2020

University of Nebraska At Omaha Department of Biomechanics Annual Report 2019-2020

Department of Biomechanics, University of Nebraska at Omaha

UNIVERSITY OF NEBRASKA AT OMAHA

DEPARTMENT OF BIOMECHANICS ANNUAL REPORT

2019-2020

University of Nebraska Omaha

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RETHINK THE IMPOSSIBLE

In a year where so much had happened around us, you may think that our efforts to reach even greater heights in Biomechanics have also taken a step back. You may have thought that we had an off year. However, this is not how we approach our lives and our work in our team, the Biomechanics team. We do not let anything deter us. As Don Quixote, the hero of Miguel de Cervantes said: "I know who I am and who I may be if I choose." In our team, we simply choose to be winners, to be leaders.

The amazing stories and news that you will read in this annual report is the proof. The opening of the expansion of our Biomechanics Research Building (BRB) demonstrates the commitment of our "angels" to our efforts. Bill and Ruth Scott, their family, my American family, and all our other angel donors who came together to provide us with this incredible space, are really motivating us to give back. When you spend a dollar on us you should know that we will work our hearts out to give you back much more. "The scariest dragons and the fiercest giants don't look no more than windmills to us" because we have our angels by our side.

As a result, in September of 2019 we received an NIH P20 grant of $10.3 million—the largest single research grant in UNO's history—surpassing our own previous record that lasted five years. However, this was only the beginning of the successful grants obtained by UNO Biomechanics faculty over the past year with 3 NIH R01's, an additional NIH R15, and 2 VA grants awarded. This is a grant total of about $20M for UNO Biomechanics in a single year demonstrating the quality of research that is performed by our scientists. Research that changes lives and greatly benefits society.

In addition, we further strengthened our team by expanding in cardiovascular biomechanics completing the first UNO cluster hire. Cardiovascular disease is the leading cause of death and disability worldwide, and cardiovascular biomechanics research at UNO aims at the discovery, development, and translation of innovative technologies to treat it. Many more stories are waiting for you inside this report. Our Division of Biomechanics and Research Development, blessed with great university leadership, has established an environment of academic excellence. In such an environment, young faculty like Dr. Malcolm publishes almost annually in prestigious scientific journals like Science!

Nothing can stop the momentum of the "Biomechanics Field of Dreams." Nothing is impossible for our team because we always rethink the impossible.

Thank you,
Dr. Nick Stergiou

MAKING HISTORY AGAIN

GRAND OPENING OF THE BRB EXPANSION

On October 22, 2019, UNO along with the University of Nebraska Foundation hosted the grand opening of the expansion to the BRB. With the addition, the BRB is now over 57,000 square feet and provides students, faculty, and staff additional research, office, and collaboration space. The expansion was made possible by an $11.6 million private donation.

$11.6 MILLION

in private donations made expansion possible

DONORS

Lead Benefactors
Ruth and Bill Scott

Principal Benefactors

The Lozier Foundation

Dorothy and Stanley M. Truhlsen, M.D.

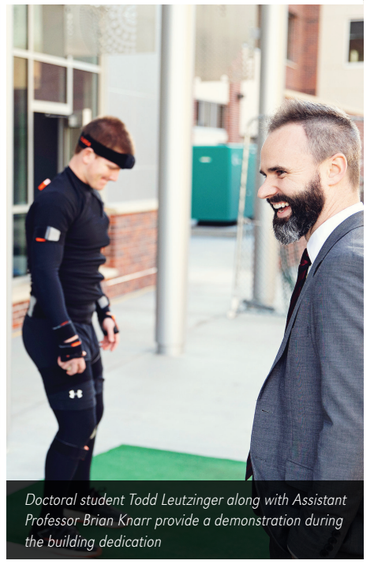
Robert B. Daugherty Foundation

George and Susan Haddix

57,000 SQ FT

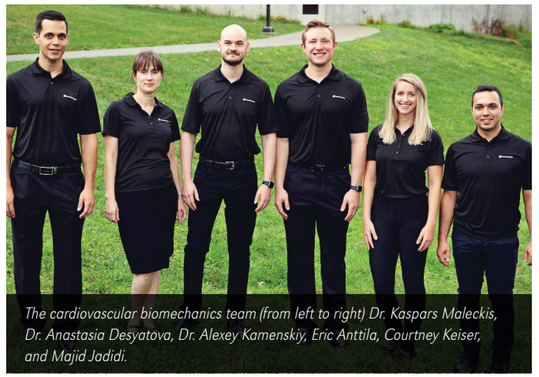
total space within the BRB for research, offices, and collaboration

Ribbon cutting ceremony at the building dedication.



Doctoral student Todd Leutzinger along with Assistant Professor Brian Knarr provide a demonstration during the building dedication

BRB with the expansion.



The cardiovascular biomechanics team (from left to right) Dr. Kaspars Maleckis, Dr. Anastasia Desyatova, Dr. Alexey Kamenskiy, Eric Anttila, Courtney Keiser, and Majid Jadidi.

EXPANDING INTO CARDIOVASCULAR BIOMECHANICS

Until recently, we have primarily focused on human and animal movement, but in 2019 we expanded our portfolio into the cardiovascular direction by adding a branch of Biomechanics that studies the heart and blood vessels. Cardiovascular disease is the leading cause of death and disability worldwide, and cardiovascular biomechanics research at UNO aims at the discovery, development, and translation of innovative technologies to treat it. The cardiovascular biomechanics research will be advanced by new faculty members, Professor Dr. Alexey Kamenskiy and Assistant Professors Drs. Anastasia Desyatova, and Kaspars Maleckis.

The team has already developed strong collaborations with UNMC vascular surgeons and local tissue procurement organization Live On Nebraska. Drs. Kamenskiy, Desyatova, and Maleckis have been working together on multiple projects funded by the NIH, US Dept. of Defense, and industry, primarily focusing on the development of materials and devices to improve the results of open and endovascular surgery. In support of this important translational work, we are building a new state-of-the-art laboratory with equipment for soft tissue testing, image analysis, cell culture work, computational modeling, and advanced material manufacturing capabilities. This new research space of our building will enable new exciting projects in cardiovascular biomechanics that will further strengthen our interactions with UNMC and support diverse and multidisciplinary student education.

TREMENDOUS GRANT SUCCESS

In September of 2019 we received an NIH P20 grant of $10.3 million—the largest single research grant in UNO's history at the time it was received—surpassing our own previous record that lasted five years. The award is the Phase II of the Centers of Biomedical Research Excellence (COBRE) grant mechanism from the National Institute of General Medical Sciences (NIGMS), one of the most competitive grant programs in the country.

Philippe Malcolm, Ph.D., (left), Vivien Marmelat, Ph.D., Nick Stergiou, Ph.D., Nate Hunt, Ph.D., and Jorge Zuniga, Ph.D. of UNO's Department of Biomechanics. Dr. Stergiou is the PI and Director of the MOVCENTR and these four faculty are all leading research that receives funding from the COBRE Phase II grant.

Funds from the grant will enable our Center for Research in Human Movement Variability (MOVCENTR) to further strengthen its world-class research infrastructure by establishing three new research cores: The Movement Analysis Core, the Nonlinear Analysis Core, and the Machining and Prototyping Core. These are the first ever Cores established in our university. Our Cores will provide services for professionals in the NU system, the local area, but also to people outside our state to progress their research or other projects. The Cores will lead to long-term sustainability of our MOVCENTR. In addition, research projects carried out in these cores will provide UNO students with the unique opportunity to conduct cutting-edge research alongside senior clinical NIH-funded scientists.

The grant will also enable the MOVCENTR to bring additional funded investigators from various disciplines to UNO's campus. Investigators aim to use their findings within human movement variability research to treat and ultimately prevent movement-affected disorders. For example, in Phase II of the grant, scholars will study falls among patients with Parkinson's disease; exoskeleton support for patients with Peripheral Artery Disease; movement variability among those using prosthesis; and stabilizing movements after slips – among a number of other impactful research projects already underway.

The COBRE Phase II was only the beginning of the successful grants obtained by UNO Biomechanics faculty over the past year with 3 NIH R01's (Dr. Anastasia Desyatova $3M; Dr. Alexey Kamenskiy $2.7M; Drs. Jorge Zuniga and Brian Knarr $1.4M), an additional NIH R15 (Dr. Nate Hunt $420K), and 2 VA grants (Dr. Sara Myers $1.1M; Dr. Jenna Yentes $200K) awarded. This is a grant total of about $20M for UNO Biomechanics demonstrating the quality of research that is performed by our scientists. Research that changes lives and greatly benefits society.

RESEARCH THAT IMPACTS THE COMMUNITY

ZUNIGA KNARR R01

Jorge Zuniga, Ph.D., associate professor of biomechanics and Brian Knarr, Ph.D., assistant professor of Biomechanics at UNO, are co-principal investigators on a study titled "The influence of 3D printed prostheses on neural activation patterns of the primary motor cortex in children with unilateral congenital upper-limb reductions". This $1.4 million R01 is funded by the National Institute of Neurological Disorders and Stroke (NINDS) and will support research into changes in neural activity in children following regular usage of a 3D-printed prosthetic arm. This information would increase our limited knowledge of how prosthesis usage influences the developing brain of growing children and use this information to create rehabilitation programs aimed at reducing prosthesis rejection and abandonment.

More information and a video can be found here:
www.unomaha.edu/news/2020/02/uno-researchers-study-prosthetic-limbs-neural-activity.php

DESYATOVA R01

Stent-grafts are devices frequently used to repair diseased or injured aortas. Though aortas are stretchy, these devices are stiff and may impose abnormal stress on the heart and the aorta. Recent evidence from Dr. Desyatova's team demonstrates that implantation of stiff thoracic aortic stent-grafts in young trauma patients is associated with significantly increased left ventricular mass and the development of hypertension, and the effects may be even more severe in older patients with weaker hearts. In order to mitigate these effects and preserve aortic compliance, the team of Dr. Desyatova which includes a vascular surgeon Dr. MacTaggart and a materials engineer Dr. Maleckis, has developed a new aortic stent-graft that possesses aorta-like mechanical properties and microstructure.

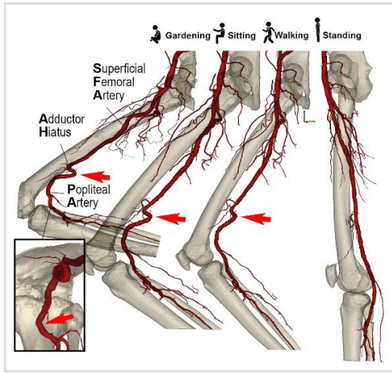
The new 5-year, $3 million R01 from the National Heart, Lung, and Blood Institute (NHLBI) will allow Dr. Desyatova and her team to determine whether their new stent-graft produces normal hemodynamics and prevents cardiac and aortic damage. This project will result in the development of a new-generation aortic stent-graft that protects the aorta and the heart. It will help both young trauma patients that have otherwise healthy aortas, and older patients with weaker hearts that may be most sensitive to aortic compliance alteration. Considering the ubiquitous use of stiff stent-grafts in patients of all ages, the clinical importance of better minimally-invasive aortic devices is tremendous.

KAMENSKIY R01 RENEWAL

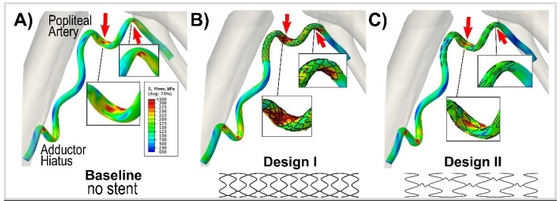
Dr. Alexey Kamenskiy, professor of biomechanics, along with his collaborators, received renewal of their $2.7 million R01 study "Optimized Stents for the Femoropopliteal Artery". This award from the National Heart, Lung, and Blood Institute (NHLBI) will allow them to develop and test an optimally-designed stent that bends and twists with the artery during walking.

In peripheral arterial disease (PAD) patients, angioplasty and stenting of the leg arteries carries one of the highest rates of reconstruction failure. This is because these arteries experience low blood flow and large deformations during walking. Collaborative research of Dr. Kamenskiy and Dr. MacTaggart, a vascular surgeon from UNMC, has demonstrated that these deformations are significantly more severe than assumed previously. They have also shown that none of the existing PAD stents are able to adequately accommodate them, which results in treatment failure.

This information along with knowledge they acquired by studying human arteries from donor tissues through their collaboration with Live On Nebraska, allowed them to propose a new optimized stent to treat PAD. This new stent will be capable of withstanding the severe stresses and buckles of the flexing legs. The team believes that their gentler yet robust stent will improve arterial healing.



The human femoropopliteal artery during limb flexion experiences severe deformations at the adductor hiatus and in the popliteal artery below the knee. These deformations often co-localize with areas most severely affected by PAD.



Mechanical stresses in the arterial wall due to limb flexion (A) are affected by stent design (B, C). Stent Design I (B) demonstrates excessive stresses in the middle and distal segments of the popliteal artery (red arrows), while Design II (C) produces stresses that are similar to the baseline (A).

Assistant Professor Nate Hunt pictured with the WASP device

HUNT R15

In June 2019, Dr. Nate Hunt assistant professor of biomechanics was awarded an $420,108 R15 from the National Institute of Aging (NIA) to understand the mechanisms of fall resistance to diverse slips. The primary goal of this project is to understand how people respond to slips that happen in different circumstances, like walking along curved paths or over sloped ground, and at different times in the walking cycle. By understanding how various circumstances affect fall vulnerability and what the appropriate responses should be for these circumstances, we can better assess someone's overall risk of falling, and design interventions to reduce the chances of a fall.

Dr. Hunt and his team designed a completely new wearable device so they can administer slips to subjects at any time in the gait cycle, and at any place in the laboratory. This not only allows the team to investigate reactive responses to slips, in which the subjects cannot anticipate the slip, but also to examine slips in a range of walking behaviors.

Their device is called WASP which is short for Wearable Apparatus for Slip Perturbations. It basically works as a remote-controlled banana peel. People can walk around normally while wearing it over their shoes. But when they press the button on the app, it releases the shoe to slip over a lubricated Teflon surface that is very slippery.

MYERS VA MERIT REVIEW AWARD

Dr. Sara Myers, associate professor of biomechanics has received a prestigious Merit Review Award from the United States Department of Veterans Affairs Rehabilitation Research and Development Service. This highly competitive research grant is awarded for basic, translational, and clinical studies that seeks to advance the rehabilitative health care of veterans. Over the next four years, Dr. Myers and her research team (pictured) will receive a total of $1.1 million to improve the design, function, and implementation of an assistive ankle exoskeleton device for patients with peripheral artery disease (PAD).

PAD is a common cardiovascular disease that significantly reduces blood flow to the legs. This results in cramping leg pain during walking or physical activity. This disease is also common among our veterans. Currently, there is a critical treatment gap for those who are not ready or appropriate for surgery, but who want to retain or restore their independence and walking ability. Dr. Myers and her research team is currently refining an exoskeleton assistive device according to the specific needs of patients with PAD. This grant will enable them to optimize the design of the ankle exoskeleton device to allow patients with PAD to walk longer without pain or walk the distance needed for completing daily activities with less stress to the affected legs.

YENTES VA SPiRE

Chronic obstructive pulmonary disease (COPD) is the third leading cause of death in the United States and is a disease especially prevalent among those who served in the armed forces. Dr. Jenna Yentes, an associate professor in biomechanics, and Dr. Debra Romberger, a professor and chair of the UNMC Department of Internal Medicine, received a $200,000 Small Projects in Rehabilitation Research (SPiRE) federal award from the VA Office of Research and Development to study the optimal methods of breathing and exercise for veterans who suffer from COPD.

The study will examine differences in respiratory and walking rates while walking at a fast pace on level ground versus walking uphill at a slower pace. The goal is to find the right pace and slope that allows patients to extend the amount of time that they exercise, improving the respiratory and physical health of COPD patients. Findings could be applied to physical therapy and exercise education for COPD patients.

DR. MALCOLM PUBLISHES IN SCIENCE

Last August, Dr. Philip Malcolm (pictured), an assistant professor of biomechanics, and his team published a report in Science which is one of the most prestigious scientific journals in the world. In their report they present a versatile and portable exosuit (an amazing type of "pants") that reduces the energy used of walking and running. Until then, different groups developed such wearables that could assist either walking or running but not both modes of locomotion.

Their lightweight exosuit has special textile components for the thighs and waist. In addition, the researchers developed a control algorithm that automatically switches between the assistance profiles for walking and running. The study shows that the exosuit reduces the energy of walking by 9.3% and running by 4%. These reductions are modest in comparison to best-in-class single-mode devices. However, the assistive effects are noticeable and of similar magnitudes to reductions that have been shown to improve athletic performance. Further developments such as more lightweight designs or further optimization of the algorithms used could enable other practical applications such as rehabilitation in athletes and improving mobility assistance in patient populations.

NEXT PHASE OF THE MOVCENTR

FOURTH ANNUAL

CONFERENCE IN HUMAN MOVEMENT VARIABILITY

On May 16, 2019 the MOVCENTR hosted the 4th Annual Human Movement Variability Conference. There were 102 attendees with a record nine vendors and six awards.

SPEAKERS

Barry T. Bates
Keynote Speaker
Dr. Didier Delignieres

Honorary Barry T. Bates
Keynote Speaker
Dr. Beverly Ulrich

Invited Guest Speaker
Dr. Tom Buchanan

AWARD RECIPIENTS

AMTI Best Scientific Achievement Award: Podium
Dr. Christopher Hovorka

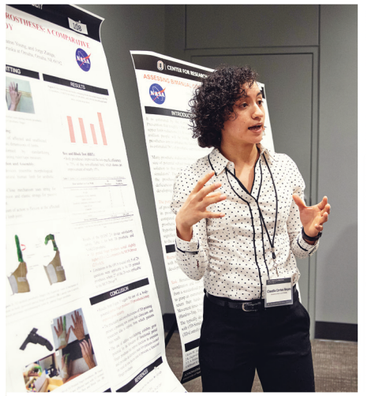
APDM Best Clinical Implications Award: Podium
Dr. Basma Yacoubi

Gait Rite Most Innovative Award: Podium
Blake Beier

Bertec Best Clinical Implications Award: Poster
Dr. Andrew Kern

Department sponsored Best Scientific Achievement Award: Poster
Corbin Rasmussen

Department sponsored Most Innovative Award: Poster
Zachary Motz



MEET OUR PHASE II JUNIOR INVESTIGATORS

WELCOME TO THE MOVCENTR

Pictured left to right: Dr. Phillippe Malcom, Dr. Vivien Marmelat, Dr. Nate Hunt, Dr. Jorge Zuniga

Dr. Carolin Curtze

DR. NATE HUNT

From running roaches and robots, to leaping and landing squirrels, to human mobility and balance—Dr. Nate Hunt draws on diverse areas to better understand biomechanics and control of high performance movement.

Nate began biomechanics research after a background of physics and computer modeling from the Physics department of the University of Nebraska-Lincoln (UNL). He got his M.S. studying human walking variability with Dr. Nick Stergiou at UNO, and his Ph.D. researching animal biomechanics and control with Dr. Bob Full at UC Berkeley. When the opportunity arose to rejoin UNO and the unbelievable growth of the Department of Biomechanics, Dr. Hunt wrapped up his Ph.D. dissertation and came back home to Nebraska.

Dr. Hunt joined the Center for Research in Human Movement Variability as an Assistant Professor during preparation for Phase II of the NIH COBRE award. "Coming primarily from animal movement and bioinspired robotics, I jumped into the deep end of biomedical research at UNO where I'm now leading two NIH-funded clinical trials" Nate says. "I'm really fortunate that the COBRE award, with the critical mass of biomechanists it has brought to UNO, provides an amazing group of scientists with diverse research experience to draw on."

Dr. Hunt's research focuses on discovering how locomotion occurs over complex and varied terrain, and understanding movement strategies and developing technology to improve mobility. A major component of achieving high performance during locomotion, whether the system is squirrels, robots or humans, involves learning from a variety of experiences. His COBRE research project aims at understanding learning to recover from different types of slips and reduce falls in older adults.

DR. PHILIPPE MALCOLM

Dr. Malcolm received his Ph.D. from Ghent University (Belgium) and after a postdoc at Harvard University joined our Department of Biomechanics in 2017. His research involves the optimization of footwear and exoskeletons to gain new insights into the energy cost of locomotion.

Wearable robots such as exoskeletons and robotic tethers in development at UNO and other universities can now reduce the energy used during walking. Fine-tuning the controls of an exoskeleton for an individual typically requires up to one hour of walking experiments. However, patient populations such as patients with peripheral artery disease typically cannot walk longer than a few minutes because of muscle pain; therefore, it is challenging to optimize exoskeletons for the patient populations that could benefit the most of them.

As part of the COBRE project Malcolm aims to develop faster and thereby more clinically feasible methods for optimizing exoskeletons. His algorithms will rely on measurements of movement variability supported by our MOVCENTR. When not studying the energetics of locomotion, Malcolm enjoys burning energy by cycling, which is one of the most popular sports in his home country, and other activities such as running with his dog.

DR. VIVIEN MARMELAT

After earning his Ph.D. in Human Movement Sciences from VU University Amsterdam (Netherlands) and Montpellier University (France) in 2014, Dr. Vivien Marmelat started working at UNO in 2015. Dr. Marmelat's COBRE project aims to better understand the relationship between gait, cognition and falls in people with Parkinson's disease (PD). These individuals experience 2 to 3 times more falls than the normal population.

In collaboration with Dr. Janelle Beadle (UNO, Gerontology), Dr. Marmelat's research team also explores the relationship between inter-personal synchronization (moving together in time) and empathy in patients with PD and their family caregiver. Recently, Dr. Marmelat and Dr. Brian Ricks (UNO, IS&T) developed a website to measure motor timing, an important aspect to control our movements that is often impaired with PD. Their long-term goal is to develop a patient-centered game to improve motor and cognitive functions in people with PD, but also in other clinical populations.

DR. JORGE ZUNIGA

Dr. Jorge M. Zuniga received his M.S. degree from UNO and Ph.D. from the University of Nebraska-Lincoln. He joined our Department of Biomechanics in 2016 after being for four years a professor at Creighton University. Dr. Zuniga's main research interests include the development of low-cost 3D printed prostheses, 3D printed anatomical models for surgical planning, and medical applications of antimicrobial polymers for additive manufacturing. Dr. Zuniga developed a 3D printed prosthetic hand for children named Cyborg Beast (http://www.cyborgbeast.org).

Dr. Zuniga's COBRE project will determine the influence of using a 3D printed prosthesis on the neural activation patterns of the brain in children with unilateral congenital upper-limb reductions. The central hypothesis is that prolonged prosthesis use will result in a reduced brain activation indicating that wearing a prosthesis may assist the brain to produce a more refined, specialized, and efficient response improving performance and the functional use of the prosthesis.

However, Dr. Zuniga "graduated" from his Junior Investigator status when he received an NIH R01 which has a similar research focus. Congratulations Dr. Zuniga! So, his position on the COBRE was awarded to Dr. Carolin Curtze.

DR. CAROLIN CURTZE

Dr. Carolin Curtze, assistant professor in Biomechanics, joined UNO as a faculty member in the Fall of 2018. Dr. Curtze grew up and completed her undergraduate studies in Germany. She received her Ph.D. from the University of Groningen (Netherlands) and subsequently completed her postdoctoral training at Oregon Health & Science University, studying the balance and gait impairments in people with Parkinson's disease.

As a junior investigator on the newly awarded NIH COBRE phase II grant, she will be investigating walking impairments in Parkinson's disease patients. These patients are more visually dependent in order to compensate for their movement deficits. Yet, visual disturbances are a common, but often overlooked problem in PD, that may lead to unsafe walking. To navigate efficiently through complex real-world environments, eye movements need to be attuned to the walking task. Gaze anticipation during walking and turning is critical for anticipation, and contributes to the perception of space during motion. Therefore, Dr. Curtze's goal in her COBRE project is to investigate how gaze is attenuated to different aspects of the environment and how visual function relates to stability during walking in complex real-world settings.

MEET OUR PHASE II CORE FACILITIES

Dr. Brian Knarr, Director of the Machining and Prototyping Core

The Main Gait Lab.

Left to right: Dr. Jenna Yentes,Director of NONAN, Dr. Sara Myers, Director of MOVAN, and Dr. Carolin Curtze one of our COBRE Junior Investigators.

MACHINING AND PROTOTYPING CORE (MAPRO) DR. BRIAN KNARR, CORE DIRECTOR | BMCHMPCORE@UNOMAHA.EDU

The Machining and Prototyping Core Facility involves the use of three major facilities within the UNO BRB: The Machine Shop, Design Studio, and the 3D Printing Laboratory. The most basic function of the Core is to provide services that utilize these spaces and their personnel and equipment. These services are for professionals in the NU system, the local area, but also to people outside our state to progress their research or other projects. This core can design, prototype, manufacture and repair, maintain, or install a wide range of devices and instrumentation.

Machine Shop, BRB 143

The 1,223 square foot space with included engineering office and garage-equipped work bay houses the Machining and Prototyping Core. The Machine Shop is equipped with both traditional and advanced machinery that allows for prototyping and fabrication in materials ranging from various woods, to metals, plastics, and other unique composite materials.

Equipment in this space includes a wide collection of hand tools, a traditional knee mill, Hurco VM10i CNC Machining Center, vertical band saw, table saw, compound miter saw, drill press, belt/disc sander, 3-Axis CNC routing machine, bench grinder, VLS 6.60 laser cutter, Laser 3D scanner, and a small format circuit board CNC milling machine Also included are large scale additive manufacturing machines that include four Pro2 Plus, a Rostock Max V2 and V3, and a 300 Series Workbench Pro.

Design Studio, BRB 135

The 470 square foot space is dedicated to supporting student researchers in planning, conceptualization, design, and basic fabrication for research projects. The studio is equipped with workstations capable of industry-grade CAD software, simulation, and analysis. Also available to studio users are basic hand tools, power tools, collaborative creative spaces, and functional prototyping layouts.

3D Printing Lab, BRB 145

The 3D Printing Lab includes a primary 675 square foot space for general activities and a secondary 224 square foot space specifically designed for printing metal components. Printers with capabilities in stereolithography, selective laser sintering, fused deposition modeling. The secondary space has a ProX DMP 200 metal 3d printer with specially designed ventilation and fire suppression systems. Printing materials include plastics, wood, metal and composites.

MOVEMENT ANALYSIS CORE (MOVAN) DR. SARA MYERS, CORE DIRECTOR | BMCHMOVAN@UNOMAHA.EDU

The Movement Analysis Core provides resources, education, advisement and services related the analysis of human movement. Equipment such as motion capture, dynamometry, electromyography (EMG), electroencephalography, functional near-infrared spectroscopy, virtual reality and high-speed digital video are provided. The Movement Analysis Core involves the use of several major facilities within the UNO BRB.

Aquatic Therapy Lab, BRB 021

This lab features an underwater treadmill where participants can sit, stand, walk, or run partially submerged underwater.

CAREN Virtual Reality Lab, BRB 027

The Computer Assisted Rehabilitation Environment (CAREN) is primarily used for virtual reality. It has a 180-degree projection screen, motion capture system and a treadmill that can move in all directions.

Gait Lab, BRB 035

Our second gait lab has a motion capture system and several high-performance force plates. The force plates are contained in a large pit that can be rearranged.

Bio-inspired Robotics Lab, BRB 037

This lab is used to study the biomechanics of insects. The temperature of the room can be raised to 90°F and there are three high-speed cameras used to record the movements of insects.

GRAIL Virtual Reality Lab, BRB 103

The Gait Real-time Analysis Interactive Lab is primarily used for virtual reality. It has a 180-degree projection screen, motion capture system and a treadmill. This lab has had several upgrades over the years and is one of our most used labs.

Main Gait Lab, BRB 116

Our Main Gait Lab is another high-use space. It has our largest motion capture space, several force plates, treadmill and lofted ceiling.

Balance and Strength Lab, BRB 123

The Balance and Strength Lab primarily features two pieces of equipment used to measure standing balance and strength. Strength testing can be performed on a wide array of joints and movements.

Brain Imaging Lab, BRB 129

This lab houses equipment used to measure brain activity. The room can be made completely dark, has solid walls, and an airlock to improve use of the equipment.

NONLINEAR ANALYSIS CORE (NONAN) DR. JENNA YENTES, CORE DIRECTOR | BMCHNONAN@UNOMAHA.EDU

The Nonlinear Analysis Core provides resources and services necessary for innovative analysis of human movement. These methods go beyond averages by looking at the time varying characteristics of a time signal. The Core provides access to a multitude of nonlinear analysis tools, assistance in experimental design, data processing, quality assurance, interpretation and dissemination. The Core is also actively exploring and validating new techniques and algorithms for future use. In addition to our nonlinear methods, standard analyses can also be performed. The following services are available:

Access to Nonlinear Techniques

These techniques include Average mutual information, False nearest neighbor, Lyapunov exponent, Recurrence quantification analysis, Entropy analysis such multiscale entropy and cross-entropy methods, Detrended fluctuation analysis (DFA), Multifractal DFA (MDFA), Correlation dimension, Surrogation, and many others.

Data Collection Approach, including Rigor and Reproducibility

Not all data can be used with the nonlinear techniques. Prior to data acquisition, it will be important to determine if proposed methods will provide high fidelity data for processing.

Data Processing

Data processing services may appear to be straightforward; however, data treatment may be required based on collection methods and the research question proposed.

Computer Programming

NONAN will provide programming services to fit the needs of researchers using the core.

Data Interpretation and Dissemination

Each algorithm is unique and depending on the type of data, methods in which data were acquired, and the research question, the resulting data interpretation can be convoluted. Thus, NONAN will provide an interpretation report for all data processing requests.

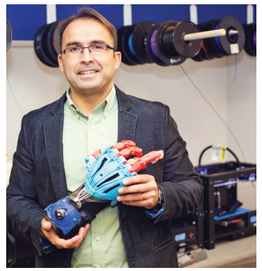
Consultation Services

In addition to training identified in services above, consultation will be available for grant submissions, experimental and methodological designs, and results dissemination.

EXPANDING OUR HORIZONS

HIGHLIGHTED COLLABORATIONS

Biomechanics continues strong relationships with industry partners. Among the many benefits of these relationships are securing student fellowships to support undergraduate and graduate biomechanics students. In this Newsletter, we highlight our relationship with Innovative Prosthetics & Orthotics, 3D LifePrints and Copper3D Inc. These relationships were made possible through Dr. Jorge Zuniga, associate professor in biomechanics.



INNOVATIVE PROSTHETICS & ORTHOTICS AND SHABRI LLC

Rakesh Srivastava MS, CPO (pictured, top left) is the president and CEO of Innovative Prosthetics & Orthotics, as well as SHABRI LLC. Innovative Prosthetics & Orthotics provides comprehensive prosthetics & orthotics services and has been in business for over 15 years. SHABRI LLC assists large and small businesses by advancing manufacturing design technology of medical devices. Rakesh Srivastava and Dr. Zuniga (pictured, bottom left) have been collaborating since 2012 training our local Nebraska workforce and making an impact in the state economy. The Department of Biomechanics offers the ideal environment to train students interested in prosthetics and medical device manufacturing by exposing them to hands-on research and industry settings. Innovative Prosthetics & Orthotics is moving their Omaha based clinical branch to the Biomechanics Research Building to further strengthen the research collaborations with Dr. Zuniga and other biomechanics faculty.

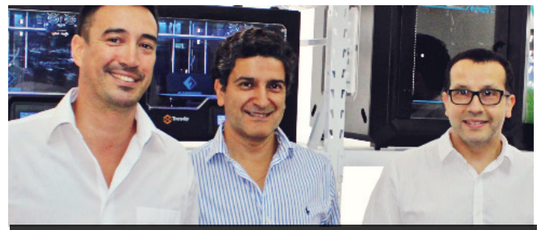
3D LIFEPRINTS

3D LifePrints is a medical 3D printing and technology organization that uses 3D technologies to provide innovative solutions across the globe to the medical sector. Currently, 3D LifePrints provides the funding to support the work of some of the Biomechanics students in Dr. Zuniga's research team, exposing them to research and clinical applications of additive manufacturing in hospital settings.

Pictured: Henry Pinchbeck CEO (top) and Paul Fotheringham Founder and CTO (bottom) of 3D LifePrints.

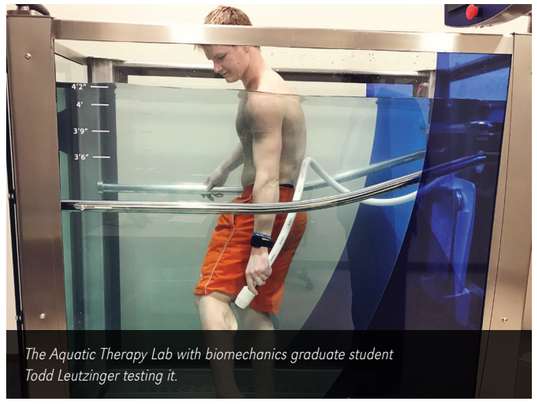
COPPER3D INC

Copper3D Inc is a Chilean/US based company founded by professionals passionate about innovation and the impact that new technologies have on the quality of life of people. Copper3D specializes in the development of antibacterial nanomaterials for the Additive Manufacturing industry focusing on medical applications. In collaboration with the Copper3D team, Dr. Zuniga has secured two NASA Nebraska mini grants and submitted several large NASA grants.



Pictured from left to right: Daniel Martinez CINO, Andres Acuna CEO, and Claudio Soto Medical Director of Copper3D Inc.

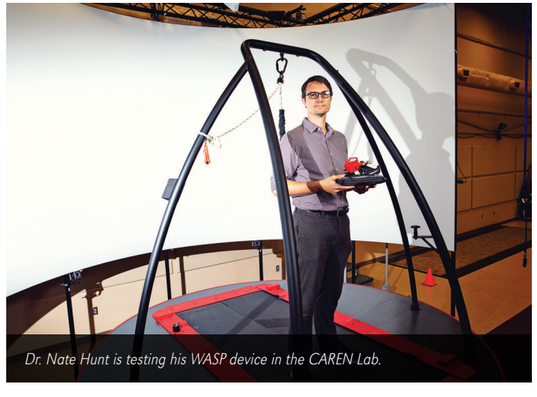
NEW LABS IN THE BRB EXPANSION



The Aquatic Therapy Lab with biomechanics graduate student Todd Leutzinger testing it.

AQUATIC THERAPY LAB, BRB 021

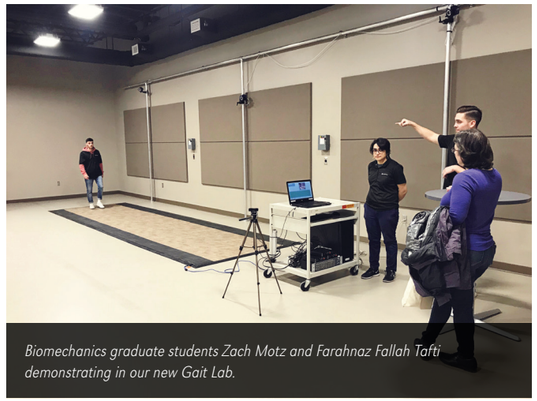
This 246 square foot lab is dedicated for a HydroWorx 300 (HydroWorx, Middletown, PA, USA) treadmill. It allows subjects to sit, stand, walk or run in a self-contained underwater treadmill. This buoys the subjects providing better rehabilitation. The warm water therapy also provides added comfort.



Dr. Nate Hunt is testing his WASP device in the CAREN Lab.

CAREN LAB, BRB 027

This 1,083 square foot lab will house a Computer Assisted Rehabilitation Environment (CAREN) (Motek ForceLink, Amsterdam, Netherlands). It is similar to our GRAIL Lab but is larger and more capable. It features a 180-degree screen and front mounted projectors. It uses ten Vero motion capture cameras (Vicon Motion Systems Ltd, Oxford, UK). The treadmill is a split-belt design with belts on the left and right sides of the treadmill. Each side can measure six-component ground reaction forces. This treadmill is supported on a motion base with six degrees of freedom. The environment is also controlled through Motek ForceLink's D-Flow software and has several options for third party device integration.



Biomechanics graduate students Zach Motz and Farahnaz Fallah Tafti demonstrating in our new Gait Lab.

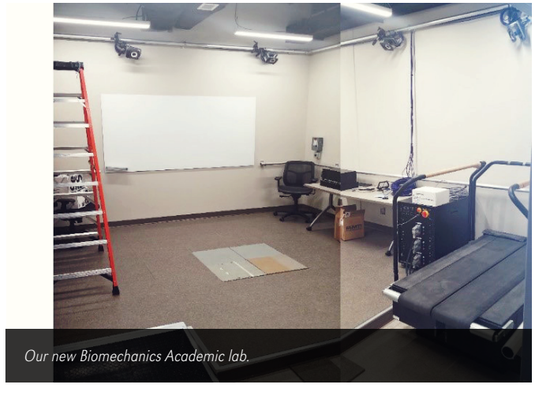
NEW GAIT LAB, BRB 035

This 1,335 square foot lab features five AMTI high performance force platforms (AMTI Inc., Watertown, MA, USA) and a 12-camera Raptor 4s motion capture system (Motion Analysis Corp, Rohnert Park, CA, USA). The force plates are embedded in a modular 3x4 array with many potential configurations. Filler plates with mechanical properties similar to the real force plates are used to fill in spaces around the actual force plates. The array is in-line with double doors to BRB 027 so extended sprinting studies can be conducted. The force plates are part of AMTI's High Performance line and feature composite tops that increase the resonant frequency of the platforms. The Raptor 4s cameras operate at 4 MP resolution up to 200 Hz. .

Our new Bioinspired Robotics Lab.

BIOINSPIRED ROBOTICS LAB, BRB 037

This 158 square foot lab is used for insect biomechanics. The climate controlled room is maintained at 90 °F, was designed with escape barriers, and has an adjoining preparation and storage space. Insect movement is recorded in a custom made containment area using one TS5 and two IL5 high-speed digital cameras (Fastec, San Diego, CA, USA). These cameras can be used to record HD color or monochrome images. The TS5 can capture 2560 x 1440 images at 359 fps. The IL5 can capture similar images but while connected to a computer. Both models can collect images over 1000 fps can be mounted on a tripod or used as a handheld.



Our new Biomechanics Academic lab.

ACADEMIC LAB, BRB 158

This 294 square foot lab features an 8 camera T160 motion capture system (Vicon Motion Systems, Oxford, UK). It is integrated with 4 OR6 strain gage force platform (AMTI, Watertown, MA). The space also contains an instrumented treadmill (Bertec Corp., Columbus, OH, USA). The treadmill has a split-belt design with separate belts running side by side. Each side is instrumented to measure 6-component ground reaction forces. This space is used primary for the education of undergraduate and graduate students.

THE PEOPLE OF UNO BIOMECHANICS

WHY I CHOSE BIOMECHANICS

> THE TRANSITION TO BIOMECHANICS GRANTED ME THREE PRICELESS THINGS: FRIENDS, PURPOSE, AND A RICH EDUCATION, FULL OF VARIABILITY. I MADE GENUINE CONNECTIONS WITH MY PROFESSORS AND BECAME BEST FRIENDS WITH A FELLOW BIOMECHANICS STUDENT.

I, like many other first-year college students, flung myself into UNO straight after graduating high school. I also shared an infliction that many of my peers kept tucked in the back of our minds. I didn't know what I wanted to do. I pushed that nagging thought deep in a mental closet somewhere. I remained undeclared for a year before eventually trudging through the computer science program for an additional two years. This is not to say the program was lackluster, but rather that my heart was not set on it. Coding seemed like a straightforward way to land a job just about anywhere and check off another box in the big "to-do" list that I understood as life.

All the while, the feelings of what I truly wanted began to fester in that closet I stuffed them away in. When I was two semesters away from graduating, those feelings came to the forefront and rendered me useless while I agonized over years of repressed decision making. Thankfully, the Biomechanics Research Building had recently been built. I had only briefly crossed paths with the field of biomechanics reading of it in articles centered around weightlifting. My tour of the building had illuminated the fact that there was more than just measuring the difference leverages produced by the barbell's position on your back. The array of research is staggering, from motor control, synchrony, gait with focuses on diseases such as COPD and Parkinson's, even squirrels and exoskeletons. However, of all of them, I was enthralled with Dr. Zuniga's research that focused 3D printed prosthetic devices and their effects within the brain. I switched my bachelor's degree to Biomechanics and began volunteering within Dr. Zuniga's team for the remainder of my undergraduate career.

The transition to Biomechanics granted me three priceless things: friends, purpose, and a rich education, full of variability. I made genuine connections with my professors within the building. I became best friends with a fellow Biomechanics student who later joined my team, and have enjoyed the company of my fellow labmates within the building. I found that I desired to learn more after graduating with my bachelor's and have nearly completed my master's thesis. My thesis aims to examine the effects within the brain of typically developing individuals using prosthetic simulators, and if they truly emulate the brain of people with upper limb reductions using their actual prosthesis. My education rests on the foundations of lessons everyone in the building has imparted onto me. Including, but not limited to, thinking like a scientist, wielding strong inference, to valuing collaboration between different paths of science, and always to make time to help both yourself and others within your calendar. I've experienced the other side of the classroom and have gained an appreciation for teaching and forming bonds with my students. And I can't escape coding thanks to MATLAB.

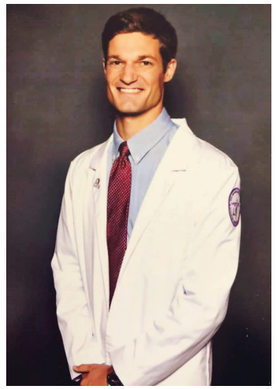
The past three years within the biomechanics building has allowed me to interact with a diverse and remarkable group of faculty, staff, and students. It is a high energy and competitive environment. Still, those traits are the catalysts that drive everyone in the building to reach new heights and drill towards a better tomorrow, where we can use the fruits of our labor and research to better our local and global communities.

CHRIS COPELAND
GRADUATE STUDENT, BIOMECHANICS

WHERE ARE THEY NOW?

CONNOR REED

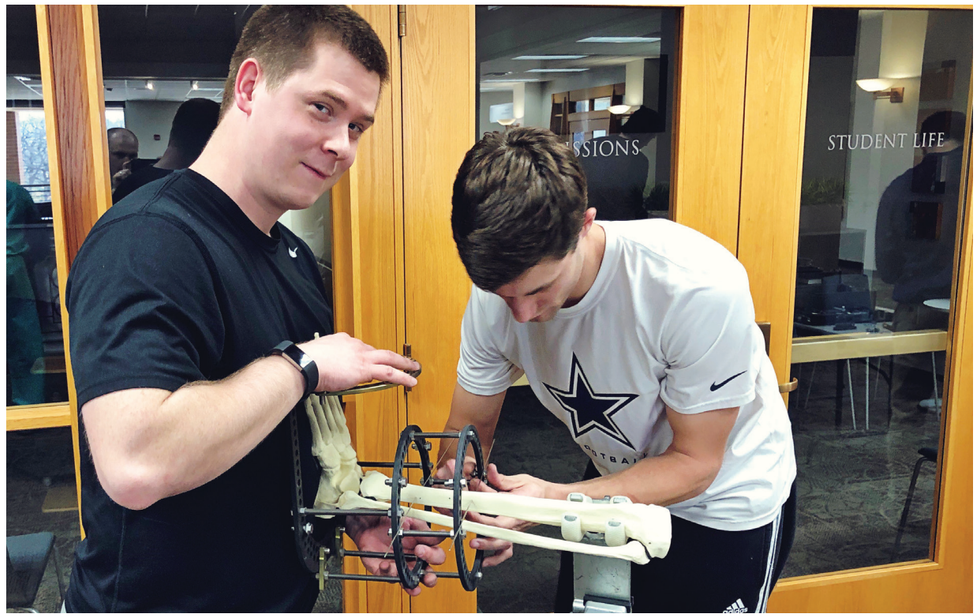
GRADUATE, BACHELOR OF SCIENCE IN BIOMECHANICS



I am a third-year podiatric medical student at Des Moines University College of Podiatric Medicine and Surgery. My journey started at the Biomechanics Research Building as a volunteer and undergraduate research assistant on Dr. Stergiou's research team, as well as being a member of the first graduating class for the Bachelor of Science degree in Biomechanics in 2017. To finish my biomechanics degree, I needed to complete an internship in a field of my choice, so I elected to intern at the Foot and Ankle Center of Nebraska with podiatrist Dr. Robert Greenhagen. After finishing the internship, I knew podiatry was the right field of medicine for me because of how well biomechanics was integrated into it. I applied to DMU's podiatry program immediately following my internship and matriculated in the fall of 2018.

My classes during the first year included gross anatomy, microbiology, immunology, physiology, neuroanatomy, biochemistry, histology, and pathology. Second-year courses included pharmacology, lower extremity dermatology, and courses based on organ systems. This past semester, we took two biomechanics courses in addition to our extensive lower limb anatomy course, so it was exciting to continue learning about biomechanics and be able to apply it in the podiatric setting. I also am the Research Coordinator for DMU's Student Chapter of the American College of Foot and Ankle Surgeons (ACFAS), of which our research team placed 1st amongst the 9 podiatry schools for our poster presentation at the 2020 ACFAS Scientific Meeting.

After I finish the next two years of clinical education, I will graduate and complete a 3-year surgical residency program. My wife, Jordan, is an occupational therapist, and we are hoping to return to Nebraska to practice in our respective fields and raise a family. I am so grateful for the support and encouragement I received during my time with the BRB family. I would not be where I am today without the amazing faculty, staff, and students I worked with, especially Dr. Stergiou and my research mentor Dr. Knarr. I am excited to see what is next for UNO Biomechanics.



NEW HIRES IN THE DEPARTMENT

Dr. Anastasia Desyatova joined the Department of Biomechanics in the Fall of 2019 as an Assistant Professor. She earned her Ph.D. in Mechanical Engineering and Applied Mechanics from the University of Nebraska-Lincoln, and her research was focused on the mechanisms to improve material toughness and durability through interfacial design. Her post-doctoral fellowship training, completed at the University of Nebraska Medical Center, was focused on the characterization of aortic growth and remodeling in young trauma patients after thoracic endovascular aortic repair and investigation of long-term performance and durability of different aortic stent-grafts. Currently, Dr. Desyatova's research is focused on understanding and predicting behaviors of biological systems and synthetic biomimetic materials, and she achieves this through the synergistic integration of experimental and computational techniques.

Dr. Alexey Kamenskiy joined the Department of Biomechanics as a Professor in the Fall of 2019. He earned his Ph.D. in Engineering Mechanics from the University of Nebraska-Lincoln, and advanced through the ranks of Assistant and Associate Professor in the Department of Surgery at the University of Nebraska Medical Center before moving to UNO. The research of Dr. Kamenskiy is focused on experimental and computational vascular mechanobiology, vascular pathophysiology and aging, and the development of devices and materials for open and endovascular repair. Dr. Kamenskiy closely collaborates with vascular surgeons in using patient data, human cadaver, swine, bench-top, and computational models to unravel complex pathophysiology of human vasculature and develop practical solutions to improve clinical outcomes. His research is currently funded by the NIH, DoD, FDA, and private industry.

Dr. David Kingston joined the Department of Biomechanics as an Assistant Professor in the Fall of 2020. Originally from Canada, he earned his Ph.D. in Kinesiology from the University of Waterloo exploring intersegmental pressure, muscle activity, and kinematics for modeling high knee flexion activities such as kneeling or squatting. Dr. Kingston completed his postdoctoral fellowship in the College of Medicine at the University of Saskatchewan studying whole-body vibration injury risks in farmers and foot tissue loading in diabetic and lower limb amputee populations. Dr. Kingston's overall research goal is to use joint loading estimations to understand disease process mechanisms and resolution. This research will enable populations for physical activity to improve tissue health and quality of life.

Dr. Aaron Likens joined the faculty in the Department of Biomechanics as an Assistant Professor in January of 2020. Dr. Likens specializes in the methodological and theoretical development of dynamical systems theory in movement and cognitive sciences. He has extensive experience applying linear and nonlinear time series analysis in a range of areas related to human performance. Prior to his appointment, Dr. Likens completed a Ph.D. in Perception, Action, and Cognition at Arizona State University and a postdoctoral fellowship in Cognitive Science. Most recently, he was a Research Associate in our Department (2018-2019). His most recent work explores the idea that perception and movement are directly linked to the context in which those actions take place. Dr. Likens plans to leverage this work to understand coordination challenges experienced by older adults.

Dr. Kaspars Maleckis joined the Department of Biomechanics as an Assistant Professor in Fall 2019. He received his Ph.D. in Biomedical Engineering from the University of Nebraska-Lincoln, researching the manufacturing and properties of nanostructured materials. Before joining the University of Nebraska-Omaha, Dr. Maleckis received his postdoctoral training at the University of Nebraska Medical Center where he focused on the clinical applications of nanostructured biomaterials and devices. At the Department of Biomechanics, Dr. Maleckis focuses on developing mechanically-optimized cardiovascular materials and devices.

STUDENT CENTERED

STUDENT EXPERIENCES

PURSUING A BACHELOR OF SCIENCE IN BIOMECHANICS: **IAN SLOAN**

When I first started my time at UNO, my intentions were to study mechanical engineering. After a semester of doing this, I began to have a need for more human anatomy and physiology. I had always dreamed of designing and testing prosthetics and orthotics. I had heard of the Biomechanics program and wanted to find my way into it. I was lucky enough to have a friend currently in the Biomechanics major and he got me hooked on the idea. The experience and knowledge I gained from this degree is a special treat that you cannot find anywhere. The Biomechanics degree pushed me to my limits and really made me think outside of the box. It also allowed me to get involved in current research and actively use what I learned in class.

For the past three years, I have been working with Dr. Stergiou and Dr. Likens as an undergraduate research assistant. They have provided me a wide array of research with varying topics. The first project I worked on involved improving amputee standing and walking. I hit the ground running with the team and was working in the lab within weeks of starting. Being a research assistant has also given me the chance to write a scientific manuscript for publication. I am now working on multiple projects involving coordination and motor control. The department also provides you the opportunities to share your research and will actively help you further your education. I was awarded the Vaya Stergiou scholarship for my hard work in the department. They also allowed me to present my research at multiple conferences, especially the American Society of Biomechanics. Being able to work in research during my undergrad is exactly what is needed to further advance your education in Biomechanics. It allows you to actively apply what you learn in class to real world scenarios and experiences.

After I graduate with my Bachelor of Science in Biomechanics, I will be attending Nebraska Methodist College. I am pursuing a degree in Nursing by going through their one year accelerated program. I plan to continue on to become a Certified Registered Nurse Anesthetist. This program gave me the connections and motivation I needed to be successful in life. I would not be where I am today without the staff and faculty in the Biomechanics department. I am excited to take my passion and knowledge for Biomechanics, and apply it to the nursing field and beyond.

MY EXPERIENCE AS A GRADUATE ASSISTANT: **LINDSEY REMSKI**

Working as a graduate assistant in the BRB, I've had the opportunity to apply concepts that I've learned in my classes in the laboratory. When I started my assistantship, I learned how to collect data using equipment like 3D motion capture and force plates. Using this equipment, I've been able to work with my advisor, Dr. Knarr, and the other students on our team to do research on topics like stroke rehabilitation and sports injuries.

Over the course of the last year, I've developed a research project aimed at learning more about motor control after ACL reconstructive surgery. I've been able to write my own research grants, help develop a novel measurement device, and pilot test my project. This next coming year, I will be completing my project and submitting a paper of the results to a journal for publication.

Having my assistantship has helped me be able to spend more time in the BRB to work on my project as well as assist with other projects being carried out in the building. I get hands-on experience with biomechanics research and am grateful to be learning at work as well as through my courses every day.

BIOMECHANICS UNITED

Biomechanics United is a student group at UNO that provides both graduate and undergraduate students the opportunity to network and interact with one another outside a classroom or laboratory setting. The group is student run and student focused with an emphasis on building greater relationships amongst the biomechanics community at UNO. The group was formed in the Fall of 2018 by Dr. Brian Knarr, as the advisor, and several graduate students to provide academic, professional, and social events to students interested in biomechanics. Some of these events have included panels with professionals to provide insight on jobs in industry and how to perform well in interviews, as well as team building events such as an escape room, happy hours, intramurals, and more. By providing events that benefit both graduate and undergraduate students alike, Biomechanics United has been working to bridge the social gap between undergraduate and graduate students, something that has become a primary goal in the group's second year.

Since its conception in 2018, Biomechanics United continues to expand and evolve. The group has begun to assist in planning the Annual Human Movement Variability Conference hosted by the department each year. It is Biomechanics United's goal to expose students to the planning process of a large meeting as well as to improve student networking events during the meeting. As the group continues to grow and develop, the goal of Biomechanics United will be to continue to bring graduate and undergraduate biomechanics student together to build comradery and prepare its members for their future careers.

STUDENT IMPACT

Our dedicated students have the opportunity to obtain prestigious grants, awards, and scholarships based on the high-quality research they conduct in the BRB.

2018-19 Fuse Grants

Cody Anderson
Anthony Arellano
Samantha Chong
Kyle Doerr
Tyler Keller
Taylor Runyan
Michael Thompson
Andrew Walski
Chenggong Zhang

2018-19 URCA Grants

Blake Beier
Farah Fallah Tafti
Henamari Ybay

2018-19 GRACA Grants

Kyle Brozek
Russell Buffum
Christopher Copeland
Farah Fallah Tafti
Arash Gonabadi
Namwoong Kim
Shane Meltz
Abderrahman Ouattas
Sheridan Parker
Thallon Pitchure

2018-19 Vaya Stergiou Distinguished Scholarship in Biomechanics

Ian Sloan

2018-19 NASA Nebraska Space Grant Fellowship

David Salazar
Claudia Cortes Reyes
Alissa Miller
Roberto Saavedra
Michael Thompson

2019 Office of Research and Creative Activity Awards

Best Graduate Oral Presentation
Nikolaos Papachatzis

Outstanding Graduate Oral Presentation
Takashi Sado

Honorable Mention Graduate Oral Presentation
David Salazar

Honorable Mention Undergraduate Poster Presentation
Ian Sloan

Meritorious Graduate Poster Presentation
Namwoong Kim

2019 Human Movement Variability Conference Awards

Department-sponsored Best Scientific Achievement Award
Corbin Rasmussen

Department-sponsored Most Innovative Award
Zachary Motz

Gait Rite Most Innovative Award
Blake Beier

2019 College of Education, Health, and Human Sciences Outstanding Graduate Student Award

Erica Hedrick

Fulbright Scholar

Samantha Sack

UNO Paul L. Beck Scholarship

Prokopios Antonellis
Ryan Meidinger
Jenny Maun

Selected as Participant in International Student Research Forum in Denmark

Zachary Motz

DEFENSES

THESIS DEFENSES

SHERIDAN PARKER

Defense: June 16, 2020

Self-Selected Adaptive Speed Treadmill Walking and Outdoor Walking in Older Adults

DAVID SALAZAR

Defense: August 14, 2019

The Development and Clinical Validation of a Low-Cost Methodology for 3D Printed Anatomical Models for Surgical Planning and Clinical Education

SAMUEL RAY

Defense: July 29, 2019

Augmenting Human Muscle Performance through Added Foot Stiffness

CORBIN RASMUSSEN

Defense: July 17, 2019

Characterizing Diverse, Unconstrained Slips and Recovery Reactions during Curvilinear Walkings

ERICA HEDRICK

Defense: June 12, 2019

How Prosthetic Ankle Stiffness Affects Metabolic Energy Expenditure During Walking with Added Loads in Non-Amputees

SHANE MELTZ

Defense: June 7, 2019

Effect of Dual-task Walking on Long-range Correlations in People with Parkinson's Disease

TAKASHI SADO

Defense: April 17, 2019

Altered Gait Adaptation and Inter-limb Coordination during Passive Exoskeleton Assisted Walking and Induced Gait Asymmetry

KEATON YOUNG

Defense: April 9, 2019

Effects of Prosthesis Use on Standing Posture in Unilateral Upper Limb Deficient Children

TODD LEUTZINGER

Defense: April 1, 2019

Walking Adaptations to an Ankle Foot Orthosis in Individuals with Peripheral Artery Disease

TYLER HAMER

Defense: March 14, 2019

The Effects of Aging and Knee Arthroplasty on Joint Angle Variability Across Terrains

JOEL SOMMERFELD

Defense: April 3, 2019

Isolating Aspects of Gait through the Use of Pacing Signals

ANGEL GONZALEZ

Defense: May 25, 2019

Foot Thermal Response to Shear Forces during Turning

DISSERTATION DEFENSES

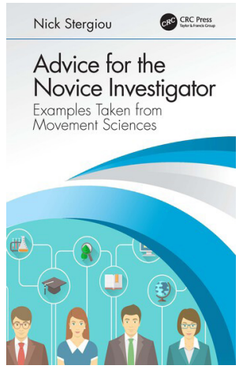
PROKOPIOS ANTONELLIS

Defense: July 8, 2020

Simplified Assistance at the Center of Mass during Human Locomotion

Samantha Sack, a major in Biomechanics and a Vaya Stergiou Scholar, gives the student address during commencement.

COMMUNITY ENGAGEMENT



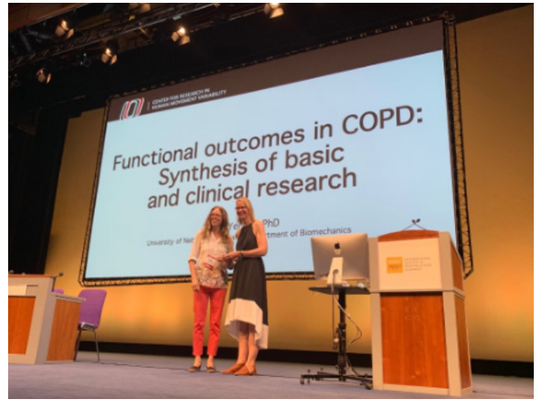
NEW BOOK BY DR. STERGIOU

During his sabbatical in the Spring of 2019, Dr. Nick Stergiou wrote a book that is intended to help young and novice scientists by providing them with advice on how to overcome adversities. This advice comes in the form of numerous examples from his career but also from the careers of many other scientists. It covers a variety of topics and areas that are fundamental in becoming a successful scientist. It presents chapters on all essential areas of the scientific life that appeal to a wide range of audiences, from the senior undergraduate student to the university administrator to the chief scientist in the industry.

Dr. Bob Full from the University of California at Berkeley wrote in his review of this book the following. "The book provides essential insight for the novice investigator to 'hit the ground running.' The personalized nature provides the authenticity needed to make a connection. The author provides practical advice in key areas of grant writing, publication, time management, ethics, and motivation, but never forgets to emphasize the importance of producing the highest quality science possible."

NEW PRESIDENT OF THE AMERICAN SOCIETY OF BIOMECHANICS: DR. STERGIOU

Dr. Stergiou was elected President of the American Society of Biomechanics. He was President-Elect for 2019-2020 and President for 2020-2021. He stated that he was honored and humbled to serve his scientific home from this role. In the past, he has been the Education Chair and the Meeting Chair for the Omaha 2013 ASB meeting. He was also elected as a Fellow of the society a few years ago. Dr. Stergiou is always committed to service for his discipline and we congratulate him for this new role.



DR. YENTES RECEIVED THE PROMISING SCIENTIST AWARD FROM ISPGR

Dr. Jenna Yentes was awarded the Promising Scientist Award at the International Society of Posture and Gait Research (ISPGR) 2019 meeting in Edinburgh, Scotland, UK. The Promising Scientist Award acknowledges someone who has performed superior research in posture and/or gait, early in their career. As part of this award, Dr. Yentes was given the opportunity to present her research to all 654 attendees. Dr. Yentes is the first person from the United States, and the first woman, to have received the award.

Dr. Jenna Yentes received her Ph.D. in biomechanics from the University of Nebraska in 2013 under the tutelage of Dr. Stergiou. She is currently an Associate Professor in the Department of Biomechanics at the University of Nebraska at Omaha. Her research focuses on functional outcomes in those that suffer from pulmonary disease, namely chronic obstructive pulmonary disease. Dr. Yentes' group were the first to document biomechanical changes in gait in persons with chronic obstructive pulmonary disease. Dr. Yentes has also explored the clinical use of walking and breathing coupling in this population. Her research has shown that rigid coupling is related to energy expenditure. She has filed two patent applications related to a wearable technology for monitoring coupling. In addition, Dr. Yentes has published several methods papers regarding the use of nonlinear analysis such as sample entropy with human movement data. Her work in this area has pushed for increased transparency regarding selection of parameters to be used in such algorithms. She hopes to continue her work in this area, cultivating proper use and interpretation of nonlinear data.

NATIONAL BIOMECHANICS DAY 2019

National Biomechanics Day is a world-wide event celebrating the field of Biomechanics! The American Society of Biomechanics encourages research scientists to open up their labs for students to explore. This past year we hosted over 100 students from the greater Omaha area in the Biomechanics Research Building for a day of biomechanical exploration. Students tested their balance, measured their step length, and learned about how their muscles use electricity to help them move their bodies. Simultaneous events were occurring across the globe, where researchers opened their labs to the community.

PERRY INITIATIVE

For the third year in a row UNO's Department of Biomechanics and UNMC's Department of Orthopaedic Surgery and Rehabilitation jointly hosted the Perry Initiative Outreach program. This event was one of the first outreach programs to be held in the newly expanded Biomechanics Research Building. This program is a one-day event where local female high school students work with undergraduate and graduate students, engineers, and surgeons to complete six mock surgeries.

The Perry Initiative was created by a mechanical engineering professor and an orthopaedic surgeon, both women, after they noticed they had very few female colleagues. The Association of American Medical Colleges reports only 5% of U.S. orthopaedic surgeons are women. Additionally, only 12.4% of engineering faculty are women. To fill this gap and create a pipeline towards these careers paths the Perry Initiative Outreach program was developed. Their goal was to introduce more young women to the variety of career opportunities they may not know about and recruit more women into these exciting fields. In completing six mock surgical activities participants are able to learn about the underlying STEM principles that inform both engineers, as they design medical devices, and surgeons, as they operate on patients.

This year the event was held at the BRB, where we hosted 40 local area high school juniors and seniors from 12 different Omaha and Lincoln area schools. The event included 2 speakers, Dr. Maegan Wallace, a pediatric orthopaedic surgeon, and Dr. Amelia Lanier, a biomechanist at UNO. The participants completed mock surgeries including suturing, femur fracture fixation, wrist fracture casting, and knee arthroscopy

NE ROBOTICS EXPO

For the past three years, UNO Biomechanics has hosted a table at the NE Robotics Expo. The expo brings together thousands of children from all over Nebraska for events like the CEENBot Showcase, FIRST Lego Robot Competition, and a Creative Visual Arts Expo. At the UNO Biomechanics table you can find a Kamigami robot obstacle course that simulates the exciting robotic animal research currently being conducted, an exoskeleton controlled computer game and electromyography kits that show kids how their muscles are controlled by electricity. This event is always exciting for the department and will be returning to the expo for many years to come!

BODYMODELS

UNO's BODYMODELS is a three-year project, funded through the National Science Foundation's (NSF) Innovative Technology Experiences for Students and Teachers (ITEST) program, that will bring biomechanics education to an estimated 1,500 Omaha youth. This project brings together faculty in the departments Teacher Education and Biomechanics to teach local teachers about biomechanics while introducing exciting classroom friendly technology. The team working on this project includes Dr. Neal Grandgenett, Dr. Michelle Friend, and Dr. Anne Karabon from the Teacher Education Department; Dr. Kota Takahashi and Dr. Amelia Lanier from the Department of Biomechanics. The project includes a three-week professional development workshop for local area 3rd-6th grade teachers.During the workshop teachers work with educators and biomechanists to understand the exciting STEM principles embedding in biomechanics and how to implement these concepts into their classrooms. This project will continue for one more year.

SEMINAR SERIES

FALL 2018–SPRING 2019

DR. ANDREW HANSEN

Veterans Affairs, Minneapolis, MN
August 31, 2018

Development of Adaptive Technologies for Veterans with Disabilities

DR. CONOR WALSH

Harvard University
September 14, 2018

Soft Wearable Robots for Everyday Wear

DR. ROBERT FULL

UC Berkeley
October 5, 2018

Nature's Extremes in Motor Control-Gripping Geckos, Leap'n Lizards, Compressed Cockroaches, and Sprinting Spiderse

DR. GREGORY SAWICKI

Georgia Tech University
October 19, 2018

Biologically-inspired Concepts Guiding Lower-limb Exoskeleton Design

DR. THOMAS BULEA

National Institutes of Health
January 11, 2019

Innovative Approaches for Evaluation and Device-Based Treatment of Gait Disorders in Children with Cerebral Palsy

DR. BRADEN FLEMING

Brown University
January 25, 2019

Strategies for Minimizing Posttraumatic Osteoarthritis after Joint Injury

DR. ALFRED FISHER

UNMC
March 8, 2019

Studying Muscle Aging in C. Elegans

DR. JOSE IRIARTE-DIAZ

University of Illinois-Chicago
April 5, 2019

Morphological Diversity and the Biomechanics of the Primate Feeding System

DR. WILLIAM MARRAS

Ohio State University
October 26, 2018

Understanding Causal Pathways for Spine Disorders

DR. KHARMA FOUCHER

University of Illinois-Chicago
November 2, 2018

Walking Toward Better Total Hip Replacement Outcomes

DR. CARY SAVAGE

UNL
November 16, 2018

Cognitive Neuroscience of Obesity

DR. SCOTT VINCENT

UNMC
November 30, 2018

Biomechanical and Clinical Implications of the Unstable SpineNeurological Health

DR. JAMES PATTON

University of Illinois-Chicago
April 12, 2019

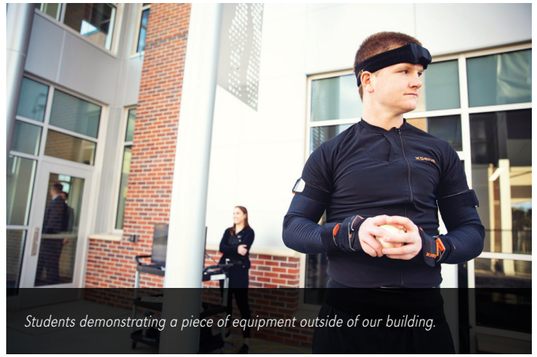
Deception, Exo-Nets, Smushware, and Organic Data: New Frontiers in Neuro-Rehabilitation

TOURS OF THE BRB

Faculty, staff, and students lead and participate in tours at the Biomechanics Research Building. Tours include politicians, educational groups, potential students, and community members.

Research Development Engineer Russell Buffum explaining equipment in the new Machine Shop

Biomechanics graduate students working with students from local schools teaching biomechanics principles.



Students demonstrating a piece of equipment outside of our building.

Graduate student, Corbin Rasmussen, presents our work on bioinspired robotics using roaches to students from local schools.

Master's student Claudia Cortes Reyes providing a tour of the new Additive Manufacturing Lab

Master's student Chris Copeland demonstrates a prosthetic device created in the new Additive Manufacturing Lab.

BEYOND OUR BORDERS

Faculty at UNO Biomechanics have collaborations with researchers from around the world. During the Spring 2019 semester, Dr. Stergiou visited many European universities to establish and continue collaborations with professors at those institutions.

Dr. Stergiou at the University of Patras in Greece.

Dr. Stergiou visiting University TEI Kastoria in Greece.

Dr. Stergiou with students in Australia and the University of Newcastle at a Nonlinear Analysis Workshop.

Dr. Stergiou at the University of Darmstadt Germany.

FUN

DID YOU KNOW?

AS OF AUGUST 2020, THE DIVISION OF BIOMECHANICS HAS THE FOLLOWING STATISTICS

2019-20 Faculty and Staff photo

34
students enrolled in the B.S. in Biomechanics

52,325
downloads of the 245 papers currently listed in the UNO Digital Commons database

791
followers in Dec 2018

991
followers as of August 2020

653
followers in Dec 2018

1,052
followers as of August 2020

17 *faculty members*

11 *staff members*

16 *undergraduate research assistants*

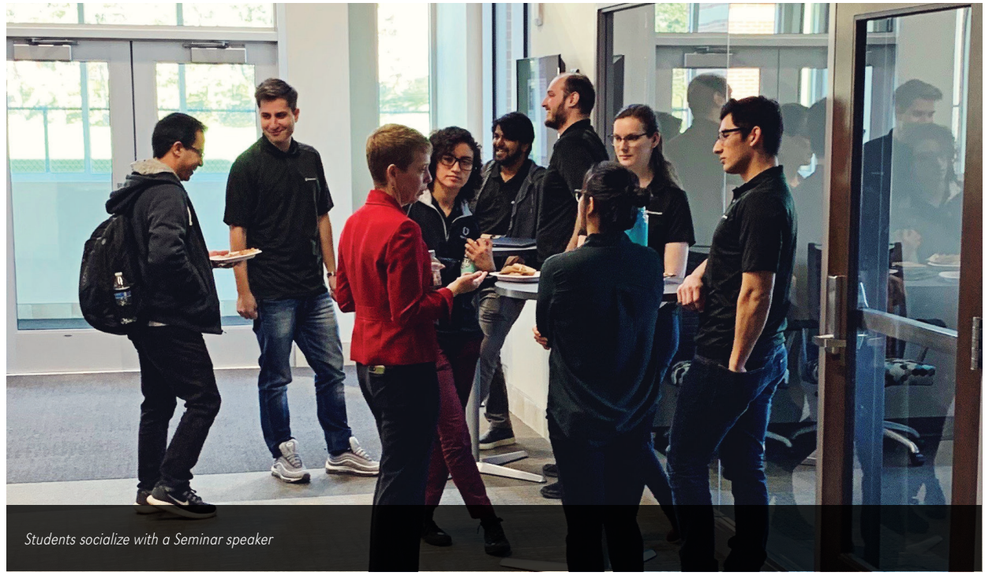
16 *masters graduate assistants*

13 *doctoral graduate assistants*

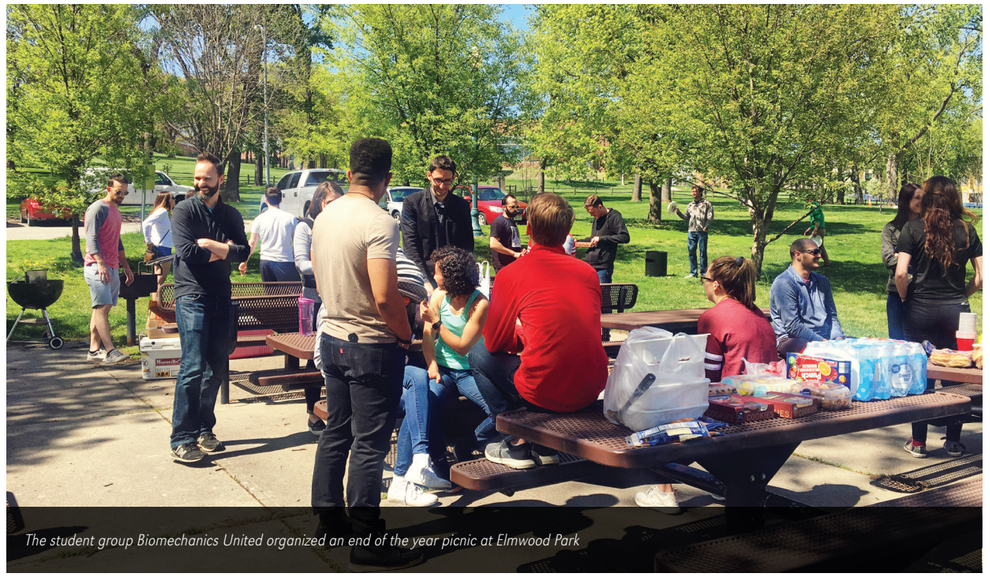
6 *postdoctoral research associates*

Dr. Jorge Zuniga receives Tenure and is promoted to Associate Professor!

Doctoral students Tyler Hamer and Todd Leutzinger and Laboratory Technician Ben Senderling practice set up of the UNO Pitching Lab outdoors



Students socialize with a Seminar speaker



The student group Biomechanics United organized an end of the year picnic at Elmwood Park

CAMPAIGN for NEBRASKA
UNIVERSITY of NEBRASKA FOUNDATION

For over 26 years, the revolutionary research taking place at UNO's Biomechanics Research Building (BRB) has led to a new understanding of human movement—how we stand, walk, and physically interact with our environment.

The only facility of its kind in the world, UNO's BRB has earned an international reputation for excellence in basic and clinical research. For example, its research in cerebral palsy and peripheral arterial disease has influenced the treatment and therapy options available to persons living with these disabilities. UNO's BRB has patented the wireless Gait-O-Gram, a biomedical instrument designed to measure an individual's walking parameters. Current research efforts are underway in the areas of robotic assisted surgery, chronic obstructive pulmonary disease, Autism, stroke and mobility issues facing elderly populations.

These achievements bring additional opportunities to advance biomechanics research in ways that aren't even known today. However, this continued growth requires private support beyond what State of Nebraska funding can provide.

Private support for new equipment, student scholarships/fellowships and faculty support is critical to continue building upon the work taking place at the BRB. Your gift to any of the areas indicated on the corresponding pledge card will help advance these efforts now and into the future.

Join us in our efforts by making a gift today.

Yes, I/we would like to support the Nebraska Biomechanics Core Facility with a gift to the Nebraska Biomechanics Excellence Fund # 01103240 by choosing one of the three options below.

☐ My check for $_____ is enclosed, payable to the University of Nebraska Foundation.

☐ Please charge $_____ to my: ☐ VISA ☐ MasterCard ☐ Discover ☐ AmEx

Card Number:_____Exp. Date:_____

☐ I'd like to fulfill my pledge of $_____ payable over _____ years (not to exceed five years) beginning _____ (month) of _____ (year).

_____
Signature (for credit card payment or to establish a pledge) Date

Name _____

Address _____

City _____ State _____ Zip_____

Phone_____ Email_____

☐ My company, _____, will match this gift. (If you, or your spouse, are employed by a company with a matching gift program, your gift could be increased. Contact your employer's personnel office for more information.)

☐ I have already included the Foundation in my estate plans through my will, trust or life insurance.

☐ Please send information about making a planned gift. You may also call 1.800.432.3216 to speak with a planned giving professional.

PLEASE RETURN TO:
University of Nebraska Foundation
2285 South 67th Street, Suite 200
Omaha NE 68106
For more information, call 800.432.3216 or visit our website nufoundation.org.

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University of Nebraska Omaha

CONNECT WITH THE UNIVERSITY OF NEBRASKA AT OMAHA BIOMECHANICS RESEARCH BUILDING

6160 University Drive South | Omaha, NE 68182-0860 cehhs.unomaha.edu/brb

unobiomechanics@unomaha.edu 402.554.3228 /unobrb /unobrb @UNOBiomechanics /uno_biomechanics