open house at the new Biomechanics Research Building at UNO. The conference chair, Dr. Nick Stergiou, would like to thank Dr. Sara Myers (UNO), Dr. Joseph Siu (UNMC), Dr. Terry Grindstaff (Creighton) and Dr. Jeff Hawks (UNL) for all of their help in contributing to the conference logistics. And most importantly, he would like to thank Ms. Amanda Fletcher and Dr. Jenna Yentes for their incredible work on all of the details of the conference, including the writing of four grants (three of which were funded) to help sponsor this incredible conference. Lastly, a thank you to Mr. Jung-Hung Chien for his work with our website and all of the undergraduates (Dylan Goodman, Carlee Howe, Jessica Renz and Whitney Korgan) that worked to secure donations, proofread documents and help out.

Grants were funded by the NIH (NIBIB/NIAMS), NASA Nebraska Space Grant and NSF EPSCoR. Additional sponsorship money was provided by UNO College of Education, UNMC College of Public Health, UNL College of Engineering, Creighton Department of Physical Therapy, The Hawks Foundation, NU Foundation, Peter Kiewit Foundation. The meeting also had exhibitors that donated additional money to the meeting. They were: Diamond Sponsors: Motion Analysis Corp and AMTI | Silver Sponsors: Qualisys and simpleware

NONLINEAR WORKSHOP 2013

On June 3-7, 2013, the NBCF hosted the fifth annual nonlinear workshop. Participants traveled from around the US and Canada to Omaha to learn nonlinear mathematics and their application to human movement studies. This workshop covered five days of lectures, hands on learning and social events. If you are interested in attending, please check our website (nbcf.unomaha.edu). Information regarding the upcoming workshop is typically released in January.

From left to right: Amanda Fletcher, Kimberly Bigelow, Albert Vette, Gregory Gutierrez, Andrew Nordin, Sean Simpson, Nicholas Stergiou. Front: Anastasia Kyvelidou

EUROPEAN NONLINEAR WORKSHOP

Left to right, Back Row: Dr John Seeley, José Pedro Silva, Dr Thomas Korff, Dr Darren James, Bruno Straitto. Middle Row: Dr Pedro Miguel Silva, Dr Marco Arkesteijn, Dr Kevin Sweeney, David Whiffin, Alan Armstrong, Dr Nick Stergiou, Dr Adam Clansey. Front Row: Dr Denise McGrath, Aoife Healy, Dr Mark Goss-Sampson, Jenny Kent, Dr Mark Colpus, Dan Robbins. Missing: Dr Johann Issartel

The first ever European Nonlinear Analysis workshop was held at the University College Dublin (UCD) on May 8-10, 2013. There was a keen appetite for this workshop among the biomechanics and motor control scientific community in Europe as Dr. Nick Stergiou's work in this field is widely known and respected. Numerous communications received by Dr. Stergiou over the years indicated that travel to the United States to attend the annual Nonlinear Analysis workshop delivered at the Nebraska Biomechanics Core Facility was not feasible and too expensive for many Europeans. Dr. Stergiou, along with his Irish collaborators Dr. Brian Caulfield (UCD) and Dr. Denise McGrath (University of Ulster) therefore, undertook the task of hosting a similar workshop in Dublin, Ireland.

An ideal working group of seventeen attendees in total were welcomed to UCD on the 8th of May, from diverse Universities and Medical Centers in Ireland, the United Kingdom and Portugal (University College Dublin, Dublin City University, University of Ulster, Brunel University, London South Bank University, Oxford Brooks University, Staffordshire University, University of Greenwich, Aberystwyth University, Defense Medical Rehabilitation Centre, University of Porto, Technical University of Lisbon). We had a wonderful mix of expertise and interests within the group that lead to many stimulating discussions in and out of the classroom. Three full days of intense teaching and learning (and a little socializing!) ensued. We are glad to say that all our attendees emerged with some new tools and perspectives that they can apply to their specialist areas of research in the future.

The following are some comments received from the attendees at the closing of the workshop:

"Delivery and content of this workshop was fantastic, met some very interesting people in my area"

"Excellent experience"

"Very well organized and presented. I found it to be a very good learning environment with easy to understand explanations and felt comfortable asking questions".

"Really enjoyed it. Learned a lot and feel a lot more aware of pitfalls"

We would like to thank all the attendees for their contributions throughout the workshop and for making the first European Nonlinear Analysis workshops a success. We would also like to thank the staff at UCD for facilitating the workshop.

Staff Updates

NEW INSTRUCTOR

Jenna Yentes, PhD, joins us as a full-time instructor in the Department of Health, Physical Education and Recreation. Jenna has worked at the NBCF for the past five years and started teaching for the department in Spring 2013. She will be teaching undergraduate anatomy and physiology, biomechanics and laboratory methods. In addition, she will continue her research in the application of nonlinear mathematical methods to human movement and the biomechanics of chronic pulmonary obstructive disease. She is the recipient of a NASA Nebraska Space Grant & EPSCoR Mini-Grant for 2013-2014. This grant will fund a Master's student to assist her in collecting and analyzing human movement data. In addition, she has partnered with Little Priest Tribal College in Winnebago, Nebraska to bring STEM education to this small college on the reservation. She hopes that by working with the Native Americans, she can provide additional opportunities for STEM education and learning.

NEW COORDINATOR OF THE BUILDING

The NBCF would like to congratulate Jeff Kaipust on his recent promotion to Biomechanics Research Building Coordinator. Jeff started in August 2011 as the inaugural NBCF lab technician and has since worked closely with all NBCF members to expedite our daily operations of the facility. Jeff has worked with Dr. Stergiou for the past eight years including working as an undergraduate volunteer and during his graduate studies. His new duties include coordinating all research projects in the Biomechanics Research Lab including but not limited to: scheduling lab times, oversight of equipment, and managing the building. He will also coordinate the purchase of equipment, materials and supplies for projects, the hiring of students and graduate assistants for all projects. He will also work as a liaison with Business Manager of the College of Education and Grant Specialists related to budgets and grant submissions. Congrats, Jeff!

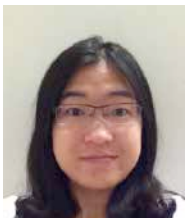
NEW LAB TECHNICIAN

Jung Hung (JC) Chien, PhDc, has been working with us since 2009. He was recently promoted to a laboratory technician position. Mr. Chien received his baccalaureate and Master of Science degrees in mechanical and electronic engineering from Huafan University in Taipei, Taiwan. He immigrated to the U.S. and received a post-baccalaureate degree in Computer Information Science and a second Master of Science degree in Human Physiology from the University of Oregon. As a laboratory technician he will not only complete the laboratory tasks but also continue his research, which includes investigating the postural control during standing and walking in patients with sensory system deficits.

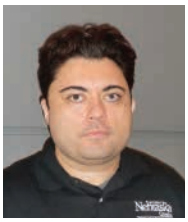

Eikema


Harrison


Rand


Liu


Applequist


Pickhinke


Hough

NEW POSTDOCS

Diderik Jan Eikema, PhD, came to us from the Netherlands via Greece. He received his Bachelor's and Master's degrees in Psychology from the University of Groningen (the Netherlands). He completed his PhD at Aristotle University Thessaloniki (Greece) in the summer of 2013. He investigated perceptual methods for the manipulation of sensory reweighting processes during standing balance in virtual environments. As a postdoctoral research associate, he is working on the effect of sensory reweighting on gait variability in virtual reality.

Steven Harrison, PhD, came to us from England via Cincinnati. He earned his PhD in Experimental Psychology in 2007 from the University of Connecticut and he completed a post-doc at the University of Cincinnati in 2012. He has worked with physical therapists to model the dynamics of postural control, and with social psychologists to model how two or more people learn to perform physical tasks together. Steven's research explores the interplay of neuro-musculo-skeletal, environmental and informational constraints on human action. Most recently he has been interested in the kinesthetic (non-visual) sense of how we are moving through the world that accompanies locomotion. He has strengths in several areas including Motor Control and Learning, Dynamical systems, psychology, perception and action. As a postdoctoral research associate, he is working on projects that involve these areas developing critical research questions, writing grants and manuscripts.

NEW PHD STUDENTS

Troy Rand, MS, attended the University of Northern Iowa where he received his Bachelor's degree in Exercise Science with an emphasis in Sports Psychology. Under the direction of Dr. Sara Myers, Troy joined us in the summer of 2011. He earned his Masters degree in August of 2013, with his thesis focusing on aging and fall risk. Troy started the PhD program in August of 2013 under the direction of Dr. Mukul Mukherjee and plans to continue his research on aging and fall risk while also researching brain imaging.

Xuan Liu, MS, completed her Bachelor's degree in Sport Rehabilitation and Health at Beijing Sport University and her Master's degree in Biomechanics at University of Tennessee-Knoxville. She is a first year PhD student with us, under the supervision of Dr. Sara Myers, starting in the fall of 2013. Her research interests include gait analysis in patients with peripheral arterial disease and in identifying fall risk factors and mechanisms associated with injury in older adults.

Bryon Applequist, MS, recently joined us in July 2013 as a first year doctoral student. He attended the University of Nevada, Las Vegas, where he earned his Bachelor's degree and Master's degree in Kinesiology with an emphasis in Biomechanics. His research has primarily dealt with gait and landing techniques in special populations. Bryon will be exploring new ways to quantify amputee gait under the direction of Dr. Sara Myers.

NEW MASTERS STUDENTS

Josh Pickhinke, BA, joined us in January 2013 as a volunteer assistant and will enter the graduate program in August, pursuing a Master's in Exercise Science with an emphasis in Motor Control. He is originally from Hastings, Nebraska and earned his undergraduate degree from the University of Nebraska-Omaha in Philosophy and Political Science. He currently works under the direction of Dr. Mukul Mukherjee on projects using virtual reality environments to study human movement variability. He also assists, Dr. Jenna Yentes on her work with nonlinear algorithms to study human movement.

Michael Hough, BS, graduated from the United States Naval Academy with a degree in Physics, and served as a submarine officer before leaving the Navy. After a number of years in the workforce, he returned to school at UNO in the fall of 2012 to pursue a Master's degree in Exercise Science, and joined our staff in the summer of 2013. He is primarily working on gait projects under the direction of Dr. Sara Myers, and plans to remain with us after graduation to pursue a doctorate in Biomechanics.

National Institute on Aging

Department of Veterans' Affairs Peripheral Arterial Disease Work

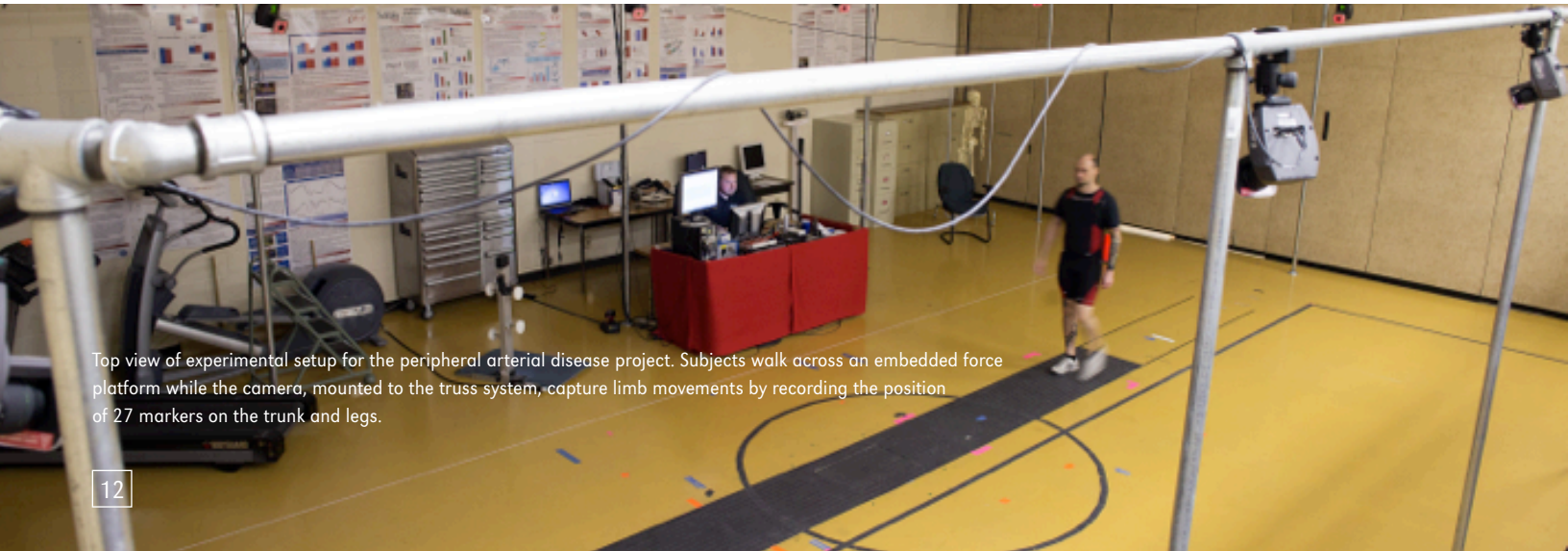
We are quite proud of the work investigating walking impairments and treatment options in peripheral arterial disease (PAD). This project has been ongoing for the past eight years. PAD is a major vascular disease affecting 8 to 12 million people over the age of 65 years in the United States. Most people are familiar with cholesterol blockages that lead to a heart attack. However, cholesterol builds up in all arteries and leads to poor blood flow in the arms and legs. The blockages in the legs can eventually lead to difficulties in walking because of pain and/or cramping.

Our work has shown that patients with PAD have weaker muscular responses at the ankle. Therefore, they are not able to push forward during walking as effectively as healthy individuals. We have also established that patients with PAD have more variable movement patterns at the ankle, knee and hip as compared to healthy controls. Furthermore, we have found that the problems are present in both legs even if PAD is only affecting blood flow in one leg. The changes in walking patterns occur before pain starts, which means that pain itself is not causing the changes. We have also discovered that PAD patients experience no benefit during walking from pharmacological treatment. Our team is currently working to find out if blood flow, muscular changes or other mechanisms are responsible for mobility problems in these patients.

We know that our work in this area is very important to improving treatment options, rehabilitation and slowing the progression of the disease. The federal government has also demonstrated their support in this area by funding a 5- year NIH R01 (PI: Dr. Iraklis Pipinos) and most recently a Department of Veterans' Affairs Merit Award (PI: Dr. Jason Johanning). These monies, as well as several grants from the state of Nebraska and private foundations, have led to the success of this research.

This project is led by Dr. Sara Myers, who has been working intimately with this project since the beginning. Our clinical collaborators are Dr. Jason Johanning and Dr. Iraklis Pipinos from the Department of Surgery at University of Nebraska Medical Center and the Veterans' Affairs Nebraska-Western Iowa Health Care System.

This year the Department of Veterans' Affairs funded a research project that seeks to improve functional treatment outcomes of patients with PAD. This newly funded project will determine whether the walking functional deficits that exist in patients with PAD can be reversed with surgical treatment. Patients are recruited from the Omaha VA Medical Center and then undergo hemodynamics, quality of life, and lower extremity function evaluation in our laboratories. Patients are evaluated prior to receiving surgery and three, six, and 12 months post-surgery. In addition to establishing whether patients can return to normal function after surgery, this randomized trial will determine the effectiveness of the two common surgical procedures; endovascular (stenting) or open (bypass). These surgical procedures account for one-third of the operations performed nationwide in the VA, making outcomes of this research important for both clinical and fiscal outcomes. The Biomechanics Research Building will facilitate completion of this grant by providing better access to the Gait Laboratory for these patients to be evaluated at four distinct visits. Dr. Sara Myers is the UNO principal investigator of this project. Also working on the PAD project are Shane Wurdeman, Bryon Applequist, Xuan (Lexie) Liu, Ryan Hasenkamp, Alek Diffendaffer, Mike Hough, and Amanda Fletcher.



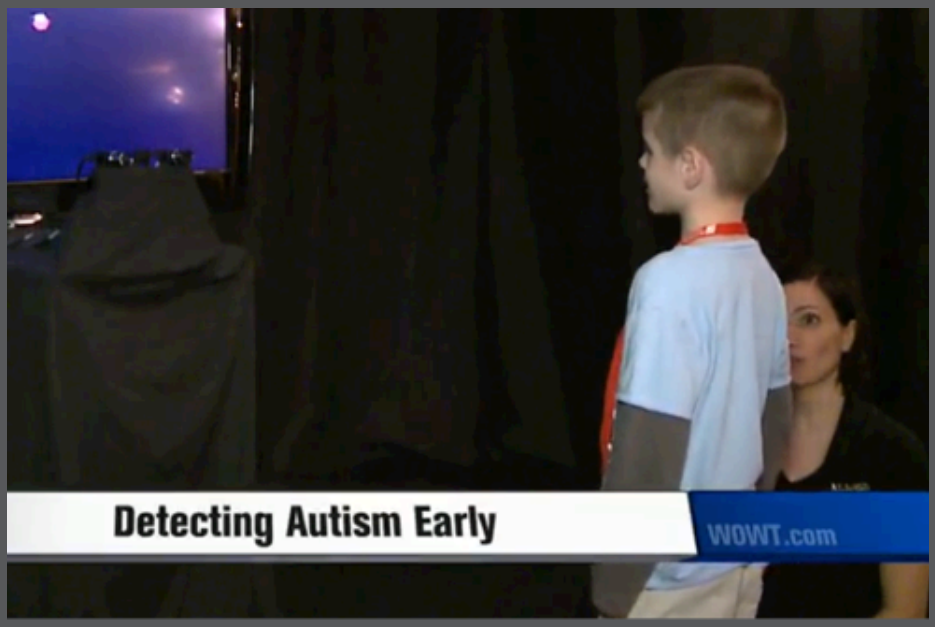
Top view of experimental setup for the peripheral arterial disease project. Subjects walk across an embedded force platform while the camera, mounted to the truss system, capture limb movements by recording the position of 27 markers on the trunk and legs.

Motor Development

Funded by a Dennis Weatherstone Pre-Doctoral Fellowship from Autism Speaks, Dr. Joshua Haworth has just completed his dissertation work under the supervision of Dr. Stergiou, with children that have been diagnosed with Autism Spectrum Disorder (ASD). He investigated the link between perception and movement in children with and without ASD. Children with ASD have difficulty identifying the movement of living beings versus inanimate objects. To investigate how children with and without ASD perceive movement, he measured both eye and standing posture movement in hopes that this work will lead to new treatment options and early diagnosis of ASD. NASA Nebraska Space Grant has also provided him an opportunity to extend his work in control of posture into adults.

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, to investigate how early motor development affects later emotional, social and cognitive development in children that are typically developing or those at risk for developmental delays and ASD. Overall UNO is a leader in Motor Development and Early Education and this is seen through their collaborative work with the Buffett Early Childhood Institute. We would also like to welcome, Dr. Samuel J. Meisels, who was recently appointed as the founding executive director of the Buffett Early Childhood Institute.

Photo: Dr. Kyvelidou sits closely next to a subject while the eye-tracking device is calibrated.



Dr. Haworth's project involving children with ASD was featured on the local news.
A subject stands while watching the stimulus on the screen while Dr. Kyvelidou looks on.

Optical Topography System

We were delighted this year to receive an NSF grant of $233,367 to acquire an Optical Topography System for research, training and outreach activities. This system enables us to image the cerebral cortex in functional postures and activities such as standing, walking, sitting, reaching, etc. In the past year, we surveyed the market for vendors of optical topography systems specifically functional Near Infrared Spectroscopy (fNIRS). We invited several companies to demonstrate their equipment (both hardware and software) to our research staff and collaborators. We also performed IRB approved studies using the fNIRS during walking tasks. Our results helped us to narrow down the efficacy of the instrument for our research purposes. We used the collected data to submit results to two annual meetings: the American Society of Biomechanics and the Society for Neuroscience. After setting up our newly acquired Hitachi ETG-4000 Optical Topography System in our new Biomechanics Research building, we and our collaborators will use the equipment to pursue research questions that involve brain function and movement. We will also include the new equipment in our teaching courses especially in Motor Control, Motor Development and Motor Learning. In addition, our staff and students will be trained on this piece of equipment. We will also use data collected with the fNIRS equipment to write grant proposals that can tackle more mechanistic questions related to motor control.

A subject in our VR environment about to perform a series of walking tasks with an electrode cap for recording brain activity data using our functional Near Infrared Spectroscopy device.

Effects of Virtual Reality

As costs continue to decline and system usability improves, innovative virtual reality (VR) approaches have emerged that demonstrate the value for scientific understanding and treatment of difficult clinical conditions. The rationale behind these applications is that a VR system will allow the patient to move in an environment that can be more pleasant than a hospital room, where the therapist can also incorporate additional challenges to be tried in a user friendly and safer situation. However, research has not kept pace with the engineering. Thus, the scientific support for the application of these systems is limited.

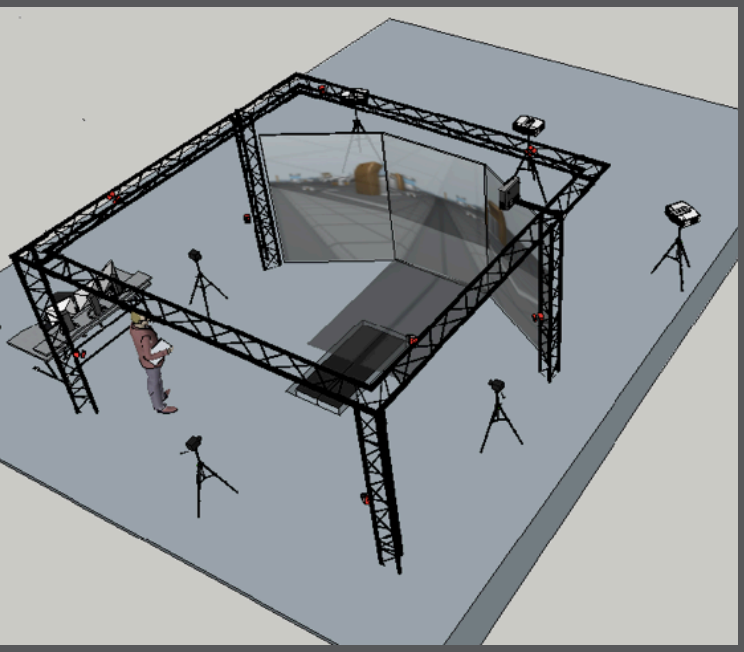
Dr. Mukul Mukherjee is leading several projects that explore the effect of VR on our ability to walk and react to different stresses during walking such as walking with a load, walking through narrow corridors and walking with side-to-side-destabilization. We are currently completing the second year of a three-year grant from NASA to investigate how the feeling of touch below the foot can be stimulated to benefit astronauts who face severe balance and walking problems after returning to Earth from space. In our laboratory, we study the integration of advanced biotechnologies, like VR, with sensory (e.g., vision, touch) stimulation to develop effective, quick and inexpensive treatment for different pathological populations. In addition we are also investigating brain activity correlates (using functional Near Infrared Spectroscopy) of the effects of VR on locomotion.

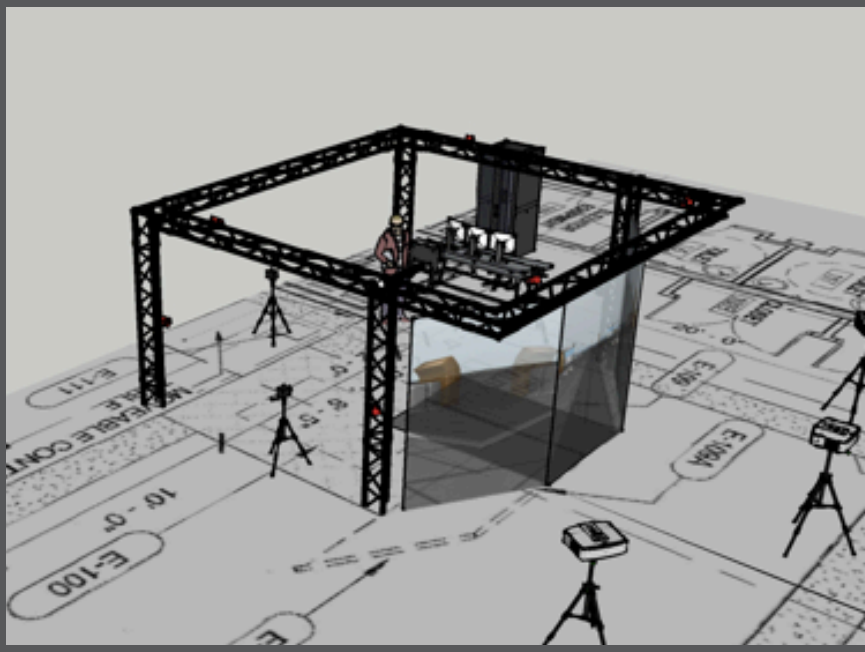
Other project members include Dr. Ka-Chun (Joseph) Siu, an Assistant Professor in Physical Therapy at the University of Nebraska Medical Center. Drs. Mukherjee and Siu are assisted by post-doc Dr. Mu Qiao, and graduate students Jung Hung Chien, Chun Kai Huang and Josh Pickhinke.

Virtual Reality

Dr. Mukherjee has been overseeing a project investigating the use of virtual reality and upper extremity robotics to improve rehabilitation in patients that have suffered from a stroke. These projects involve the study of brain activity while being presented with different types of stimuli and feedback. The goal is to determine whether training with our robots enhances the learning process in new environments. Currently we use electroencephalography (EEG) to study brain activity during this learning process. Our newly awarded grant from the NSF will allow us to expand this work using fNIRS technology. Dr. Mukherjee works closely with Dr. Wen Pin Chang from Creighton University. Dr. Mukherjee is also supervising Dr. Mu Qiao and MD/PhD student Songita Choudhary in a project that involves developing a portable mini robot that can provide force feedback to stroke patients. This robot will not only allow us to test and train patients in their homes but also allow functional imaging using MRI technology.

A subject is shown using our Inmotion2 upper limb robot for performing reaching tasks during which EEG measurements are being recorded.



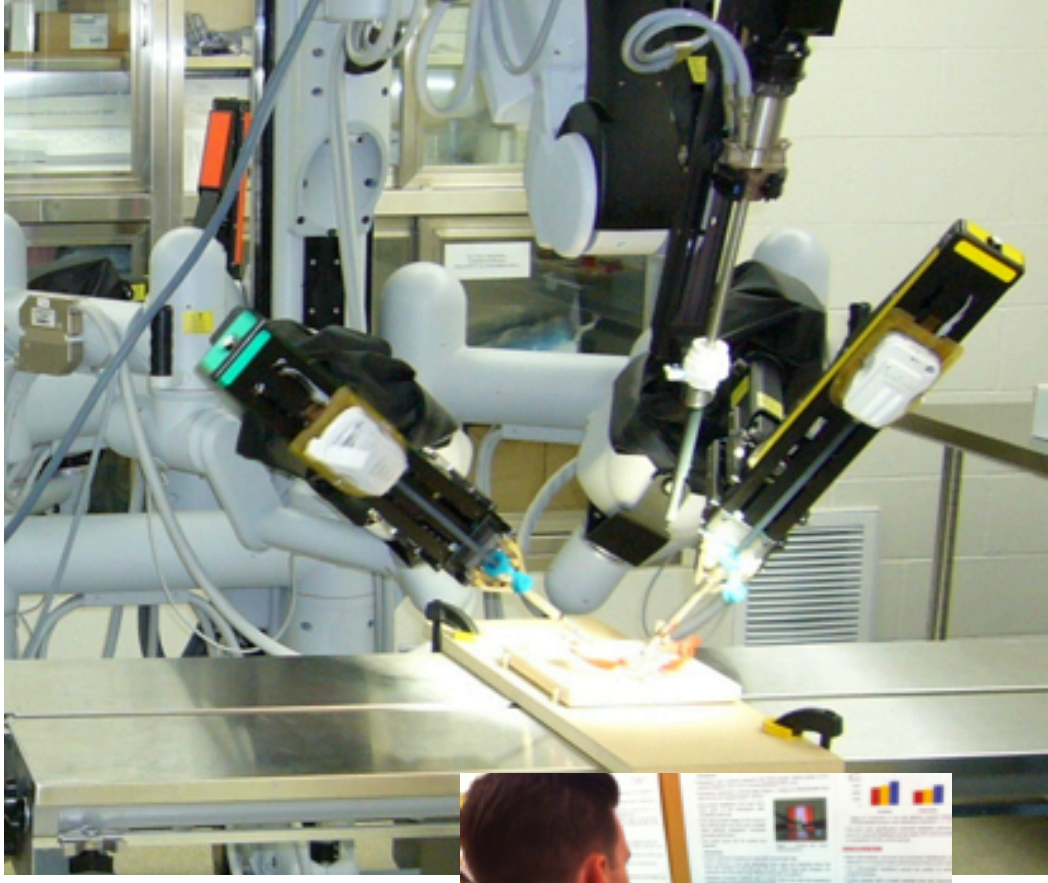


The top view and top-diagonal of our new virtual reality setup with integrated instrumented treadmill and motion capture environment

Robotic Surgery

In an effort to reduce blood loss and tissue damage during surgery and shortening the hospital stay after surgical procedures, robotic-assisted surgery has become a popular choice for patients. Robot-assisted surgery is a form of surgery performed by a surgeon who controls a specialized robot. Becoming an expert in robotic surgery requires extended training outside the operating room. In this project, we developed a risk free and low-cost environment using virtual simulation for surgical trainees to learn robotic surgical skills. Dr. Ka-Chun (Joseph) Siu and his team have successfully created a training program using their own developed virtual simulators.

Dr. Carl Nelson and his Masters Student, Mohsen Zahiri at UNL, along with computer programmer, Ryan Booton of UNMC joined Dr. Siu's research team last year to develop a portable, camera-based simulator for new surgeons to learn robotic surgical skills whenever and wherever they prefer. This study was funded by the State of Nebraska through the Nebraska Research Initiative and NASA Nebraska Space Grant & EPSCoR. A brand new laboratory dedicated to robotic surgery will be housed in the Biomechanics Research Building in the Fall 2013.



A specialized robot, DaVinci, is designated at UNMC for robotic surgical research.

A medical trainee uses our training simulator to practice fundamental robotic surgical skills.

Sports Medicine

Dr. Melanie McGrath is supervising our Sports Medicine research. Her student Holly Remmenga (MA in AT student who graduated in May 2013) completed her thesis examining the running and balance abilities of recreational runners who used minimalistic, "five-finger"-style footwear compared to runners who use traditional shoes. She found that runners in minimalistic shoes make more strides per minute and change the way that the hip is moving as compared to traditionally shod runners. There were no differences in balance, and essentially no changes if the runners were analyzed under different conditions (i.e. barefoot, running in lab shoewear, or running in their preferred shoewear). In addition, her student Anne Beethe (MA in AT student who graduated in May 2013) completed her thesis examining the effects of tape on the shoulder motion and throwing speed and accuracy of baseball players. She found that using tape to reposition the shoulder affects shoulder rotation, and decreased throwing velocity in collegiate baseball players. Tape did not affect throwing accuracy though. Lastly, in her collaborating work with Dr. Terry Grindstaff at Creighton, another master's student (Michaella Spenceri) is collecting data on how the muscles around the knee function in people with knee osteoarthritis.

Amputee

At present, we have several ongoing studies focused on improving limb loss rehabilitation. We are implementing state-of-the-art analyses that are very different from traditional biomechanics. We are investigating walking from the perspective of "how do we determine the best prosthesis for an individual?" Despite the millions of amputees that wear a prosthesis, there is truly no objective means to determine which prosthesis is the best for a person. We acknowledge that every individual has a unique walking style or pattern. The measures we use examine over multiple steps rather than just a single representative step and allow us to see how well the person is integrating the prosthesis into their natural walking pattern. Our initial work has found that patient's prosthesis preference is strongly related with such a measure. This marks 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 a 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 to 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.

This work is spearheaded by Shane Wurdeman, PhDc, who is a certified prosthetist and he is completing his PhD under the supervision of Dr. Stergiou. Shane has received funding from numerous entities that develop prosthetic devices and fellowships from the University of Nebraska Medical Center and Grand-In-Aid support from the American Society of Biomechanics. Dr. Sara Myers has also received recently a grant of $100,000 from the Nebraska Research Initiative to further strengthen our research work with amputees.

Amputee studies at the NBCF include a range of designs from simple, inexpensive devices, to more sophisticated, externally powered and microprocessor controlled devices.

Proof of Concept Grant

On September of 2012 we received an $80,000 Proof – of – Concept grant from the Nebraska Research Initiative to improve and validate our current Gait-O-Gram device to assess the likelihood of falls in at risk populations. We are currently testing our device and we are in the process of collaborating with Methodist Hospital's Geriatrics department to employ our device in elderly patients just discharged from the hospital. This project will establish that the Gait-O-Gram system is on-par in terms of accuracy with current gold-standard methodologies in assessing gait, especially as it relates to fall risk. This will have a number of important ramifications. First, it will provide the basis for moving gait analysis out of otherwise immobile (and expensive) clinical laboratories to a portable system. This will enable remote-monitoring of patients on an outpatient-basis, which will pass on reduced costs to the patient. Furthermore, it will enable patients who otherwise may be unable to travel to clinic on a regular basis - such as the elderly - to take part in gait based assessments. Dr. Anastasia Kyvelidou and Mr. Eric Cutler are the participating personnel in this project.

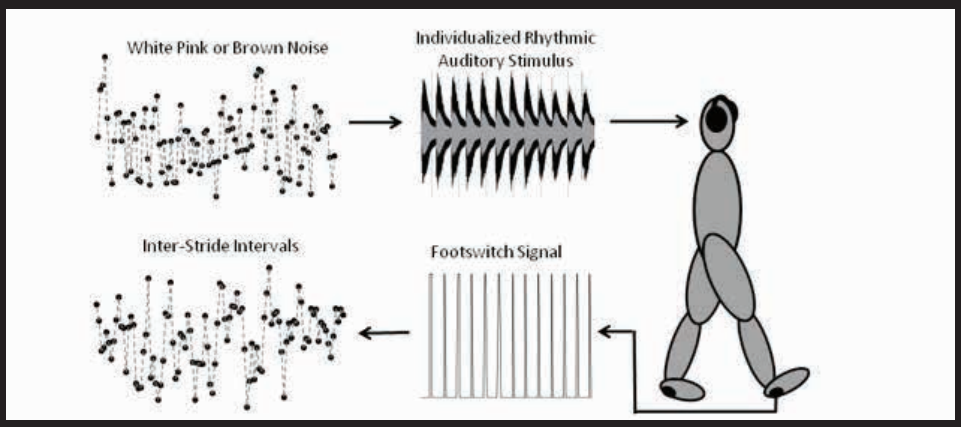
Lateral Stepping Project

The lateral stepping project initially grew from a small idea based on a large concept: if walking is less stable in the side-to-side direction, then it should be this way when stepping side-to-side. Our results, to the contrary of what the experts would have believed, showed that this is not the case. In fact, the brain and peripheral nervous system's control over walking seems to be equally similar regardless of which direction a person is walking. This novel finding has paved the way for future ideas that are currently being tested. For example, is it possible that we could harness this phenomenon and utilize it to improve walking balance, perhaps helping to reduce fall risk for the millions of Americans every year that suffer from a fall leading to serious injury or even death. We are combining our years of experience working with fall-related populations and our unique, innovative insights into control paradigms to clinically relevant training protocols to improve walking balance. This work is led by Shane Wurdeman, PhDc, under the supervision of Dr. Stergiou. Several graduate and undergraduate students are also involved.

Schematic of the lateral stepping procedure

The Marriage of Music and Math

"One good thing about music, when it hits you, you feel no pain." We are taking the poetic words of Bob Marley quite literally in our efforts to utilize music in the rehabilitation of movement! However, this is not just about music, it is the marriage of music and math. This year, Dr. Jenna Yentes, Jeff Kaipust, Nate Hunt, and Dr. Denise McGrath, produced some really exciting results when using a specially manipulated, algorithmic musical rhythm to restore healthy walking rhythms in older adults over 80 years of age. We believe that the potential for this approach to transform gait rehabilitation is enormous. We have also applied this novel approach to upper limb movement in collaboration with Dr. Natalie Dounskaia, from Arizona State University, with a view to targeting stroke rehabilitation in the future. Together, we will unpick the neuromuscular control mechanisms that underpin this very interesting phenomenon.



Chronic Obstructive Pulmonary Disease

Chronic obstructive pulmonary disease is not just a disease of the lungs. This disease results in reduced physical activity, increased fall risk and even a lower quality of life. As this disease is the only chronic disease on the rise, it is important that we understand the progression of the disease as well as development of innovative rehabilitative techniques to complement pulmonary rehabilitation. Drs. Jenna Yentes and Nick Stergiou along with their clinical collaborator, Dr. Stephen Rennard (UNMC), have worked for the past five years on understanding the biomechanical limitations of these patients. Studies have been conducted on biomechanical deficits of walking, gait variability in walking and issues within the natural coupling of breathing and walking. Further, they have tested a 6-week intensive cardiorespiratory and resistance training protocol in patients with chronic obstructive pulmonary disease. This well funded project has received support in the past from the American Society of Biomechanics, American Alliance for Health, Physical Education, Recreation and Dance, the University of Nebraska Medical Center, and NASA Nebraska Space Grant & EPSCoR.

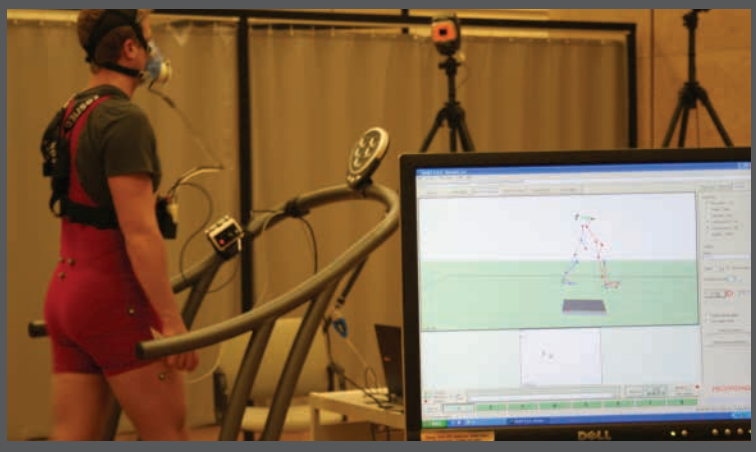
Balance

The Neurocom® Balance Manager is a device that measures postural sway. This is accomplished in an environment that has a three-sided visual surround. The ground has the ability to translate or rotate forward and backward and the visual surround also has the ability to rotate forward and backward. This allows us to examine how information that we receive from the environment with our eyes, our foot sensors, and our inner ear sensors affect balance. Our device is also unique in that it has a researcher module that allows us to control the ground or the visual surround and move them in any way that we want. Currently, this technology is being used in a study focusing on the control of posture and fall risk, comparing how older individuals and individuals who have fallen are different from healthy young individuals. Another study currently under way is investigating how posture changes when information from our foot sensors and our eyes is altered.

Left: A subject stands in a safety harness in the Neurocom® device while either the floor or the surround moves in sync with the subject's movements. This allows for testing of the various senses that are involved in being able to stand upright.

Below: The floor will also move with the subject in some conditions.

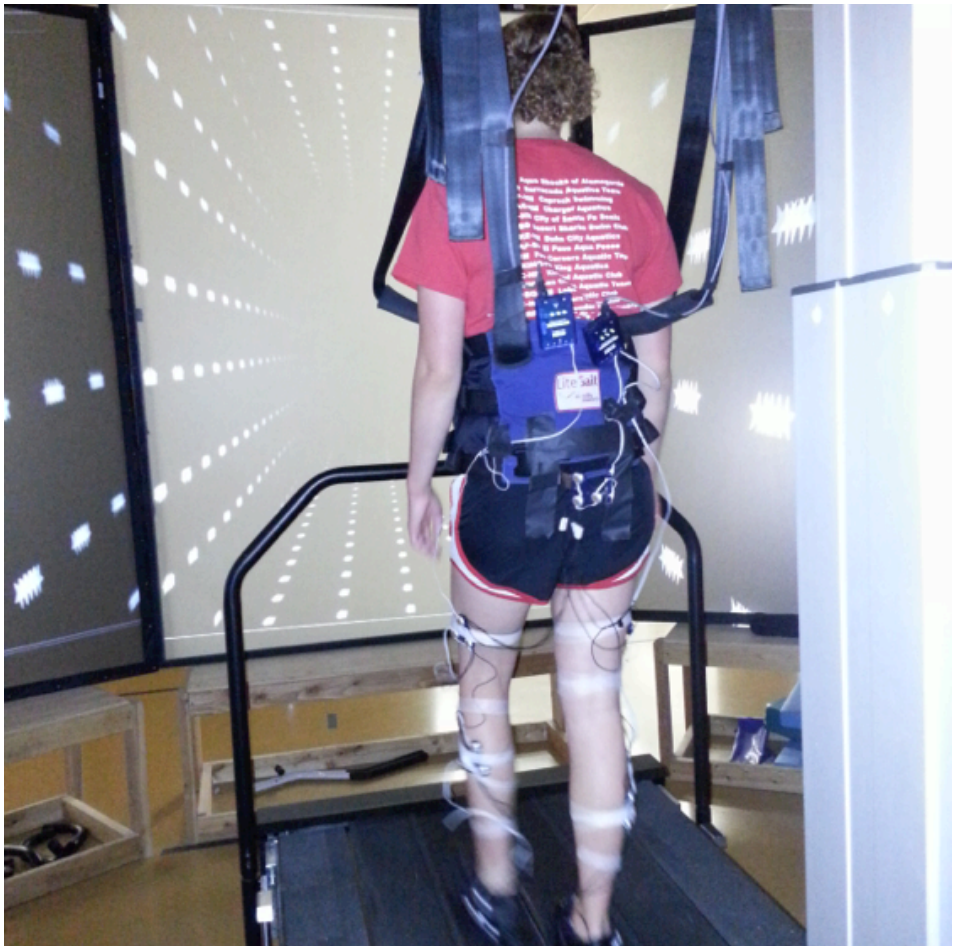
Subject with chronic obstructive pulmonary disease completing the overground walking trials. Reflective markers are placed on the subjects' legs and pelvis to track their movements while walking.



A healthy, young adult completes a trial on a treadmill. The subject walks at different speeds and the cameras record their body movements. They also wear a device around their chest to measure chest movement.

NASA Grant

Dr. Stergiou was awarded a three-year, $750,000 EPSCoR research grant from NASA to determine the effect of how our various senses affect the way we walk. This project hopes to develop interventions to decrease the effects of long space flight and the problems that they produce on the way the astronauts walk. The project is based upon our previous work on the effects of virtual reality on walking. Dr. Mukherjee and Dr. Myers have been supervising this project with assistance from Dr. Mu and Mr. Chien. We presented the results of the first phase of the project at the annual meetings of the Aerospace Medical Association and the American Society for Gravitational and Space Research. We are currently completing the second phase of the project while for the final phase of the project, our team members will travel to the NASA-Johnson Space Center at Houston, Texas.



Subject walking on the treadmill in the virtual reality environment.

Three small devices are placed underneath the foot to alter sensations while walking.

Back Pain Research

In July 2012, we began collaboration in low back pain research with Dr. Deborah Givens, the current chair of Creighton University's Department of Physical Therapy. This new project is an extension of the work of the late Dr. Kevin Granata and involves the development of a device, the Trunk Reflex Examination Device (TRED), for the diagnosis and possible treatment of low back pain. This device was originally designed by Dr. Givens and Dr. Granata. Dr. Givens is also funding and supervising this research. TRED applies mechanical perturbations to the torsos of subjects and measure delay and magnitude in low back muscle reflexes in individuals with low back pain. Such delayed reflexes have been shown to present along with low back pain, both of which are results of low back injuries. Delayed reflexes also increase the likelihood of future low back injuries, resulting in a cycle of secondary injury. This apparatus will also be used in an intervention to prevent future low back secondary injury in individuals with low back pain by retraining their reflexes using mechanical perturbations. In the past year, graduate student Eric Cutler has been developing the software and refined the hardware needed for TRED. Dr. Mu Qiao will carry the torch this year completing human experiments.

FACULTY RESEARCH INTERNATIONAL GRANTS

With IRELAND

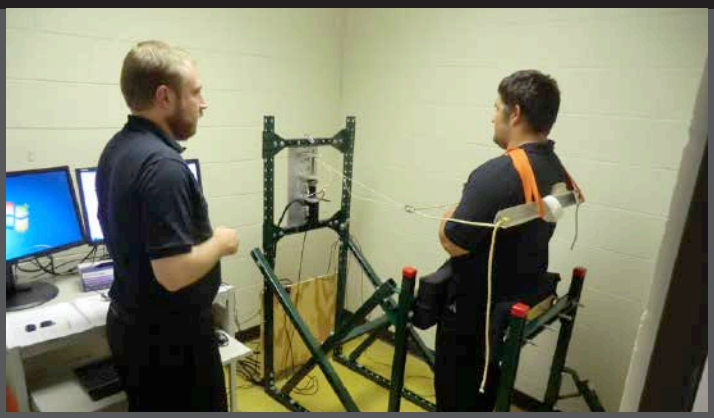
Dr. Stergiou continues to work with Drs. Brian Caulfield and Denise McGrath, and also Dr. Richard Carson (Queen's University Belfast, Trinity College Dublin) in the development of an interdisciplinary project that seeks to enhance the lives of older adults through a novel, technology enabled, movement based intervention. Funding from a Faculty Research International grant sponsored by UNO has enabled travel to and from Ireland and UNO to establish this network. Dr. Caulfield came to UNO last fall and Dr. Stergiou went to Ireland this past Spring. Dr. Julie Masters, Chair of the Department of Gerontology at UNO and Dr. Terry Grindstaff from Creighton University are also involved with this project. Combined expertise in nonlinear analysis of movement behaviors, the aging process, user-centered technology design, and neurophysiology will ensure an innovative and scientifically rigorous approach to prolonging independence in older adults with impaired mobility. The group are currently preparing an NIH funding application for a project with a budget of approximately $1.25 million. Two thirds of this budget will be provided by Irish and Northern Irish funding agencies who have already given their commitment to the project.

With GREECE

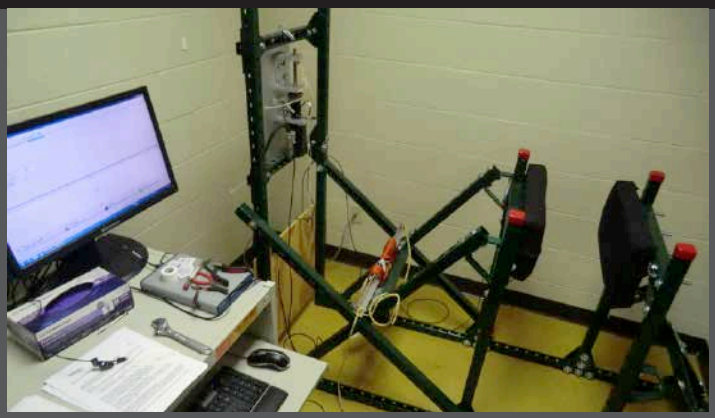
Funding through the same UNO mechanism has allowed Dr. Stergiou to establish collaboration with Dr. Vasilia Hatzitaki from the Aristotle University of Thessaloniki. This collaboration continues on the footsteps of a Fulbright Student fellowship to Neil Huben who went for a year to Dr. Hatzitaki' s laboratory to further the research experiences he was gaining with Dr. Stergiou. Funding from the Faculty Research International grant will enable travel to and from Greece and UNO to strengthen this collaboration. Dr. Hatzitaki will be traveling to UNO this fall and Dr. Stergiou will go to Greece next spring. Their research investigates how specific visual and auditory information from the environment can be used to guide control of postural sway and balance. This research is important in order to understand the underlying mechanisms responsible for movement abnormalities that are present in various pathological populations (i.e. multiple sclerosis, Parkinson's disease) as well as in the elderly. In addition, the study of how sensory information from the environment and movement are synchronized as a function of aging and pathology would help to identify the sources of impaired balance function and associated falls.

Dr. Brian Caulfied

Dr. Vasilia Hatzitaki



Doctoral student Eric Cutler and Masters student Alek Diffendaffer test the function of the Trunk Reflex Examination Device. A forward force is applied by the machine in order to record low back reflex response.



The Trunk Reflex Examination Device was developed as a tool for identifying functional deficits in individuals with low back injuries. This device consists of a mechanical frame, upper body harness, electronic controls and a servomotor.

Journal clubs

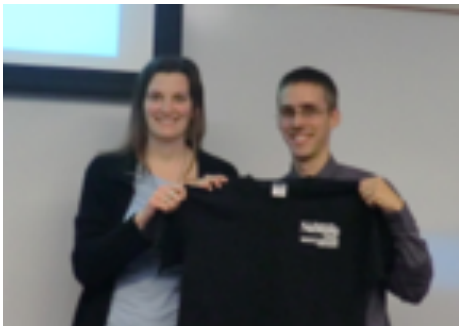
Dr. Hesham Ali, Dean of the College of Information Science and Technology at the University of Nebraska at Omaha– 4/12/13 "Biological networks and wireless technology in advancing aging research"

Dr. Jack Turman, Program Director of the Division of Physical Therapy Education at the University of Nebraska Medical Center – 4/5/13 "The Connections Project: Establishing a community based participatory research program to improve African American birth outcomes"

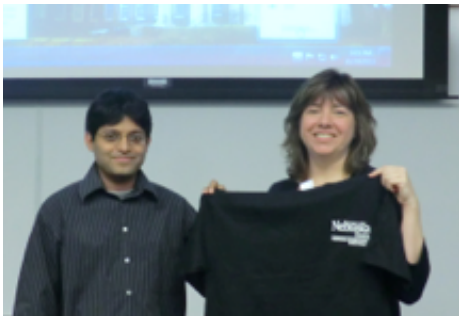
Dr. Sofia Jawed-Wessel, Assistant Professor in Health Physical Education and Recreation at the University of Nebraska at Omaha– 3/29/13 "Scale development and psychometric analysis in social and behavioral sciences"

Dr. Raj Dasgupta, Associate Professor in Computer Science at the University of Nebraska at Omaha and director of the C-MANTIC (Collaborative Multi-Agent/multi-robot Networked Technologies and Intelligent Computation) Research Group. – 3/1/13 "Coordinating multi-robot teams"

Dr. Deborah Givens, Professor and Chair of the Physical Therapy Department at Creighton University – 2/8/13 "Trunk muscle reflexes in patients with recurrent low back pain"



Dr. Carl Nelson, Associate Professor in Mechanical & Materials Engineering at the University of Nebraska–Lincoln – 12/7/12 "Circles, Lines and Elliptical Machines: Some things they forgot to mention in high school geometry, and how it all applies to biomechanics"



Dr. Rosemary Strasser, Associate Professor in Psychology at the University of Nebraska at Omaha - 12/7/12 "Finding your way: Studies in animal navigation"

Dr. Terry Grindstaff, Assistant Professor of the Physical Therapy Department at Creighton University – 11/9/12 "Neuromuscular consequences of lower extremity injury"

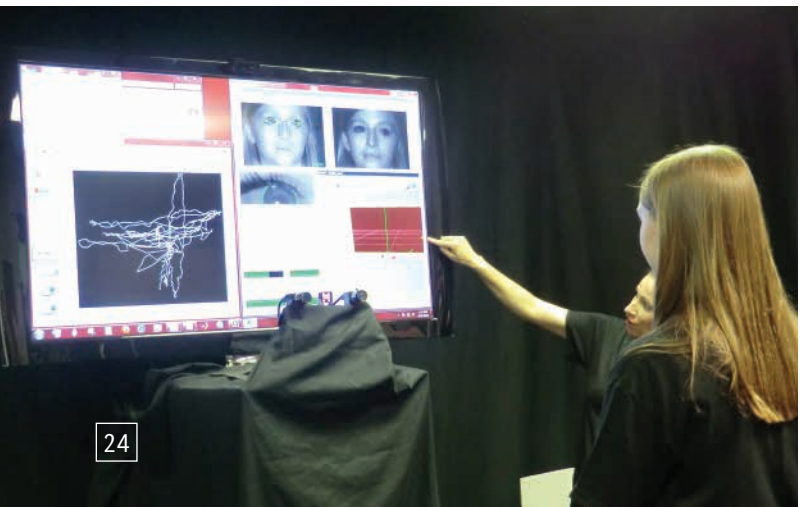
Dr. Jason Gillette, Assistant Professor of Kinesiology at Iowa State University – 10/26/12 "Biomechanical changes post-ACL reconstruction and potential pathways to early onset knee osteoarthritis"

Dr. Jason Coleman, Assistant Professor in Health Physical Education and Recreation at the University of Nebraska at Omaha – 10/12/12 "Qualitative Research"

Dr. Jeff Hawks, Assistant Professor in Mechanical & Materials Engineering at the University of Nebraska–Lincoln – 10/5/12 "Surgical Robotics, Sports Science: Analysis of placekicking in american football, and medical devices for human space exploration"

Dr. Julie Masters, Chair of the Dept of Gerontology at the University of Nebraska at Omaha– 11/16/12 "Aging inmates in the 21st century"

Dr. Melanie McGrath Assistant Professor in Health Physical Education and Recreation at the University of Nebraska at Omaha – 10/19/12 'Biomechanics related to knee osteoarthritis: potential for early intervention"



Other Visitors/Tours

7/23/13	Omaha World-Herald
7/12/13	College of Engineering summer camp students
6/21/13	Nebraska Spine Hospital CEO
6/13/13	STEM Education Tour
6/13/13	Computer Science Teachers
5/29/13	UNK Students
5/22/13	Home Instead
5/2/13	University of Agder (Norway)
10/10/13	Mary Our Queen Middle School Students

From left to right: Ryan Hasenkamp, Dr. Tom Stoffregen, Dan Leib, and Alek Diffendaffer. Dr. Stoffregen is a Professor at the School of Kinesiology at the University of Minnesota. He stopped by for a few days to hang out and help us collect some data during his sabbatical!

Troy Rand (in red) demonstrates the Neurocom to our visitors from Japan. Dr. Masaya Anan (far left) spent the Fall 2012 semester with us collecting data and developing a project in human movement variability. Dr. Koichi Shinkoda was able to join us in the US for four days in November 2012.

Dr. Koichi Shinkoda, Dr. Nick Stergiou and Dr. Masaya Anan

All student awards from 2012-2013

Grant, Impact of dual-tasking on lower joint dynamics during stair ascension, University Council on Research and Creative Activity, Austin Davidson (2012).

Annual North American Society for the Psychology of Sport and Physical Activity Meeting. University Committee on Research and Creative Activity Travel Award, Austin Davidson, $500.00 (2012).

Annual North American Society for the Psychology of Sport and Physical Activity Meeting. NASA Nebraska and Space Grant Travel Award, Austin Davidson, $1,254 (2012).

Annual North American Society for the Psychology of Sport and Physical Activity Meeting. College of Liberal Arts and Sciences (Office of Dean Boocker) Austin Davidson, $500 (2012).

26th Annual American Society of Biomechanics Conference. University Committee on Research and Creative Activity Travel Award, Austin Davidson, $500 (2012).

26th Annual American Society of Biomechanics Conference. College of Liberal Arts and Sciences (Office of Dean Boocker) Austin Davidson, $500 (2012).

26th Annual American Society of Biomechanics Conference. College of Education (Office of Dean Edick) Austin Davidson, $175 (2012).

Grant, Variability of gait is dependent on direction of progression, Fund for Undergraduate Scholarly Experience (FUSE), Dylan Goodman, $2,500.00 (2012-2013).

UNMC College of Public Health Doctoral First Year Fellowship, Eric Cutler, $21,500 and tuition remission (2011-2012).

Grant, The relationship between ambulatory activity and gait kinematic variability, University Council on Research and Creative Activity, Ryan Hasenkamp, $500.00 (2012).

NASA Nebraska Space Grant & EPSCoR Travel Award, Joshua Haworth, $980 (2012).

NASA Nebraska Space Grant & EPSCoR Travel Award, Joshua Haworth, $840 (2012).

Grant, Reduced vertical displacement of center of mass coincides with increased metabolic energy expenditure, Fund for Undergraduate Scholarly Experience (FUSE), Whitney Korgan, $2,500.00 (2012-2013).

Grant, Altered kinematics between flat and curved treadmills do not cause increased energy expenditure, NASA Nebraska and Space Grant Travel Award, Whitney Korgan, $700.00 (2012).

Grant, Changes in elderly walking while listening to chaotic music, University Council on Research and Creative Activity, Daniel Leib, $500.00 (2013).

Grant, Investigation of center of pressure and fall risk in the elderly, Graduate Research and Creative Activity, Troy Rand, $5,000.00 (2012).

Grant, Nonlinear mathematics detects subtle changes in balance measures, University Council on Research and Creative Activity, Troy Rand, $500.00 (2012).

Student Award, Best Poster Award, Fear of falling is related to walking impairment in peripheral arterial disease., Gait and Clinical Movement Analysis Society, Troy Rand (2012).

Grant, Difference in stride interval variability during stair-climbing and treadmill walking, University Council on Research and Creative Activity, Jessica Renz, $500.00 (2012).

Student Award, Exercise Science Major of the Year, Nebraska Association for Health, Physical Education, Recreation and Dance, Jessica Renz (2012).

Student Award, Outstanding Undergraduate Service Award in Exercise Science, Helen B. Hewitt Scholarship, Jessica Renz (2012).

Quantifying Stride-to-Stride Fluctuations in Amputee Gait: Implications for Improved Rehabilitation. American Society of Biomechanics Graduate Student Grant-In-Aid, Shane Wurdeman, $2,000 (2012).

Nonlinear Gait Analysis in Amputees. AmericanAlliance for Health, Physical Education, Recreation and Dance Graduate Research Consortium Award, Shane Wurdeman, $3,000 (2012).

Orthotic and Prosthetic Education and Research Foundation, Shane Wurdeman, $2,870 (2012).

University of Nebraska Medical Center Widaman Fellowship, Shane Wurdeman, $22,200 (2012).

Gait and Clinical Movement Analysis Society Travel Award, Shane Wurdeman, $400 (2012).

NASA Nebraska Space Grant & EPSCoR Travel Award, Jennifer Yentes, $500 (2012).

NASA Nebraska Space Grant & EPSCoR Travel Award, Jennifer Yentes, $770 (2012).

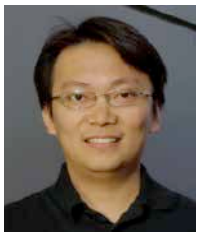
Understanding walking and breathing coupling when abnormal breathing patterns are present. NASA Nebraska Space Grant & EPSCoR Fellowship Award, Jennifer Yentes, $3,500 (2012-2013).

University of Nebraska Medical Center Bukey and McDonald Fellowship and Regents Tuition Fellowship, Jennifer Yentes, $21,500 (2012-2013).

HIGHLIGHTED STUDENT AWARDS/ACTIVITIES

Alek Diffendaffer was a recipient of the 2013 Graduate Research and Creative Activity award (GRACA) for his proposal of a project he is currently working on. The title of this project is 'A comparison of walking moments and powers overground vs. treadmill in peripheral arterial disease patients.' This project provided funding for Alek to continue his research.

UCRCA
University Committee on Research and Creative Activity



Kai Huang is the student recipient of 2012 NASA Nebraska Space Grant & EPSCoR Research Mini-Grant. He participated in the project with Dr. Ka-Chun Siu on investigating the impact of modular joystick on upper limb muscles activation while performing different surgical training tasks.

NASA EPSCoR Nebraska

Ryan Hasenkamp received a NASA Nebraska Space Grant Fellowship titled "Dual Tasking: A Paradigm for Cognitive and Physical Functioning Assessment and Training for Astronauts". This grant was funded to support his research investigating the interaction between a cognitive task and a physical task such as walking. Ryan also received a grant from the University Committee on Research and Creative Activity titled "The Relationship Between Ambulatory Activity Patterns and Gait Kinematic Variability" for $500. This grant supported his research investigating the validity of an accelerometer as a tool to assess gait variability.

NASA Nebraska Space Grant

UCRCA
University Committee on Research and Creative Activity

Troy Rand received a grant from the University Committee on Research and Creative Activity for $495 to fund his thesis topic investigating postural control and fall risk in an aging population. This grant allowed him to offer stipends to subjects who participated in his research. Troy was chosen as the graduate speaker for the May 2013 commencement ceremony for the College of Education. He gave a speech highlighting overcoming adversity by sharing his story of being homeless and the struggles he has overcome in order to earn a Masters degree. He also found time between all of his other responsibilities to train for and complete the Texas Ironman on May 18th, 2013. This event involved 2.4 miles of swimming, followed by 112 miles of biking, and finally 26.2 miles running. Starting at 7:10 a.m. he worked throughout the day to cross the finish line just before midnight.

Michael Hough was awarded a Graduate Research and Creative Activity (GRACA) grant from UNO's Office of Research and Creative Activity. His project, titled "Improving elderly gait with a structured auditory stimulus," aims to address a major factor influencing fall risk through the use of a musical stimulus that reflects the variable movement patterns found in healthy walking.

UCRCA
University Committee on Research and Creative Activity

Faculty Travels

New Orleans

Dr. Sara Myers traveled to New Orleans, Louisiana in November, 2012 for the American Society for Gravitational and Space Research annual conference to present preliminary work from the NASA EPSCoR funded project. She gave an oral presentation entitled "Effect of Tactile Stimuli on Locomotor Rhythm Depends on the Characteristics of the Tactile Signal". While at the conference, Dr. Myers was able to interact with other scientists performing research relevant to space travel. She attended several sessions on translating astronaut health issues and gravity related issues faced by astronauts during and after space travel.

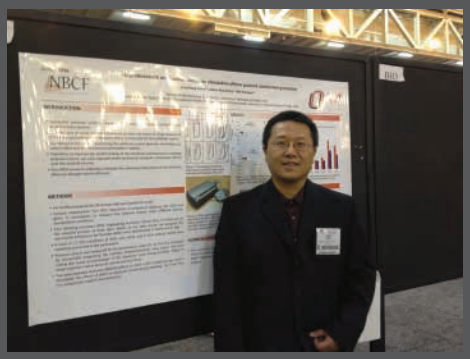
Germany

Last Spring Dr. Stergiou was invited to teach a Methods course for the Interdisciplinary College (IK) in Germany (www.interdisciplinary-college.de). The IK which started in 1982 is an annual, intense one-week spring school which offers a dense state-of-the-art course program in neurobiology, neural computation, cognitive science/psychology, artificial intelligence, robotics and philosophy. It is aimed at students, postgraduates and researchers from academia and industry. By combining humanities, science and technology, the IK endeavors to intensify dialogue and connectedness between the various disciplines. Participants come mainly from European countries, lecturers from all over the world. The IK2013 took place at Günne at Lake Möhne. Dr. Stergiou's workshop was titled "Nonlinear Analysis and Human Movement Variability" and spanned four 2-hour lectures. Several people came from around Germany just to listen to him. His course was very well received and attended. There were 31 courses and with an overall average rating of 7.94 (1=poor, 10=excellent), Dr. Stergiou's course received an 8.76. He also had the opportunity to interact with many other scientists from around the world and exchange ideas.

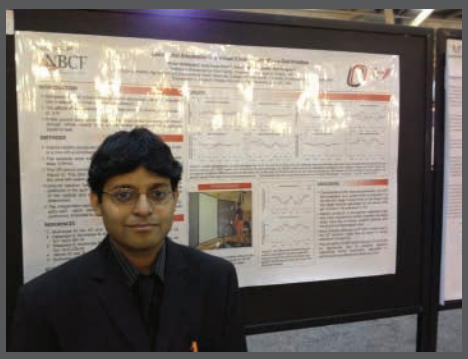
Lake Muhne, Germany

Annual Society of Neuroscience 2012

Dr. Mukherjee and Jung Hung Chien (JC) went to the Annual Society of Neuroscience 2012 at New Orleans, Louisiana. They presented how virtual reality environments can affect control of posture during standing.

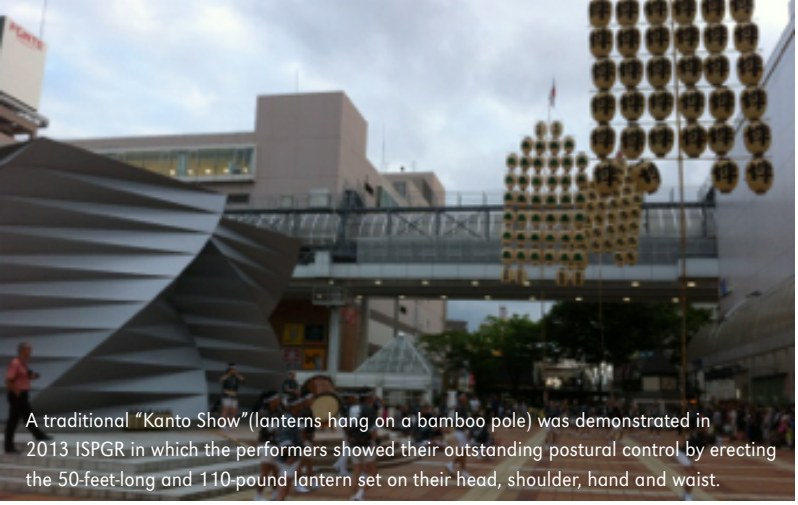


PhD candidate, Jung Hung Chien, at his poster at Neuroscience



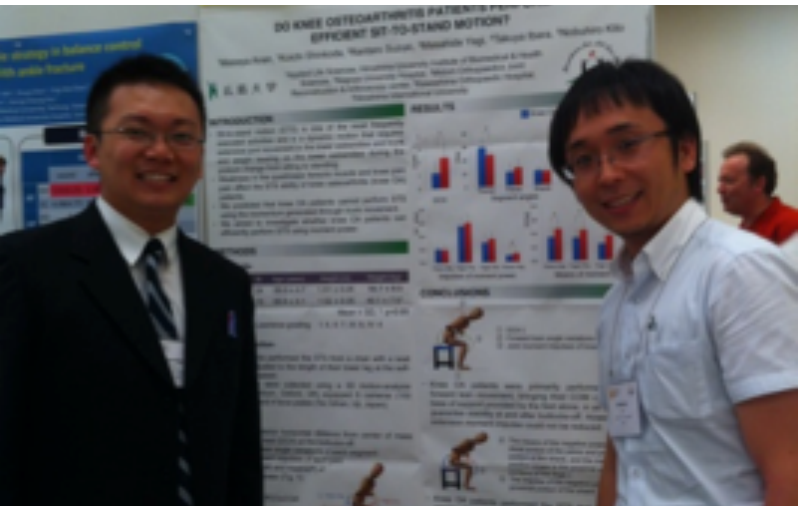
Dr. Mukul Mukherjee presenting his poster at Neuroscience

Student Travels

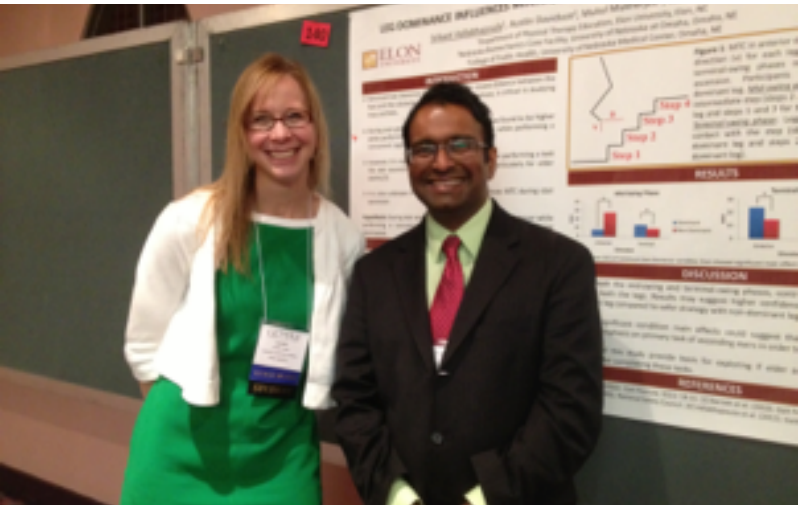


A traditional "Kanto Show"(lanterns hang on a bamboo pole) was demonstrated in 2013 ISPGR in which the performers showed their outstanding postural control by erecting the 50-feet-long and 110-pound lantern set on their head, shoulder, hand and waist.

Doctoral student, Kai Huang, attended the joint world congress of the 2013 International Society for Posture & Gait Research (ISPGR) and Gait & Mental Function held in Akita, Japan, where he met many friends of ours such as scientists Dr. Emily Keshner (Temple U) and Dr. Li-Shan Chou (U of Oregon).



Kai met Dr. Masaya Anan, one our international collaborators, with his current research work: "Do Knee Osteoarthritis Patients Perform Efficient Sit-to-Stand Motion?" presented in 2013 ISPGR congress.



As the outgoing student representative for the Gait and Clinical Movement Analysis Society, Jenna Yentes attended the 2013 meeting in Cincinnati, Ohio in May. During this meeting, Jenna was responsible for coordinating and presenting the Student Career Symposium, co-hosting the Student Mixer and making sure the mentorship program ran smoothly.

During her two years as the representative, she has worked hard to help grow their student membership and implement programs that are of interest to students. Also in attendance at this meeting was Dr. Srikant Vallabhajosula (pictured below), a previous postdoc with us who finished last year and is now a faculty member at Elon University in North Carolina.

In April of 2013, senior doctoral student, Jenna Yentes, traveled to Charlotte, North Carolina. She attended the American Alliance for Health, Physical Education, Recreation and Dance Annual Meeting and Expo. Here she presented the preliminary results of her dissertation that had been sponsored by this organization. During this meeting, she was able to attend a talk given by her previous mentor at California State University, Fullerton, Dr. Debra Rose.

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For more than 25 years, the revolutionary work of the Nebraska Biomechanics Core Facility (NBCF) 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, Alzheimer's, 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 NBCF. 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 NBCF 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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In Memory

This last year Dr. Stergiou lost one of his mentors, Dr. George Rontogiannis. Dr. Rontogiannis was his mentor as a young undergraduate and he is the one who introduced him to biomechanics of sport shoes. He also encouraged him to pursue graduate education in the United States. Dr. Rontogiannis was a Professor of Sports Medicine in the University of Thessaly in Greece, Director of the National Center of Sports Research of Greece and a cardiologist.

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