2021

University of Nebraska at Omaha Department of Biomechanics Annual Report 2020-2021

Department of Biomechanics, University of Nebraska at Omaha

UNIVERSITY OF NEBRASKA AT OMAHA

DEPARTMENT OF BIOMECHANICS

ANNUAL REPORT

2020–2021

University of Nebraska Omaha

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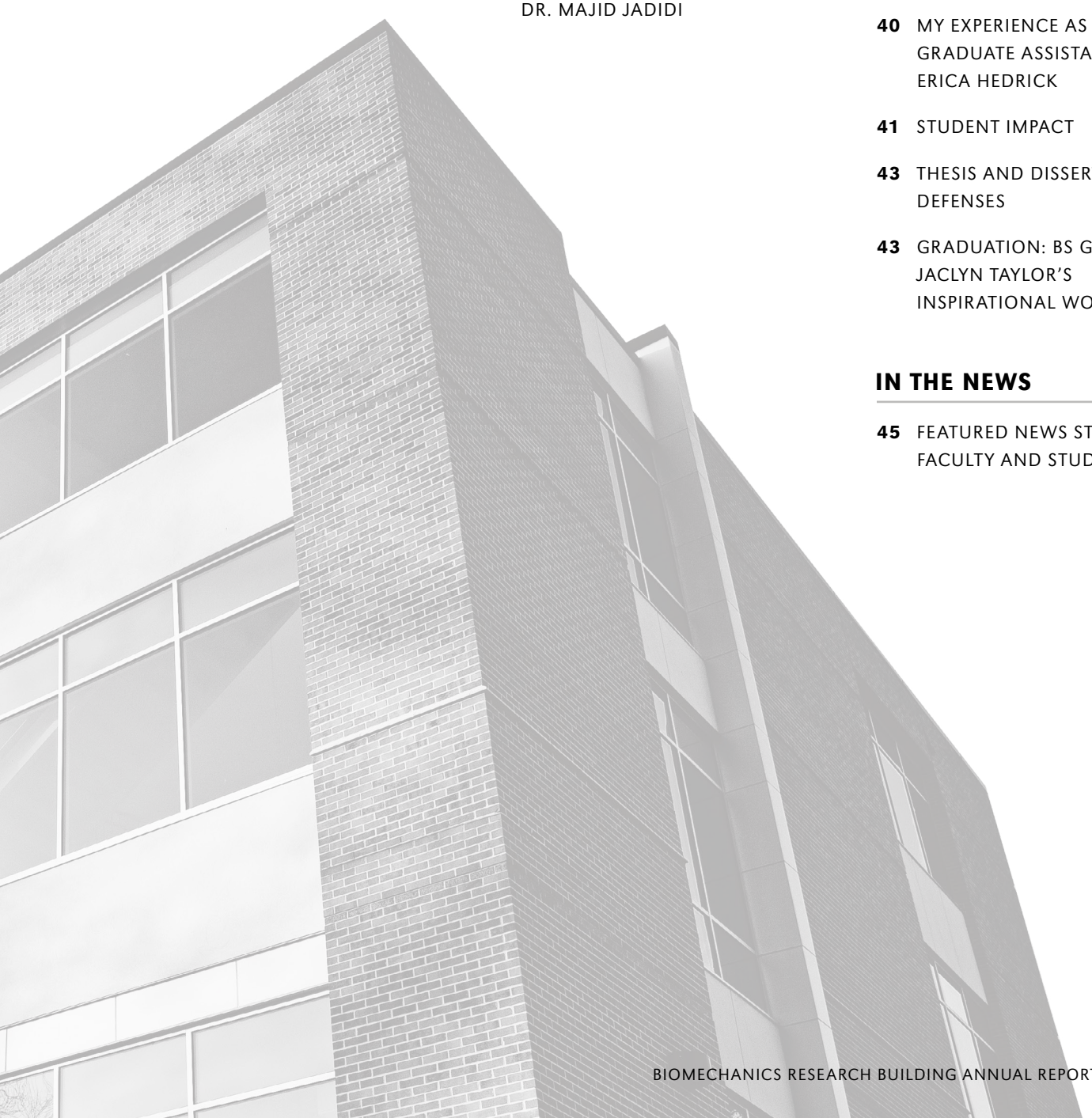
THE PEOPLE OF UNO BIOMECHANICS

STUDENT CENTERED

IN THE NEWS



Dr. Stergiou and Ruth Scott at the Biomechanics Research Building dedication

Dr. Stergiou with Ruth Scott when she told him she was providing the initial donation for the Biomechanics Research Building

RETHINK THE IMPOSSIBLE

It's been a very rough year around the world and the country due to a number of natural disasters and our continuous fight with COVID-19. In such difficult times there is one constant: UNO Biomechanics will not only persevere but will respond achieving new heights and successes.

Only five years after starting our Department, enrollment in our degree programs is exceptional. We now have 92 students, 53 being graduate students. Impressively, 50 of those graduate students are on research assistantships due to our grant successes. New funding from the Department of Defense, the U.S. Army, the National Science Foundation (NSF), and others are added on our impressive list of existing research grants. These research grants change lives and greatly benefit society.

Our efforts in cardiovascular biomechanics are significant to improving the lives of others as cardiovascular disease is the leading cause of death and disability worldwide. We strengthened our cardiovascular biomechanics team by recruiting two new faculty members, to work towards submitting a second NIH P20 grant and development of a Center in Cardiovascular Biomechanics. Our new Center at UNO will aim at the discovery, development, and translation of innovative technologies to treat this debilitating disease.

Many more stories are waiting for you inside this report. From Squirrel Parkouring, an article in Science, to our Biomechanics Rehabilitation and Manufacturing Initiative which is launched from $1.5M UNO Big Ideas funding. Our new advancements include a new tenant in the Biomechanics Research Building, Innovative Prosthetics & Orthotics, to augment our industrial partnerships, and our continuous growth in Sports Medicine research with our new Biomechanics Pitching Lab. Our Center for Research in Human Movement Variability, the MOVCENTR, is also thriving and its three Research Cores are developing quite effectively, supporting the entire UNO Biomechanics enterprise.

Blessed with incredible community support in our donors, strong university leadership, exceptional talent, and indescribable tenacity, we continue achieving new heights, we continue towards our "Biomechanics Field of Dreams." In honor of our new Biomechanics Pitching Lab, I will borrow the words of the great Tommy Lasorda, a famous baseball pitcher and coach, "the difference between the impossible and the possible lies in a man's determination." In UNO Biomechanics we are determined to always rethink the impossible.

Thank you for helping us rethink the impossible,
Dr. Nick Stergiou

OUR REACH

DR. NATE HUNT PUBLISHES IN SCIENCE

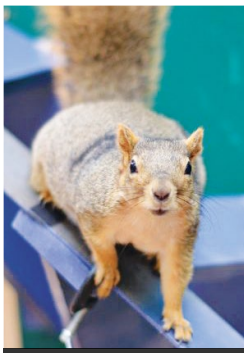
While we all see the aerial acrobatics of squirrels leaping and landing through the trees in our backyards, we don't often stop to ask how they do that? That was the question Dr. Nathaniel Hunt, an Assistant Professor of Biomechanics, set out to answer along with his colleagues at UC Berkeley.

In a highly innovative study, they created a laboratory-like set up in the woods and trained wild squirrels to leap and land on flexible branches. By simulating branches with different flexibility, from very stiff to very bendy, they discovered how squirrels decide and learn how to leap across gaps, and to change their behaviors in novel situations. The results, which were published in the journal Science, showed that the branch flexibility is approximately six times more important to the squirrels than the distance of the gap. "Squirrels demonstrate an amazing capability for learning how to use their biomechanical power and control that enables incredible movement behaviors over all kinds of structures," said Dr. Hunt. This research that also graced the cover of Science, was featured in many media outlets around the world!

New experiments in Dr. Hunt's lab aim to unlock the secrets of how they balance and run along branches through the canopy. These studies into the agility and creativity of squirrels are inspiring the design of robots that can go anywhere, and be used for search and rescue, disaster response, and environmental monitoring.

The cover of Science with Dr. Hunt's research.

Dr. Nate Hunt



Dr. Hunt's research subjects!

Dr. Jorge Zuniga

Dr. Brian Knarr

BIOMECHANICAL REHABILITATION AND MANUFACTURING INITIATIVE (BRMI)

During the 2019-2020 academic year, the University of Nebraska at Omaha identified six themes or "Big Ideas." The overall goal of the UNO Big Ideas program is to "create an intentional and inclusive decision making process to prioritize investment in areas of campus strength and where there are opportunities to enhance scholarly, research, and creative activities at UNO." The Biomechanical Rehabilitation and Manufacturing Initiative (BRMI), led by Associate Professors Dr. Jorge Zuniga and Dr. Brian Knarr, was identified by the University as one of the "Big Ideas."

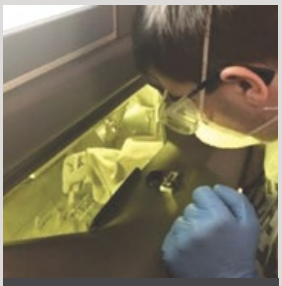
More information can be found here:
unomaha.edu/news/uno-big-ideas.php

BRMI MISSION

The mission of the BRMI is to improve the quality of life of medically underserved populations through the offering of comprehensive rehabilitation services and the creation of low-cost medical devices for our local, national, and international communities.

GOALS FOR 2021

- Provide pro-bono rehabilitation services to under-served and low-income communities.
- Continue to build interdisciplinary collaborations between departments, disciplines, and campuses.
- Expand research efforts in translational research, rehabilitation, and manufacturing. New research strategies include:
  - Virtual reality for stroke rehabilitation
  - Non-invasive, portable brain imaging
  - Prosthetic training strategies at home
  - New printing strategies
- Grow partnerships dedicated to device design, prototyping and manufacturing, and research design.



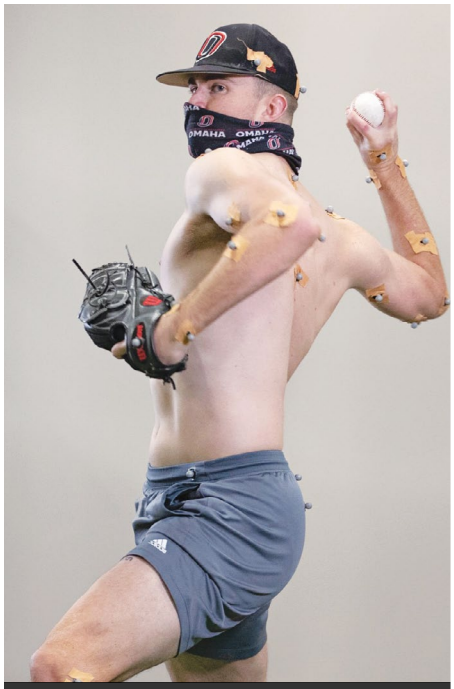
3D Metal Printing

$7,000 **$30,000**

UP TO 58% OF CHILDREN DON'T USE THESE DEVICES

SOLUTION

Home Intervention Prosthetic Training



Pitcher in motion capture lab with markers placed

Clinical Analysis

UNO BIOMECHANICS PITCHING LAB

The UNO Biomechanics Pitching Lab, which officially opened to the public in August 2020, provides a cutting-edge process to gaining an edge on the competition to all pitchers in the Omaha area. Using leading technology, this in-depth process seeks to improve performance while also decreasing injury risk by helping athletes in their understanding of pitching biomechanics. Through a combination of clinical and biomechanical evaluations, the UNO Biomechanics Pitching Lab offers athletes the opportunity to receive the same expert analysis found at the professional level.

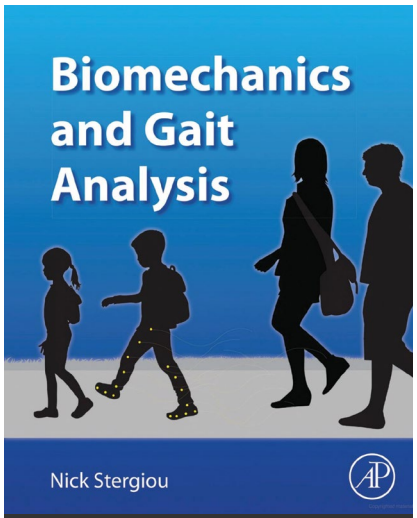
The multi-step approach starts with a clinical analysis conducted by Co-Directors, Dr. Adam Rosen and Dr. Sam Wilkins, and their athletic training staff. A series of clinical tests detailing shoulder strength and range of motion, scapular dyskinesis, and ulnar-collateral ligament ultrasound imaging allow athletes to understand their movement capabilities.

Then, pitchers receive a detailed assessment of their pitching biomechanics from Co-Director Dr. Brian Knarr and Ph.D. candidate and Biomechanics researcher Tyler Hamer, a former pitcher. This assessment includes data from 14 state-of-the-art motion capture cameras that capture each athlete's movement at very high frequencies as well as data from the ground while they throw from a force plate-instrumented pitching mound.

Key variables relating to performance and injury risk are analyzed and compiled into a customized report alongside clinical assessment findings. Each report is designed to gain a complete understanding of each pitcher's biomechanics in order to keep them healthy and performing at their peak potential.

Schedule an appointment today at:

bmchpitchinglab@unomaha.edu



The cover of book

DR. STERGIOU'S NEW BOOK: BIOMECHANICS AND GAIT ANALYSIS

Dr. Nick Stergiou published a new book titled "Biomechanics and Gait Analysis" on March 25th, 2020. The book provides a comprehensive overview of biomechanics that focuses specifically on gait analysis. The intended audience is anyone from a novice reader learning the basics of gait analysis to experts in the field updating their knowledge.

This is the second book that Dr. Stergiou publishes for a second straight year. His 2019 book was called "Advice for the Novice Investigator."

More information about the book can be found on the publisher's website:

elsevier.com/books/biomechanics-and-gait-analysis/stergiou/978-0-12-813372-9

UNO FACULTY RECEIVES NU SYSTEM HONOR:
NICK STERGIOU, OUTSTANDING RESEARCH AND CREATIVE ACTIVITY AWARD (ORCA)

WRITTEN BY: MELISSA LEE, UNIVERSITY OF NEBRASKA

Nick Stergiou, Ph.D., is assistant dean and director of the Division of Biomechanics and Research Development at UNO as well as the Distinguished Community Research Professor and Founding Chair of the Department of Biomechanics, and Director of the Center for Research in Human Movement Variability at UNO.

"To be honored not only by the university, but the entire NU system, means so much to me," Dr. Stergiou said. "This particular award, recognizing outstanding research and creativity, is an acknowledgment of why I entered academia—to perform high-quality research. I look at this award as a recognition of all the people who have supported me as well as the students and researchers of UNO Biomechanics: our donors, the Scotts, Dean Edick, and the many people who believe in our work."

When Dr. Stergiou began teaching at UNO in 1996, "biomechanics" wasn't part of the university's lexicon. He has since secured two of the largest research grants in UNO history – National Institutes of Health grants worth more than $10 million each – and a private gift to build the 23,000 square-foot Biomechanics Research Building that opened in 2013. The building, home to the first center in the world dedicated exclusively to research in human movement variability, later underwent a 30,000 square-foot expansion, made possible with another private gift, after Stergiou's programs outgrew the original space. His research has impacted the training techniques of surgeons, as well as the treatment of pathologies like peripheral arterial disease.

"I love being a scientist," Dr. Stergiou added. "I don't look at research like I'm spending hours and days closed up in a lab—I look at the work like an intriguing puzzle, like a mystery that needs solved. I gain deep satisfaction from the process of discovery and using research to give back to others. This is what inspires me the most—helping people with pathologies and disabilities gain a better quality of life."

Dr. Stergiou also received the University of Nebraska Innovation, Development and Engagement Award (IDEA) award in 2018. He is only the second professor in the history of the entire University of Nebraska system that has received both awards.

Dr. Stergiou (right) providing a tour of the additive manufacturing lab

BIOMECHANICS WELCOMES INNOVATIVE PROSTHETICS AND ORTHOTICS

AS ON-SITE CLINICAL PARTNER

WRITTEN BY: MIMI BOSWELL, COMMUNICATIONS SPECIALIST, COLLEGE OF EDUCATION, HEALTH, AND HUMAN SCIENCES

The Division of Biomechanics and Research Development announces a new on-site partnership with Innovative Prosthetics and Orthotics, the first tenant in the rapidly-growing Biomechanics Research Building at the University of Nebraska at Omaha (UNO).

Innovative Orthotics and Prosthetics:

https://www.innovativeprosthetics.net/

Founded in 2006 by CEO and Board-Certified Prosthetist and Orthotist Rakesh Srivastava, Innovative Prosthetics and Orthotics specializes in providing clients a full range of prosthetic and orthotic services including custom devices and durable medical equipment. The Omaha clinic recently completed a move from 90th and Dodge Streets to their new location at the Biomechanics Research Building, joining Srivastava's clinics in Hastings, Grand Island, and Kearney.

This partnership will create a unique clinical concept for Nebraska and UNO.

"OUR STATE IS ONE OF THE FIRST FEW TO PIONEER SOMETHING LIKE THIS–WHERE THE CLINICAL SIDE OF THE PROSTHETICS AND ORTHOTICS, AS WELL AS THE RESEARCH, IS UNDER ONE ROOF."

RAKESH SRIVASTAVA

RAKESH SRIVASTAVA

"Our state is one of the first few to pioneer something like this–where the clinical side of the prosthetics and orthotics, as well as the research, is under one roof," said Srivastava. "This will not only help the university and the business, but also the patient. Through research opportunities at UNO, patients will explore newer possibilities they did not previously have access to."

The on-site partnership will focus on:

- Development and production of low-cost prosthetics and orthotics components.
- Device assembly and custom fabrication.
- Expanded research opportunities for patients.
- Research and training opportunities for UNO students through hands-on experience and job shadowing, creating stronger career pathways to the field of prosthetics and orthotics.

In 2014, Srivastava joined the Cyborg Beast research team, headed by UNO Associate Professor of Biomechanics, Dr. Jorge Zuniga. The Cyborg Beast team develops visually appealing, easy-to-assemble, low-cost 3D printed prosthetic and orthotic devices for children with upper and lower limb differences.

Srivastava met Dr. Zuniga in his search for low-cost 3D-printed components shortly after opening his clinic at the Omaha location.

"Components for prosthetics and orthotics can get pretty pricey, and I wanted to see how they could be produced not so just a few people could afford them, but thousands and thousands worldwide could afford the technology," explained Srivastava.

"I WANTED TO SEE HOW THEY COULD BE PRODUCED NOT SO JUST A FEW PEOPLE COULD AFFORD THEM, BUT THOUSANDS AND THOUSANDS WORLDWIDE COULD AFFORD THE TECHNOLOGY."

"My first intention was to reach out to a company on the West coast. I called them and said, 'I'm from Nebraska, how do I get associated with 3D printing?' And they told me about an Omaha professor who was doing 3D research on upper extremity for kids. So that's how I got connected. I emailed Dr. Zuniga, and that's how our journey started."

"I AM EXTREMELY EXCITED ABOUT THIS OPPORTUNITY BECAUSE NOW OUR RESEARCH PARTICIPANTS COMING FROM ALL OVER THE COUNTRY WILL HAVE ACCESS TO PROFESSIONAL PROSTHETIC SERVICES."

DR. JORGE ZUNIGA

DR. JORGE ZUNIGA

"I am extremely excited about this opportunity because now our research participants coming from all over the country will have access to professional prosthetic services," said Dr. Zuniga.

"This unique approach of having one of the top prosthetics clinics in the state working side-by-side with UNO researchers has already produced results. Under this partnership we submitted a grant proposal to the National Institutes of Health Small Business Technology Transfer and received excellent reviews. This potential federal funding will help our state to develop the next generation of affordable prosthesis and provide hands-on experience to our students."

Always at the forefront of innovation, UNO Biomechanics received the two largest federal research grants in university history, and constructed one of the first stand-alone buildings in the world dedicated to Biomechanics research. In 2019, completion of a privately-funded $11.6 million expansion of the Biomechanics Research Building more than doubled the size of the original building, bringing the facility to 57,000 square feet and adding critical space for research, machining, prototyping, and education.

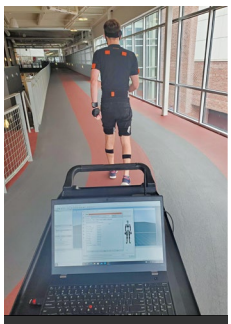
Bringing clinical partners and businesses into the Biomechanics Research Building is a vision of Biomechanics founder Dr. Nick Stergiou, and he is excited to see how this partnership will usher in a new era for researchers and students.

"It was a dream of mine for many years to have scientists working together with industry, to create a hub for Biomechanics innovation and science where scientific discovery can quickly get from the lab into the hands of the general public," explained Dr. Stergiou.

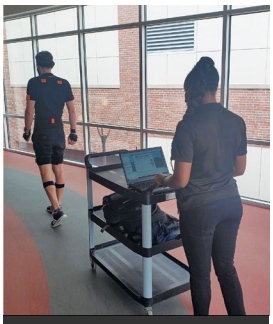
"I've seen it at institutions like MIT in Boston and EuroMov in France—institutions that are housing companies and launching start-ups, who are working side-by-side with researchers—and I thought, 'why not here in Nebraska? Why not Omaha?' The partnership with Innovative Prosthetics and Orthotics is a major accomplishment, and it is the beginning of many new possibilities for UNO."

"THE PARTNERSHIP WITH INNOVATIVE PROSTHETICS AND ORTHOTICS IS A MAJOR ACCOMPLISHMENT."

RESEARCH THAT IMPACTS THE COMMUNITY



Our investigators explore the existence of gaitprints



This research requires sophisticated equipment

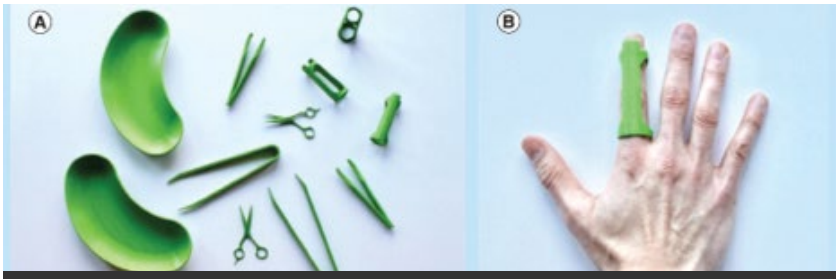
NSF SUPPORTS OUR GAITPRINTS PROJECT

Dr. Aaron Likens and Dr. Nick Stergiou from the Department of Biomechanics, along with Dr. Spyridon Mastorakis from UNO Department of Computer Science, received a 3-year $447K award from the National Science Foundation. This team was formed with the goal to investigate the following question regarding the study of human movement. In the same way we have unique fingerprints, do we also have a unique "gaitprint", a characteristic manner of walking that differentiates us from everyone else? This NSF funded project is attempting to answer this question by focusing on the fact that no two steps we take are identical. People produce rich movement patterns when they walk. The team will use the richness of human movements to identify the essential elements that allow us to recognize our friends and loved ones just from the way they walk. Though important, the goals for this project go far beyond this basic scientific question. This variability present in human walking reveals critical information about health and well-being. For that reason, the team aims to investigate gaitprints for the purpose of predicting disease and physiological decline as well as improving rehabilitation. They also aim to make the findings of their research accessible to a broad scientific and clinical community by making data and computer code publicly available. In addition, they will translate their research into education by incorporating methods and results into UNO Undergraduate and Graduate courses and providing summer internship opportunities for K-12 students, so that students acquire vital skills for success in STEM education.

NASA SUPPORTS DR. ZUNIGA'S RESEARCH IDEAS

Dr. Jorge Zuniga, an Associate Professor of Biomechanics, received $150K from the NASA George C. Marshall Space Flight Center to develop and test recyclable and antimicrobial materials for additive manufacturing. This project will help astronauts who are exposed to fomites during space flight missions. This imposes an inherent risk of experiencing immune responses while distant from medical facilities when aboard the International Space Station (ISS). 3D printing has been adopted on the ISS as a means of rapidly, and cost effectively, manufacturing tools and devices required by astronauts, simultaneously reducing the material supply loop due to the recyclability of 3D printing filaments. Recent advances in filaments possessing antimicrobial properties, in development with our industry partners Copper3D, has the potential to reduce the risk of fomite exposure utilizing tools and devices manufactured with these polymers. Thus, Dr. Zuniga and his team, plan to develop and test a recyclable and antimicrobial polymer for additive manufacturing for use on long duration missions. They aim to develop, in collaboration with Copper3D, antimicrobial polylactic acid (PLA) and polyurethane (TPU) based materials to test through several closed-loop recycling cycles. In conjunction with the Marshall Space Flight Center, properties of these materials will be assessed through antimicrobial and mechanical testing, as well as chemical characterization.

In addition, Dr. Zuniga, along with Dr. Brian Knarr and their team, received $750K from NASA EPSCoR to expand the above research to the development and testing for in-space manufacturing of medical devices. It is important that these devices be free of bacteria and other fomites aboard the ISS where astronauts remain at risk of illness, yet distant from fully equipped medical facilities. To produce sterile medical devices rapidly and self-sufficiently aboard the ISS, advances in 3D printing polymers would allow astronauts the capability to do so. Our team aims to develop, in collaboration with Copper3D, Made-In-Space, and NASA, antimicrobial polymer materials to send for in-space manufacturing of medical devices. Our efforts will equip astronauts with a versatile tool that advances the safety and efficiency of personnel during long duration space flight through preventative countermeasures embedded in antimicrobial polymers.



Examples of antimicrobial medical devices developed by Dr. Zuniga and his team. A. Antimicrobial 3D printed surgical instruments B. Antimicrobial finger orthosis

Dr. Aaron Likens

DR. LIKENS RECEIVES U.S. ARMY COMBAT CAPABILITY DEVELOPMENT COMMAND SOLDIER CENTER AWARD

Dr. Aaron Likens, Assistant Professor in the Department of Biomechanics, received a 3-year $275K award from the U.S. Army Combat Capabilities Development Command Soldier Center (CCDC SC) in Natick, MA. The major goal of this project is to develop new technology that monitors and analyzes effects of prolonged physical stress on U.S. soldiers. During this three-year project, Dr. Likens and his team will develop a readiness toolkit that will analyze soldier movements and physiological processes in real-time. They plan to provide military leaders with objective data that will inform critical decisions for soldier well-being and promote mission success.

Christopher Copeland

Claudia Cortes Reyes

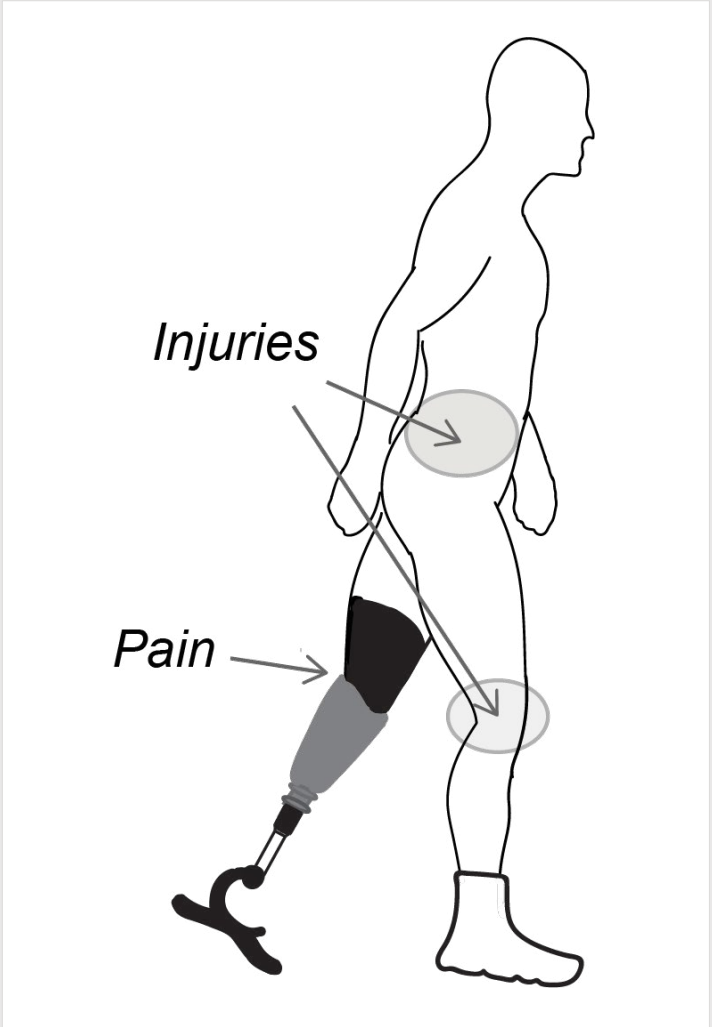
DR. ZUNIGA RECEIVES R01 DIVERSITY RESEARCH SUPPLEMENT AWARDS

Dr. Jorge Zuniga, Associate Professor in Biomechanics, received two separate awards that are called Research Supplements. Both were from the National Institute of Neurological Disorders and Stroke (NINDS) and were extensions of Dr. Zuniga's R01 award. Their scope was to promote diversity by supporting the training of underrepresented individuals. The awardees are UNO Biomechanics doctoral student Chris Copeland and UNMC DPT student and UNO Biomechanics researcher Claudia Cortes-Reyes. The awards fund these two very talented students for 2 years.

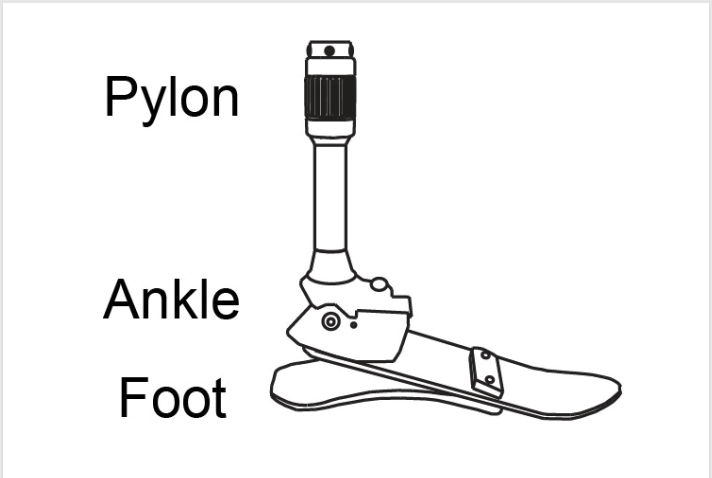
Chris' project is titled "Development and Validation of a Low-Cost 3D Printed Upper Limb Prosthetic Simulator." The goal is to determine differences in brain function during a gross manual dexterity assessment using prosthetic simulators and 3D printed prostheses.

Claudia's project is titled "3D Printed Prostheses for Children: A Tool to Monitor Upper Limb Movement." The goal is to assess coordination between hand movement and gross manual dexterity after completing an 8-week home intervention.

These awards target underserved student minorities significantly contributing to UNO's Diversity, Equity, Access, and Inclusion initiatives by providing research funding to underrepresented students that have shown a high degree of academic and research performance.



Compared to the civilian population, Service Members with limb loss are twice as likely to develop secondary health complications, such as low back pain or knee osteoarthritis

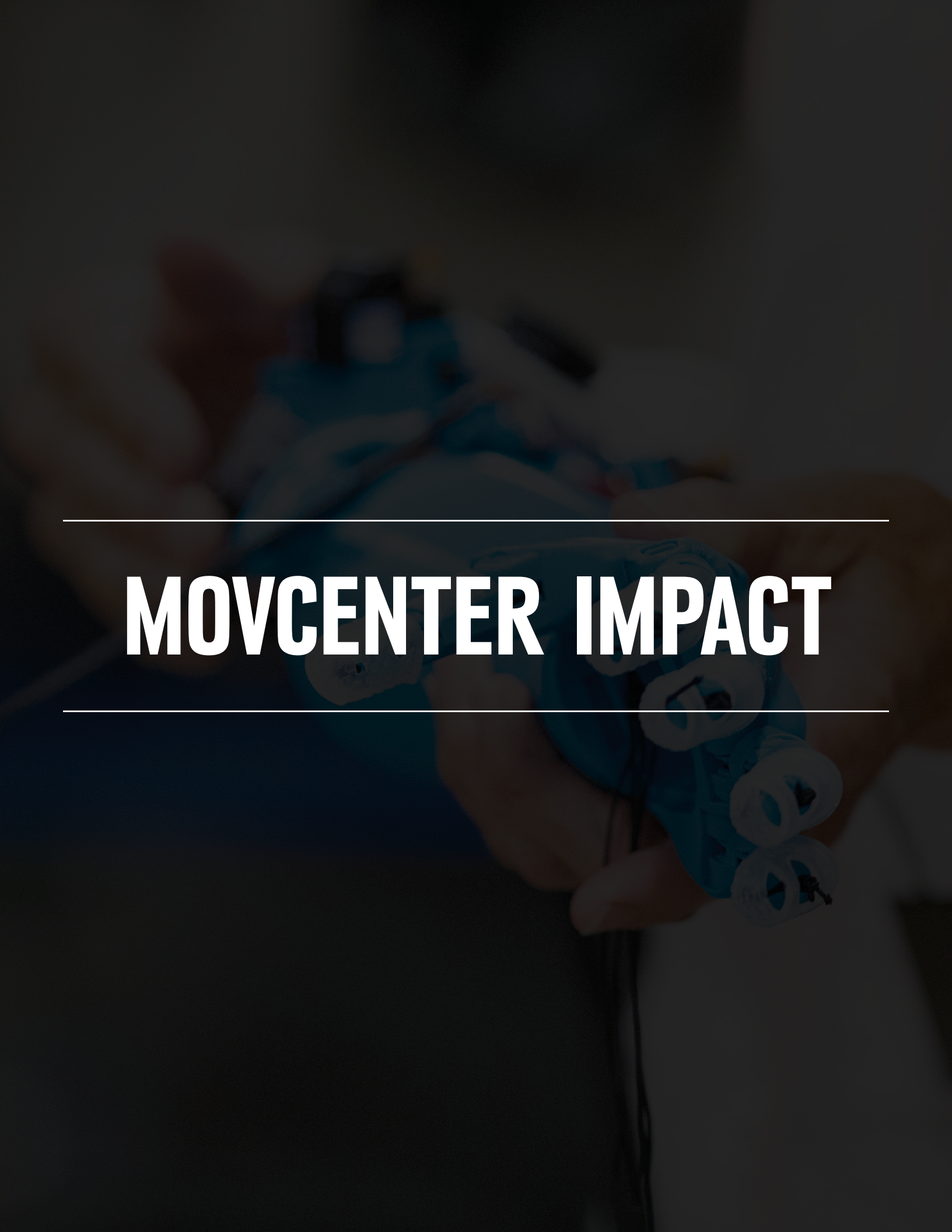


Shock-absorbing prostheses can play an important role in reducing harmful forces and movement compensations that compromise the health of intact joints and muscles over the lifespan

DR. TAKAHASHI RECEIVES DEPARTMENT OF DEFENSE AWARD

Dr. Kota Takahashi, an Assistant Professor of Biomechanics, received 2 million dollars from the Department of Defense for his research project titled "Optimizing prosthetic shock absorption for high demand mobility of service members with leg amputation." Specifically, when we perform daily activities like walking or running, our feet and legs collide with the ground each step. The muscles in our feet and legs usually act to soften the impact, absorb the shock, and to protect us from injuries. Many Military Service Members and Veterans that have lost their legs during combat must rely on prosthetic legs to replace functions of the biological legs. When prosthetic legs are unable to restore the shock-absorbing functions of the biological legs, it leaves individuals with an amputation prone to secondary injuries such as knee and low back pain. While numerous commercially available prostheses are marketed as "shock absorbing" legs, there are currently no objective guidelines for prescribing such devices for individuals with a leg amputation.

The goal of this project is to study the effects of various shock-absorbing prosthetic components (feet, ankles, to pylons) on user performance during a wide range of high-demand activities such as walking on slopes, stairs, during pivot maneuvers, and load carriage. To do this, Dr. Takahashi and his team will use state-of-the-art experimental tools to test Service Members and Veterans using various combinations of shock-absorbing prostheses, while obtaining estimates of musculoskeletal health-related outcomes (forces, motion, and energy of the legs) and qualitative surveys on mobility and comfort. By generating new evidence to inform clinical prescription of shock-absorbing prostheses, their goal is to enable active-duty Service Members and Veterans to perform at their highest level without compromising their health years and decades later. For this project, Dr. Takahashi has brought together scientists from Northwestern University, the Naval Medical Center San Diego, Humotech, University of Nebraska Medical Center, and our Omaha VA Medical Center.



MOVCENTER IMPACT

UPDATES FROM OUR PHASE II JUNIOR INVESTIGATORS

DR. NATE HUNT, ASSISTANT PROFESSOR

RESEARCH PROJECT: *Variability and specificity in reactive stabilization movements to diverse slip perturbations*

Preparing for a data collection for Dr. Hunt's research project

The Banana-Peel shoe that was invented by Dr. Hunt and his team

Dr. Nate Hunt, Assistant Professor in the Department of Biomechanics, is leading an NIH-funded clinical trial to better understand slip-related falls. Unfortunately falls after age 65 are not uncommon. One out of every four older adults fall each year, often with devastating consequences. With most of the injuries causing falls coming from slips and trips, we need to improve our understanding of how these instabilities affect us to find effective ways to prevent them.

Dr. Hunt's research team includes graduate and undergraduate researchers that bring older adults into the Biomechanics Research Building to walk in the laboratory collecting data while repeatedly slipping them without warning. Of course, they wear a safety harness, so they don't fall on the ground! To deliver these slips, the team developed a wearable device that works like a remote-controlled banana peel and straps to a normal shoe. At first the device provides strong traction for normal walking, but when the researcher presses a button, the friction drops and it's like walking on ice. This setup lets the researchers observe all kinds of slips, and the reactions people make to prevent a fall. The experiment is ongoing, but early analysis of this slipping data is beginning to reveal specific vulnerabilities at different times in the walking cycle for different kinds of movement like walking along curved paths, slopes, and one- or two-footed slips.

DR. PHILIPPE MALCOLM, ASSISTANT PROFESSOR

RESEARCH PROJECT: *Exoskeleton optimization for reducing gait variability in patients with Peripheral Artery Disease*

Soft hip exoskeleton prototypes designed with support from the MOVCENTR Machining and Prototyping Core facility

Dr. Philippe Malcolm, Assistant Professor in the Department of Biomechanics, and his team work on methods for optimizing wearable hip exoskeletons for assisting patients with peripheral artery disease to walk better. Over the past year, Dr. Malcolm and his team worked on refining different hip exoskeleton designs with feedback from his clinical mentor Dr. Iraklis Pipinos from the University of Nebraska Medical Center and VA Nebraska-Western Iowa Health Care System. The team published studies on robotic walking assistance and a study on methods for detecting the metabolic cost of different parts of the walking cycle that could be useful for guiding how the exoskeleton's assistance is timed to obtain the greatest benefit. The strong mentoring of the MOVCENTR, which is supported by Dr. Daniel Ferris from University of Florida and Dr. Iraklis Pipinos, helped Dr. Malcolm to refine his ideas and prepare several federal grants. Dr. Malcolm's long-term goal is to combine biomechanical measurements and computer science methods for optimizing exoskeletons.

DR. VIVIEN MARMELAT, ASSISTANT PROFESSOR

RESEARCH PROJECT: *Longitudinal assessment of gait variability to predict falls in Parkinson's disease*

A pilot data collection of brain activity for Dr. Marmelat's research project

Dr. Vivien Marmelat, an Assistant Professor in the Department of Biomechanics, aims to better understand the relationship between gait, cognition, and falls in people with Parkinson's disease. These individuals experience two to three times more falls than healthy older adults, but it is currently very difficult to predict the risk of falls. Through this project, the goals of Dr. Marmelat and his team are to improve fall risk detection based on measurements during "dual-task" walking, e.g., when people divide their attention by walking and performing another task such as listening to an audiobook. The preliminary data collected in this project serve to support future federal grant applications that will investigate how walking and brain activity change over time in these patients.

Dr. Marmelat is also working on developing and testing a web-application to improve movement timing in people with Parkinson's Disease. Movement timing is the ability to produce and maintain regular rhythmic movements (such as tapping the finger in time with music) which is often impaired in these patients. The long-term goal of this project is to develop a patient-centered game that can be used at-home to improve movement timing skills, which in turn may lead to improvements in cognition and walking capabilities. This project is a collaborative effort that merges biomechanics, computer science, user experience, and clinical research.

DR. CAROLIN CURTZE, ASSISTANT PROFESSOR

RESEARCH PROJECT: *Visual control of locomotion in people with Parkinson's disease*

Dr. Curtze and UNMC Researchers test a subject enrolled in a novel collaboration between the UNMC Department of Neurosurgery, Department of Neurological Sciences, UNO Department of Biomechanics, and Medtronic Neuromodulation Research Division (Foreground left to right: Dr. Erin Cameron-Smith, UNMC Department of Neurological Sciences (DONS); Study Subject; Dr. Carolin Curtze, UNO Department of Biomechanics. Background: Medtronic Research Personnel)

Dr. Carolin Curtze, Assistant Professor in the Department of 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 the Oregon Health & Science University, studying the gait impairments in people with Parkinson's disease. Her research project aims at understanding how gaze behavior relates to stability during walking and turning in complex real-world settings.

Dr. Curtze's research focuses on the development of digital biomarkers of mobility during daily living to identify disease specific gait and turning impairments for a spectrum of neurological diseases (e.g., Parkinson's disease, multiple sclerosis, and cerebella ataxia). The long-term goal is to use these digital biomarkers to monitor disease progression and in clinical trials.

UPDATES FROM OUR PILOT AWARDEES

DR. SPYROS MASTORAKIS, ASSISTANT PROFESSOR

Dr. Spyridon Mastorakis

Dr. Spyros Mastorakis is an Assistant Professor in the Department of Computer Science in the College of Information Science and Technology at UNO. His research is focused on Augmented Reality (AR) in non-laboratory-based environments. AR applications have certain unique characteristics that make their pervasive deployment more challenging than existing applications (e.g., video streaming or activity tracking); AR applications require powerful computing resources so that they augment the human perception of the world. The goal of his project is to investigate how variability of human gait can be affected using augmented reality applications in metronomes. Dr. Mastorakis collaborates with Dr. Aaron Likens (NONAN Core Director) and Dr. Joao Vaz (previous pilot project awardee).

DR. SONG-YOUNG PARK, ASSISTANT PROFESSOR

Dr. Song-Young Park

Dr. Song-Young Park is an Assistant Professor in the School of Health and Kinesiology in the College of Education, Health and Human Sciences at UNO. His research is focused on the intake of mitochondria-targeted medication, the MitoQ, to improve the vascular function in peripheral artery disease patients. Peripheral artery disease (PAD) is the manifestation of blockages in the arteries supplying the legs. The overall project goal is to understand the role of the vascular mitochondria (little, tiny organs inside our cells that supply energy) in chronic leg ischemia and to investigate the application of mitochondrial-targeted therapy to improve vascular function and walking mechanics in patients with PAD. Dr. Park collaborates with Dr. Sara Myers (Phase I Research Project Lead) and Dr. Iraklis Pipinos (Phase I and Phase II Junior Investigator Clinical Mentor).

HIGHLIGHTED PROJECTS

MACHINING AND PROTOTYPING CORE PROJECT: SWINE TREADMILL

The Machining and Prototyping Core (MAPRO) recently completed the design and fabrication of a custom swine treadmill for our UNO Department of Biomechanics Cardiovascular Biomechanics research team. This team investigates the effects of reduced aortic elasticity by stiff stent-grafts on the function of the heart's left ventricle. Increased aortic stiffness results in increased cardiac work and left ventricular hypertrophy, and our team is developing a new stent-graft that preserves aortic compliance and reduces adverse remodeling effects. To replicate the remodeling process that takes years in humans, in a swine model we need to intensify cardiac work. One way to do this is through aerobic exercise. The treadmill was specifically designed to accommodate swine of different sizes and allow the trainers to interact with the animals while keeping the entire system waterproof for easy cleaning.

Interested in staring a project with MAPRO? Email:
bmchmpcore@unomaha.edu

A picture of the swine treadmill

MOVEMENT ANALYSIS CORE PROJECT: OMAHA CHILDREN'S HOSPITAL AND MEDICAL CENTER

Participant during a data collection

The Movement Analysis Core (MOVAN) has a new partnership with Children's Hospital & Medical Center Omaha to provide clinical gait analyses for children with cerebral palsy and related disorders. MOVAN will be analyzing walking patterns, muscle activity, forces at the joints, and metabolic efficiency before and after surgical correction of knee deformities. These data will be used by our collaborating clinicians to make data-centric treatment recommendations for the children. Assistant Professor Dr. David Kingston, our new MOVAN Core Co-Director, is working closely with Dr. Nick Nahm, the partnering clinician at Children's, on a variety of different research projects to improve health care in this population. In addition, this research team has established a strong relationship with senior pediatric physical therapists who are key partners during data collection and interpretation sessions.

Interested in starting a project with MOVAN? Email: bmchmovan@unomaha.edu

NONLINEAR ANALYSIS CORE UPDATE

Dr. Likens and Mr. Senderling attending the BMES 2021 annual meeting and presenting the services of our Nonlinear Analysis Core

The Nonlinear Analysis (NONAN) Core has a new Director, Dr. Aaron Likens who is an Assistant Professor in Biomechanics. He brings a plethora of skills into this very important position for the MOVCENTR. The NONAN Core provides resources that go beyond examining just averages of data. It provides access to a multitude of analysis tools, assistance in experimental design, data processing, quality assurance, interpretation, and dissemination of data. These services are available for individuals in the University of Nebraska system, as well as individuals outside of the system and from around the world! NONAN is also actively exploring and validating new techniques for future use. NONAN has had a very successful year. They have given multiple webinars that were very well attended. Lastly, the Nonlinear Workshop, organized by the NONAN core, for 2021 was a mix of synchronous and asynchronous learning as it was attended by people from all over the world!

Interested in starting a project with NONAN? Email: bmchnonan@unomaha.edu

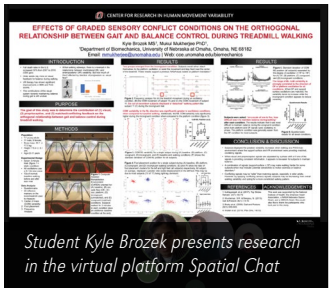
VIRTUAL CONFERENCES

2020 HUMAN MOVEMENT VARIABILITY AND GREAT PLAINS BIOMECHANICS CONFERENCE GOES VIRTUAL!

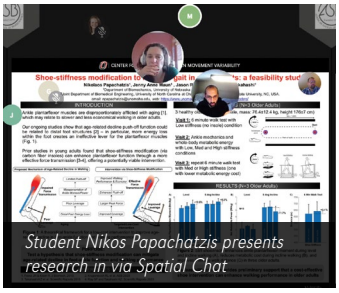
The COVID pandemic provided challenges and opportunities for us. It was challenging but we quickly had to prepare our annual in-person conference to be held virtually. Not knowing what the future held, we had planned for only one conference to be virtual. In the fall of 2020, we held our 5th Annual Human Movement Variability Conference and the 1st annual Great Plains Biomechanics Conference. We quickly realized this was a great opportunity for us to reach researchers from across the globe.

5TH ANNUAL HUMAN MOVEMENT VARIABILITY CONFERENCE AND THE 1ST ANNUAL GREAT PLAINS BIOMECHANICS CONFERENCE

In September of 2020, we hosted our annual conferences, the 5th Annual Human Movement Variability Conference and the 1st annual Great Plains Biomechanics Conference. Researchers from across the globe came together in a virtual format to interact with the keynote speakers, and poster and podium presentations. There were a total number of 269 registrants from locations all over the globe including University of Nebraska at Omaha, University of Illinois-Champaign, Montana State University, Truman State University, Sanford Health, Boise State University, United States Olympic & Paralympic Committee, Brock University, Cairo University, Columbia University, Queen Mary University of London, German Sports University, University of Bologna, and many more! These conferences would not be possible without generous support from our sponsors including the American Society of Biomechanics, AMTI, Delsys, and Motek. Numerous awards were given including the first ever Promising Student Award which was awarded to Corbin Rasmussen, a doctoral student who works with Dr. Nate Hunt.



Student Kyle Brozek presents research in the virtual platform Spatial Chat



Student Nikos Papachatzis presents research in via Spatial Chat

2020 AWARD WINNERS

Promising Student Award: Corbin Rasmussen
AMTI Best Clinical Impact Award: Joel Sommerfeld
Delsys Best Scientific Achievement Award: Peter Raffalt
Outstanding Poster Awards: Rebecca Wagner, Alissa Miller and, Abderrahman Ouattas.

6TH ANNUAL HUMAN MOVEMENT VARIABILITY CONFERENCE AND THE 2ND ANNUAL GREAT PLAINS BIOMECHANICS CONFERENCE

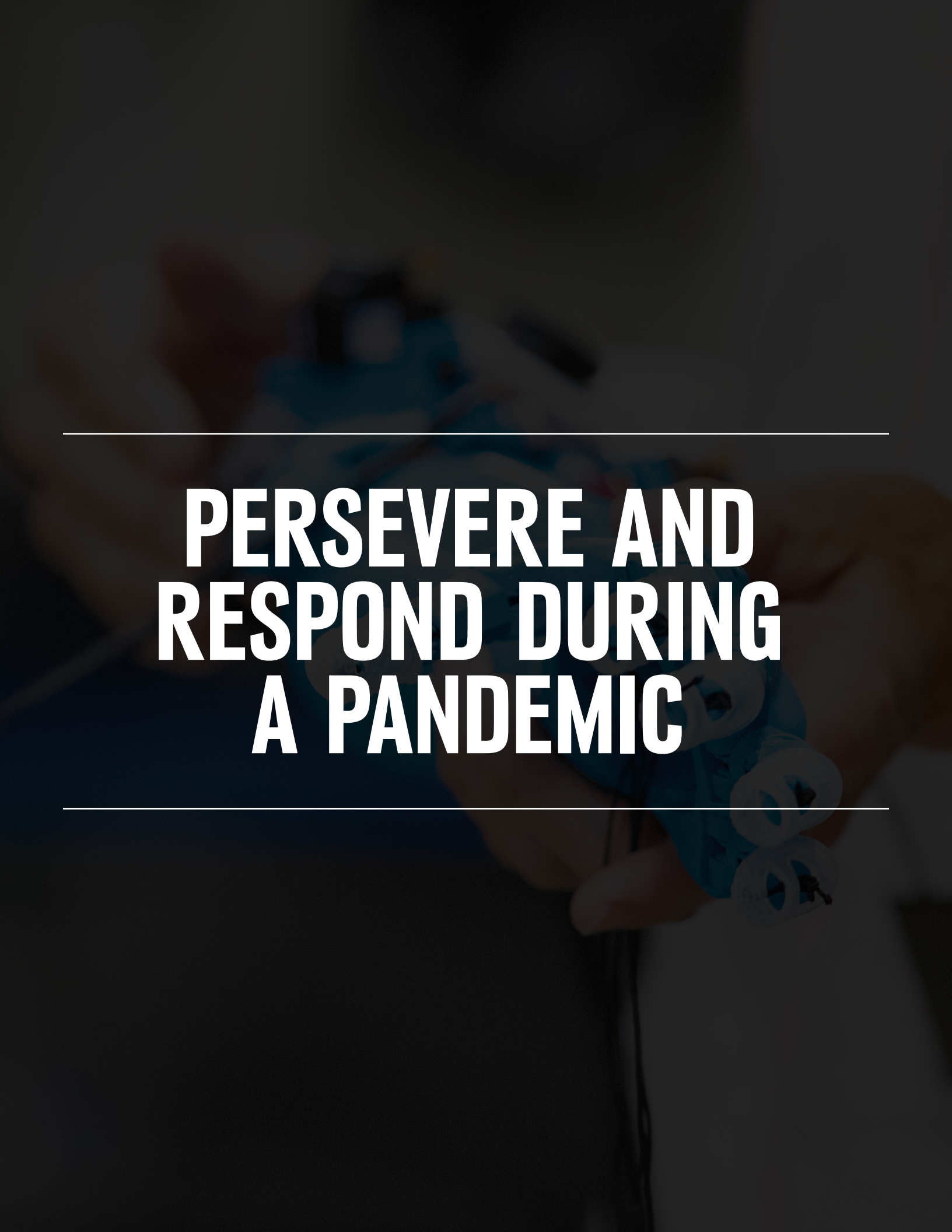
During the 2020-2021 academic year, we once again prepared to hold virtual conferences. Due to the great success of the previous virtual conferences, we were excited for the opportunity to reach scientists nationally and internationally. The 6th Annual Conference in Human Movement Variability and 2nd Annual Great Plains Biomechanics Conference was held May 20-21, 2021. A Nonlinear Analysis Core (NONAN) Fractal Webinar was also held in conjunction with the conference and was supported by the American Society of Biomechanics. Thanks to the American Society of Biomechanics, students received free registration! The conferences had 70 poster and podium presentations and 148 attendees! Our vendors were ProtoKinestics, Delsys, AMTI, Motek, Dashr, Novel, Cosmed, and Bertec. The Barry T. Bates Keynote speaker was Dr. James Finley from the University of Southern California. The Great Plains Biomechanics Keynote speaker was Dr. Brianne K. Connizzo from Boston University.

2021 AWARD WINNERS

Promising Student Award: Nikos Papachatzis
Protokinetics Best Clinical Impact Award: Emma Dupuy
Delsys Best Scientific Achievement Award: Cody Anderson
Outstanding Poster Awards: Stephanie Mace, Alyx Jorgensen, Meghan Prusia, Taylor Wilson, Dionyz Rutz, and Amin Kazemi

7TH ANNUAL HUMAN MOVEMENT VARIABILITY CONFERENCE AND THE 3RD ANNUAL GREAT PLAINS BIOMECHANICS CONFERENCE

When we started the virtual conferences, we weren't sure what to expect and planned for a one time-event. Due to the success of the virtual conferences and COVID vaccinations available, we have decided to hold the 7th Annual Conference in Human Movement Variability and 3rd Annual Great Plains Biomechanics Conference both in-person and virtually in May 2022. This hybrid version will provide the opportunity for us to meet face-to-face while maintaining the great benefits of a virtual meeting to have people join us from all over the world!



PERSEVERE AND RESPOND DURING A PANDEMIC

HOW RESEARCH ADAPTED TO THE PANDEMIC

SAFETY INITIATIVES

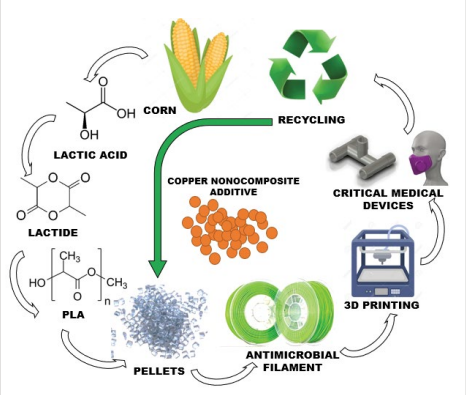
In March 2020, the COVID-19 pandemic changed the way we live, work, and conduct research. At UNO, the Office of Research and Creative Activity and the UNMC internal review board (IRB) continually monitored human subjects research and provided guidance to the UNO research community. The IRB is the regulatory board that oversees human subject research. In March, the IRB sent its first cautionary memo to all investigators advising researchers to minimize risk to participants. Practices including social distancing, modifying protocols to decrease in person contact, and to consider pausing new subject accrual were recommended. Just five days later, the IRB halted all face-to-face human subjects research, halted new subject recruitment, and encouraged research to transition to remote settings if feasible (see inset of event timelines). To safely monitor human subjects research, the Human Subjects Research Safety Review Committee was formed. This committee included representatives from the IRB, UNO and UNMC research offices, as well as leaders in clinical research units. The committee was given the authority to review and approve COVID safety parameters to keep researchers and research participants safe. Researchers were required to submit a safety plan to restart their research or initiate new protocols with human subjects. Following approval, the safety plan moved forward to the Human Subjects Research Safety Review Committee for discussion and approval or revisions. Communication of the process and approval was coordinated with the IRB to ensure all protocols had IRB approval to proceed. There have been various limitations and halts over the past year, but fortunately with appropriate safety precautions, research has been able to move forward as you clearly see in this newsletter.

Safety measures, including masks, gloves, and physical distancing were incorporated during data collections. In the picture, Dr. Hafizur Rahman with a patient in our man gait laboratory

TIMELINE	
Mar 13, 2020	Investigators asked to reduce risk to research participants
Mar 17, 2020	Face-to-face research halted; new accrual was halted
Apr 8, 2020	University of Nebraska President Carter issued closure of the University of Nebraska, meaning only essential personnel are allowed on campus
May 18, 2020	Clinical research reopened with an approved COVID-19 safety plan
Jun 26, 2020	Extramurally funded human subjects research and pilot studies reopened with an approved safety plan
Jul 9, 2020	Opening Clinical Research Safely memo that allowed all research to be conducted with an approved safety protocol. This included the initiation of new research protocols
Nov 13, 2020	Keeping Research Safe memo halting face to face human subjects research for a second time and new protocol approvals
Jan 14, 2021	Halt on new protocol approvals was lifted and research remains open with appropriate safety precautions

DR. ZUNIGA AND COPPER 3D

The pandemic had a detrimental impact on the performance of human research by delaying research projects or simply halting data collections. However, our scientists did not remain idle and focused their efforts towards writing projects, analysis of collected data, and even fighting the pandemic. Dr. Jorge Zuniga, Associate Professor in Biomechanics, and Copper 3D partnered to develop an open-source antimicrobial 3D printed face mask. This open-sourced effort led to the publication of a paper in the journal Expert Review of Medical Devices titled, "The role of additive manufacturing and antimicrobial polymers in the COVID-19 pandemic" describing the applications and proposed biocidal cellular mechanism of copper additives. This paper was published a year ago and has reached over 8,000 downloads and 50 citations in scientific papers. Furthermore, this open-source effort also led to NIH funding for an application titled, "Efficacy and Efficiency of Antiviral 3D printed and Injection Molded Face Masks."



The manufacturing process of antimicrobial critical medical devices using an antimicrobial polymer. The process starts with corn fermentation (corn to Lactic Acid), condensation (Lactide) and polymerization (Polylactic acid; PLA). The addition of copper nanocomposite additive to pellets at different concentrations allows the development of a multipurpose antimicrobial filament. The recyclable characteristics of this filament facilitate the production of new antimicrobial medical devices in austere environments.

MASK DEVELOPMENT FROM DR. SALKOVSKIY

N95 mask with nanofibers

When the COVID-19 pandemic hit, the healthcare systems of countries around the world faced an acute shortage of protective equipment. Deficiency in N95 respirators had been particularly severe. Thus, many organizations had moved on to implement multiple mask re-sterilization and reuse policies. Unfortunately, this is associated with a significant reduction in N95 filtration ability that puts healthcare providers at an increased risk of infection. The filter material of the regular N95 is made of electret melt-blown fibers several microns in diameter, and its efficiency heavily depends on the electrostatic charge. When the charge is completely drained, for example, due to breathing and prolonged use, the efficiency of N95 reduces from 98-95% to about 40%, making it practically ineffective. Therefore, while re-sterilization strategies, such as ultraviolet treatment, may completely remove the virus from the N95 respirator, the sole fact that the respirator is being continuously reused, reduces its efficiency.

As part of his research, Dr. Yury Salkovsky, a new Assistant Professor in the Department of Biomechanics, previously worked on the development of nanofiber materials for respiratory protection and protective clothing using a method of producing ultrafine polymer fibers called electrospinning. The average fiber diameters in the electrospun material are in the range of 0.1-0.3 microns, and therefore the mechanical filtration ability of this material is much higher than the N95-grade melt-blown fibers even when there is no electrostatic charge. Under Dr. Salkovskiy's supervision, Saratov State University in Russia, where he used to work before coming to Omaha, adapted the nanomanufacturing technologies to the industrial level using commercially available full-scale equipment that allowed for a full cycle of product development.

In April 2020, when all stocks of protective equipment in Saratov's hospitals ran out, this technology came to the rescue. In just two weeks, it was adapted to produce 300,000 nanofibrous N95/FFP2-type respirators that were sent to city hospitals, solving the problem of personal protective equipment shortage for the medical personnel at the most critical moment. Thanks to the use of nanofibers, these face masks are resistant to moisture and do not lose their protective qualities after re-sterilization. Dr. Salkovskiy was saving lives in Russia even though he now works with us here in Omaha! Dr. Salkovskiy plans to continue his research in developing materials for advanced personal protective equipment to help combat new outbreaks and viral epidemics.

STUDENT PERSPECTIVE-LEARNING AND PERFORMING RESEARCH

DURING THE PANDEMIC

LEARNING AND RESEARCH DURING THE PANDEMIC:

RYAN L. MEIDINGER, DOCTORAL STUDENT

In Biomechanics, we learn that we are a complex system, constantly adapting to our environment and our internal and external interactions. In the pandemic, our environment was reduced to our homes. Our interactions with others were restricted to the individuals at home (if we lived with others) and through virtual platforms. Isolation forced us to often face mental health issues, many times alone or within our small bubbles at home. If a pandemic was not enough, we were also confronted with social justice issues, and, many of us, familial issues (e.g., a death in the family). During this pandemic, I also had to adapt, learn, and continue to perform my research responsibilities.

"DURING THIS PANDEMIC, I ALSO HAD TO ADAPT, LEARN, AND CONTINUE TO PERFORM MY RESEARCH RESPONSIBILITIES."

The isolation caused by the pandemic has been difficult for us all, whether people agreed with it or not. The pandemic seems to have affected everyone in some way, I was even diagnosed with COVID-19 in November of 2020, and most people in my family were infected at some point in the year. I was fortunate that no one in my family died during the pandemic, I was able to do some work while I was sick, and I was able to get back to work once I recovered. However inadvertently, during the pandemic there was a lot of good that happened for me. Students had open conversations about their well-being, we adapted to learn in a new environment, and we found new and novel ways to perform research. The lack of in-person interaction limited student discussion about their research and it had a clear effect on me because I loved to hear about other's research and share my thoughts. When I did my comprehensive exams and proposed my dissertation, I learned to write in isolation but without discussion. I struggled to understand and communicate with my committee about my research when they asked me questions. It also feels like I am still relearning how to have scientific conversations with friends, but this will come with time and practice. I now realize how much of an adaptation we had to make from the interactions we have with others and their impact on our development. I am confident I will and know I must gain this again, since I am in my third year and will be thrust out of the protective umbrella of my advisor and professors soon.

"I NOW REALIZE HOW MUCH OF AN ADAPTATION WE HAD TO MAKE FROM THE INTERACTIONS WE HAVE WITH OTHERS AND THEIR IMPACT ON OUR DEVELOPMENT."

At the beginning of the pandemic, I had finished all my in-class course work and all I had left was independent studies and

Ryan Meidinger (right) with his faculty advisor Dr. Vivien Marmelat (left)

dissertation hours. To date I have finished one independent study, I am finishing the second, have collected 16 participants for one of my dissertation studies, and have four scheduled for my second dissertation study. I have also learned how to create apps in Matlab, learned how to do statistical analysis and visualization in GraphPad, created an agent-based model, and learned how to create an experiment in a software called PsychoPy. Biomechanics, this environment of academic excellence, afforded me these opportunities at this university, and I am very thankful for my advisor, Dr. Vivien Marmelat, the team I am on, my committee, and my reading club colleagues for helping me with my development through this process.

"I AM VERY THANKFUL FOR MY ADVISOR, DR. VIVIEN MARMELAT, THE TEAM I AM ON, MY COMMITTEE, AND MY READING CLUB COLLEAGUES FOR HELPING ME WITH MY DEVELOPMENT THROUGH THIS PROCESS."

All that happened this last year can (and likely did) get many of us a bit depressed and stressed, but with vaccines and safety protocols in place, there is more reason to be happy. Look back at all the great things that each of you did over this last year, remember where you started, and plan to make adaptations today for your future. It is difficult, if not impossible, to predict the future but I would be willing to bet that the next great adaptation will be a return to a "normal" environment, with new social interactions.

LEARNING AND RESEARCH DURING THE PANDEMIC:

CODY ANDERSON, UNDERGRADUATE STUDENT

When the pandemic began, and everything started to shut down, it was exciting because of the sudden urgency. In a way, the initial response to the pandemic was a little bit fun because everything became new; there were new ways of working, new ways of going to school, and new ways of interacting with the world. While it was thrilling at first, after a while, the negative impacts of the shutdown on research and academics began to come into clarity.

After our extended spring break in 2020, the chaos of online classes became evident. At first, nothing was coherent, and classes had wildly different expectations. I had some classes that tried to maintain normalcy, and I had other classes that basically stopped. As the semester progressed, each professor found a way to generate a stable learning environment, but I learned that no online format could replace in-person classes. There is something special about being in a room with other students that facilitates better performance from the students and teachers.

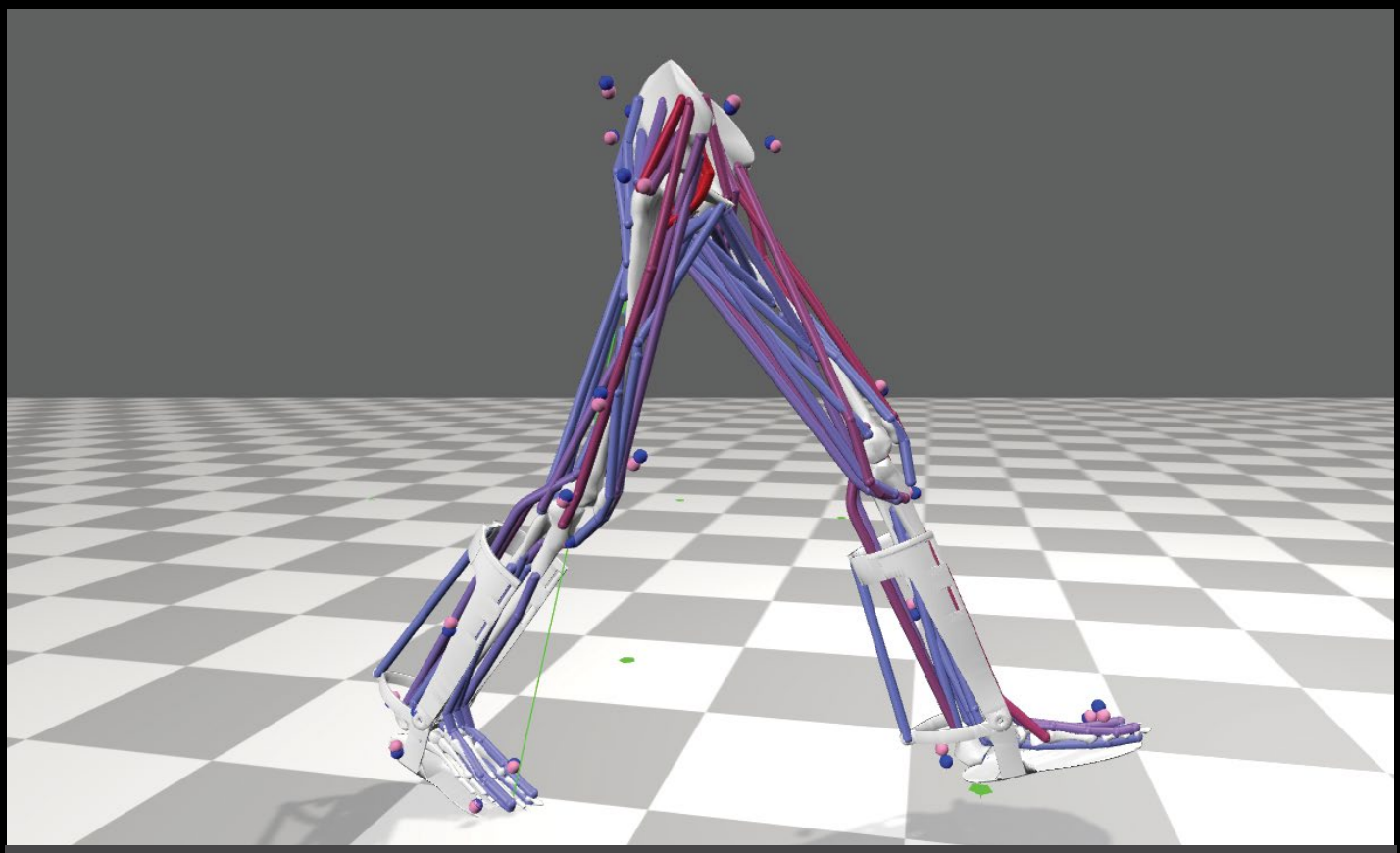
"THERE IS SOMETHING SPECIAL ABOUT BEING IN A ROOM WITH OTHER STUDENTS THAT FACILITATES BETTER PERFORMANCE FROM THE STUDENTS AND TEACHERS."

Even though the learning environment was not optimal, I realized that there are many conveniences to taking online classes. For instance, one only needs to wake up approximately five minutes before class to be on time. As well, you do not have to worry about forgetting assignments or books when you leave for class because everything is right next to you on your desk. Overall, even though the quality of some classes inherently suffered from an online format, the transition to online classes was not terrible, and I realized that I save a lot of time not having to physically travel for classes and meetings.

Over the past year, I have spent time working under Dr. Sara Myers in the Biomechanics Research Building, and under Dr. Song-Young Park in the Vascular Physiology Laboratory. In both environments, human subject research was halted because of the pandemic. The suspension of human subject research made it difficult to continue with our normal projects because we perform live experiments on individuals with peripheral artery disease. This delayed much of our research and the additional restrictions made it more difficult to operate.

I was personally affected by the research restrictions because I had an IRB pending in March of 2020. When the shutdowns began, and I realized that the IRB was moving slower than usual, I realized that I would likely not have an IRB in time for my FUSE grant deadline. I quickly decided to change my project from something that experimented on live humans to a theoretical musculoskeletal modeling project. It was a good thing I decided to switch my project when I did, because my IRB was not approved until far past the May deadline. While it became very difficult to perform our original research projects, the lockdowns gave me new opportunities that have benefited me in the long run.

"WHILE IT BECAME VERY DIFFICULT TO PERFORM OUR ORIGINAL RESEARCH PROJECTS, THE LOCKDOWNS GAVE ME NEW OPPORTUNITIES THAT HAVE BENEFITED ME IN THE LONG RUN."



Musculoskeletal modeling using the computer program OpenSim

Because of the lockdowns, I had to switch my FUSE project from human subject research to a computer simulation project with OpenSim. I was not familiar with OpenSim before the pandemic, and I learned quickly that it was going to take a lot of work to master the program. OpenSim is an opensource musculoskeletal simulation software. The individuals who created OpenSim left the program very adaptable, so researchers can change the mathematical models for their projects, however, to effectively use OpenSim, one must possess the ability to write computer script, which was something I was not competent at before the pandemic.

I decided to begin scripting in the Python language, so that I could effectively use OpenSim. I began reading books on Python and then I started developing simple programs. Since my class load was attenuated because of the lockdowns, I had plenty of time to practice my new project. Over time, I developed a substantial amount of skill in Python, and I was able to write complex programs for processing data and manipulating OpenSim. Because I was able to learn Python, my previous FUSE project was very successful, and we are currently attempting to publish some papers from my results. If I had not learned how to write scripts in Python, I would not have been able to do the complex data analysis that yielded the interesting results we discovered. Additionally, because I learned how to write in Python, I was able to harness OpenSim for other projects, like my current FUSE project, which is focused on identifying the optimal

> "OVER TIME, I DEVELOPED A SUBSTANTIAL AMOUNT OF SKILL IN PYTHON, AND I WAS ABLE TO WRITE COMPLEX PROGRAMS FOR PROCESSING DATA AND MANIPULATING OPENSIM."

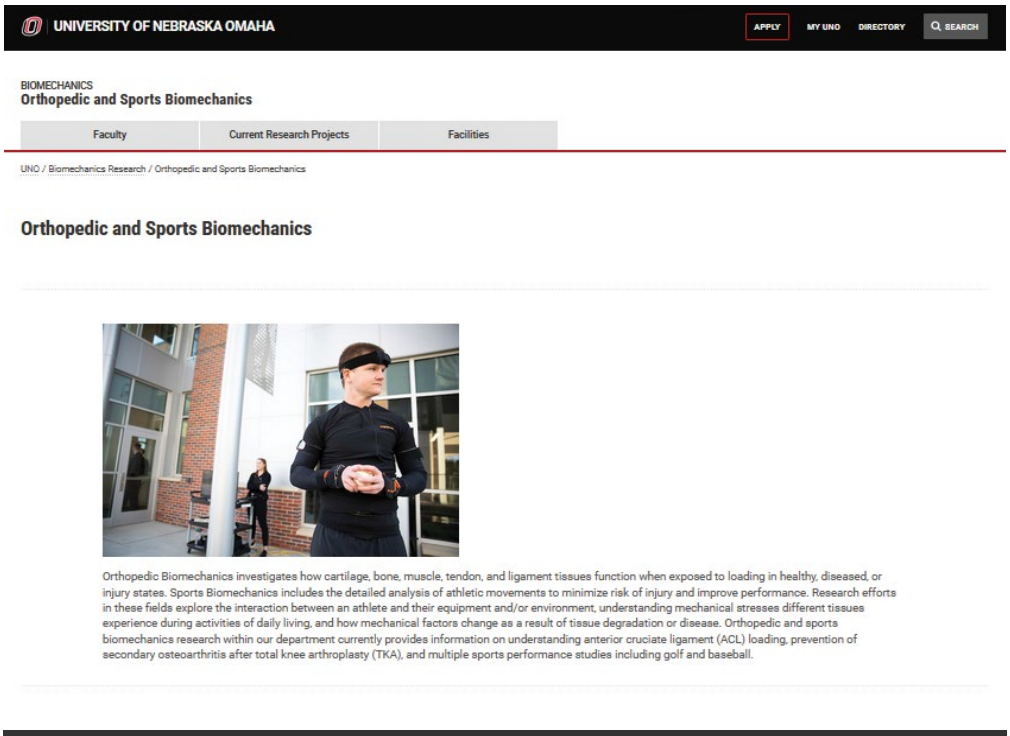
relationship between spring stiffness and spring activation timing for a passive ankle exoskeleton. The simulation results from my current FUSE project will be used for developing better ankle exoskeletons to help individuals with peripheral artery disease walk farther.

"THE SIMULATION RESULTS FROM MY CURRENT FUSE PROJECT WILL BE USED FOR DEVELOPING BETTER ANKLE EXOSKELETONS TO HELP INDIVIDUALS WITH PERIPHERAL ARTERY DISEASE WALK FARTHER."

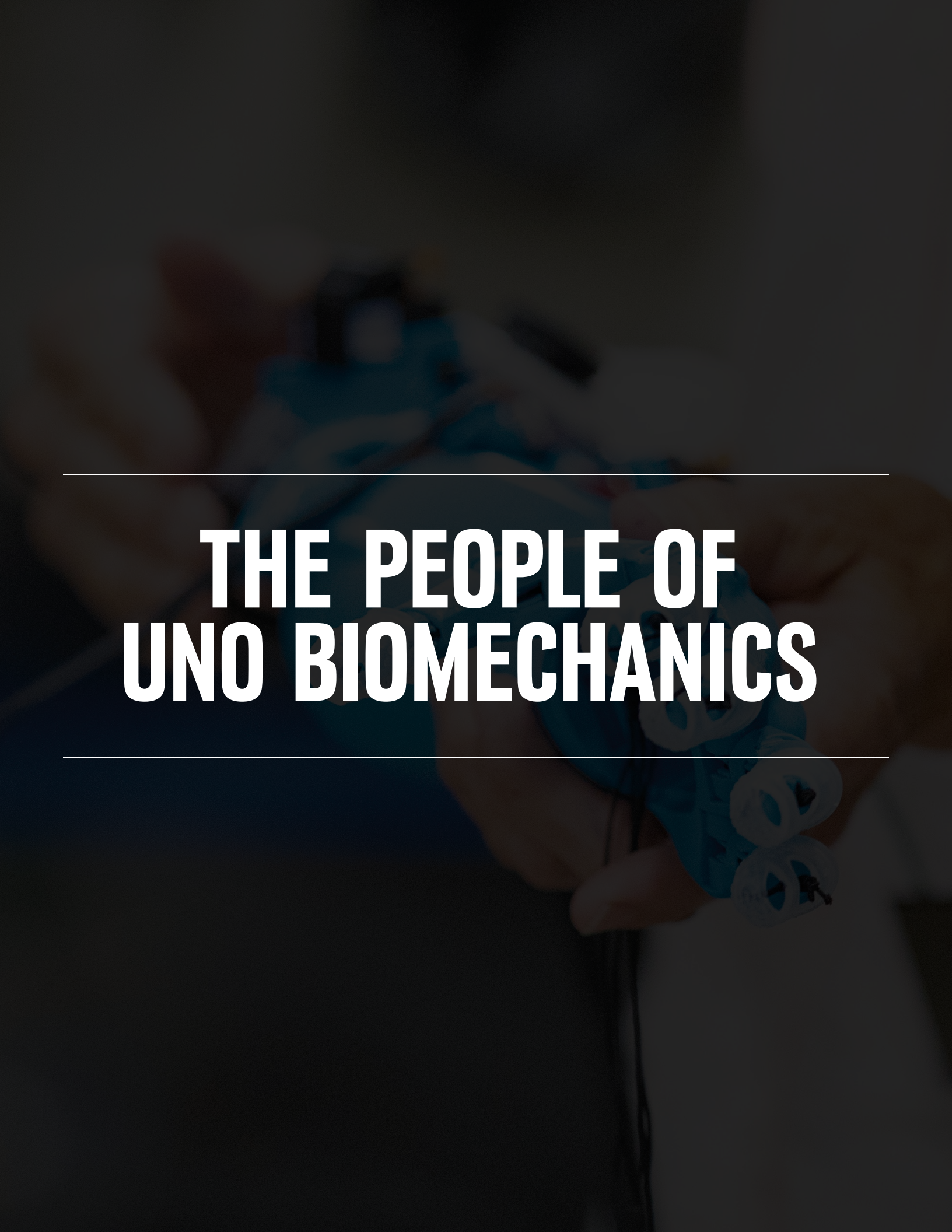
The pandemic, and the subsequent lockdowns, presented new adversities, but also new opportunities. At first, the quality of my classes suffered because of the online environment, but over time, the quality of my classes improved, and the students and professors adapted to the new environment. Additionally, the shutdowns halted most of the traditional research projects in the laboratories, however, this allowed me to learn about research methods that I had not previously considered. The pandemic allowed me to learn new computer skills, which I have been able to effectively apply to many projects over the past year. Overall, even though I would have preferred to spend my senior year in-person with my friends, I cannot complain because the events of the past year have allowed me to develop new skills that have made me more effective in the laboratory and the classroom.

WEBSITE REDESIGN PROJECT

Due to our tremendous success in grants and student enrollment in our undergraduate and graduate programs, we have many new people in our department. For this reason, we have been working on updating our website to reflect the innovative ground-breaking research being conducted in our building. To describe our research more fully, we have developed six new research areas that highlight our current projects, collaborators, and facilities. In creating this content, our students have been integral to creating this exciting new website. Students have helped create some of the definitions and assisted faculty in putting together research project content. It was a wonderful initiative and a communal activity during the isolating times during the pandemic!



A preview of one of our new research subpages



THE PEOPLE OF UNO BIOMECHANICS

WHY I CHOSE BIOMECHANICS

> I CHOSE UNO BIOMECHANICS BECAUSE IT IS ONE OF THE LEADING RESEARCH ENVIRONMENTS IN THE WORLD WITH AMAZING FACILITIES, OFFERING A HIGH CHANCE OF SUCCESS FOR ALL STUDENTS.
>
> **ANAËLLE CHARLES**

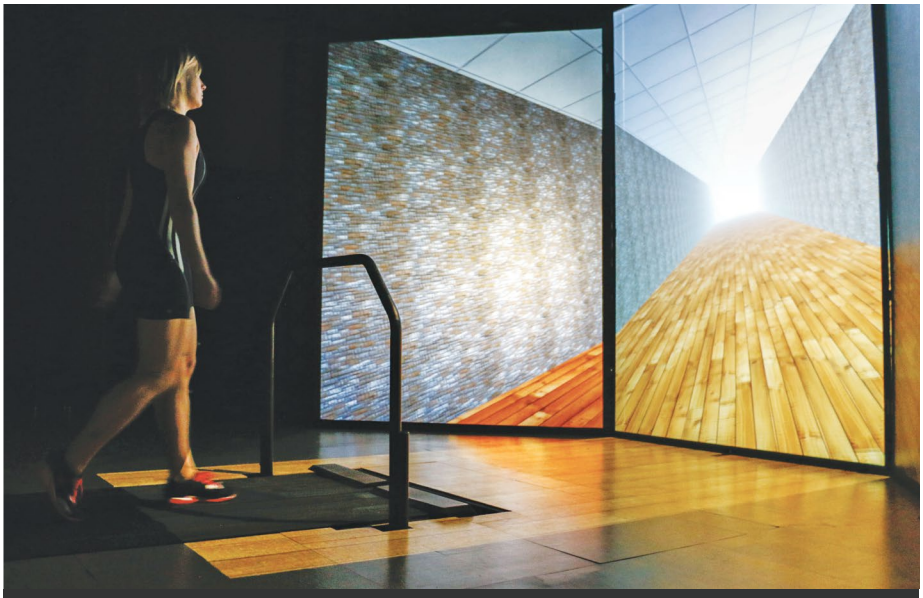
I first heard about the field of Biomechanics when I was about 17 years old. I had come across a Ted Talk on Bionics Prosthetics presented by Dr. Hugh Herr. I remember being very intrigued about the idea of using science to improve people's lives. I was fascinated by the extensive research opportunities that Biomechanics could offer. Since then, I was fixed on the idea that I wanted to study Biomechanics, and I, too, one day could make a difference. As a track athlete, I was particularly interested in human performance and running injury research. Originally from Paris, France, I moved to the U.S. after high school to pursue my athletic career and complete my education. Throughout my experience as a member of the track and field/cross-country team at Arkansas State University, I nurtured my passion for human movement sciences both on the track and in the classroom.

I was first introduced to research in the last year of my undergraduate program as part of the Kinesiology Research Club. Our research was focused on sports performances working with the track and rugby team. After my bachelor's degree, I pursued my education with a Master's in Exercise Sciences, where I had the chance to work with Dr. Pribyslavska and Dr. Scudamore. They introduced me to the world of research and helped me grow as a scientist while encouraging me to continue my education. The decision to pursue a Ph.D. came later, near the end of my Master's program. I was indecisive about my future and I felt that I needed to build on my set of skills before going into the job industry. I was looking for an auspicious environment that would help me grow as a scientist and provide me the opportunity to pilot my ideas. When I was introduced to the UNO Biomechanics program by Dr. Nick Stergiou at the Mid-South Biomechanics Conference in Memphis, I was amazed by all the research opportunities and ongoing projects. I chose UNO Biomechanics because it is one of the leading research environments in the world with amazing facilities, offering a high chance of success for all students.

ANAËLLE CHARLES
DOCTORAL STUDENT, BIOMECHANICS

WHERE ARE THEY NOW?

JESSICA FUJAN-HANSEN, PH.D.



Dr. Jessica Fujan-Hansen in our Virtual Reality Laboratory while a student

It is with gratitude that I write this, for with certainty, I would not be in my current position if not for my time at the Biomechanics Research Building (BRB). My daily activities reach beyond a job that challenges and motivates me each day. It encompasses a career which allows me to take part in a cause that advances the greater good. For this is what I sought when first stepping into the BRB.

Formerly a business graduate with roughly a decade of management experience, I opted for a shift in career trajectory. Little did I realize I lived down the street from a world-renowned Biomechanics program. Here I found an altruistic cause which not only pushed the boundary of research within the field, but personally challenged me and opened my eyes to a subject matter with great purpose.

Upon graduating with my Ph.D. in Biomechanics with a concentration in motor control and motor learning, I sought a career which allowed me to utilize both my scientific and business acumen. I found that opportunity with DIH Technology. I currently manage the North American Research Division of DIH Technology; better known to the research community as the Virtual Reality technology behind Motek Forcelink. I started with the company in 2019 managing Sales for the United States which evolved into managing North American Sales. My current position entails managing the North American team of Sales, Clinical Applications, and Service Engineers. Each day I get to talk about human movement research involving a wide array of populations, entities, and markets which span the globe and involve cutting-edge Virtual Reality technology. Not only am I privileged to work with top scientists, but I am also able to incorporate my business background. This ranges from the management of processes and a wonderful team, to authoring business strategies for the future growth and direction of our region and products.

I am truly fortunate to say that the University of Nebraska at Omaha Department of Biomechanics is my alma mater. I look forward to seeing the innovative manners in which this program continues to challenge and push the boundaries of research in the name of human movement science.

NEW FACULTY HIRES

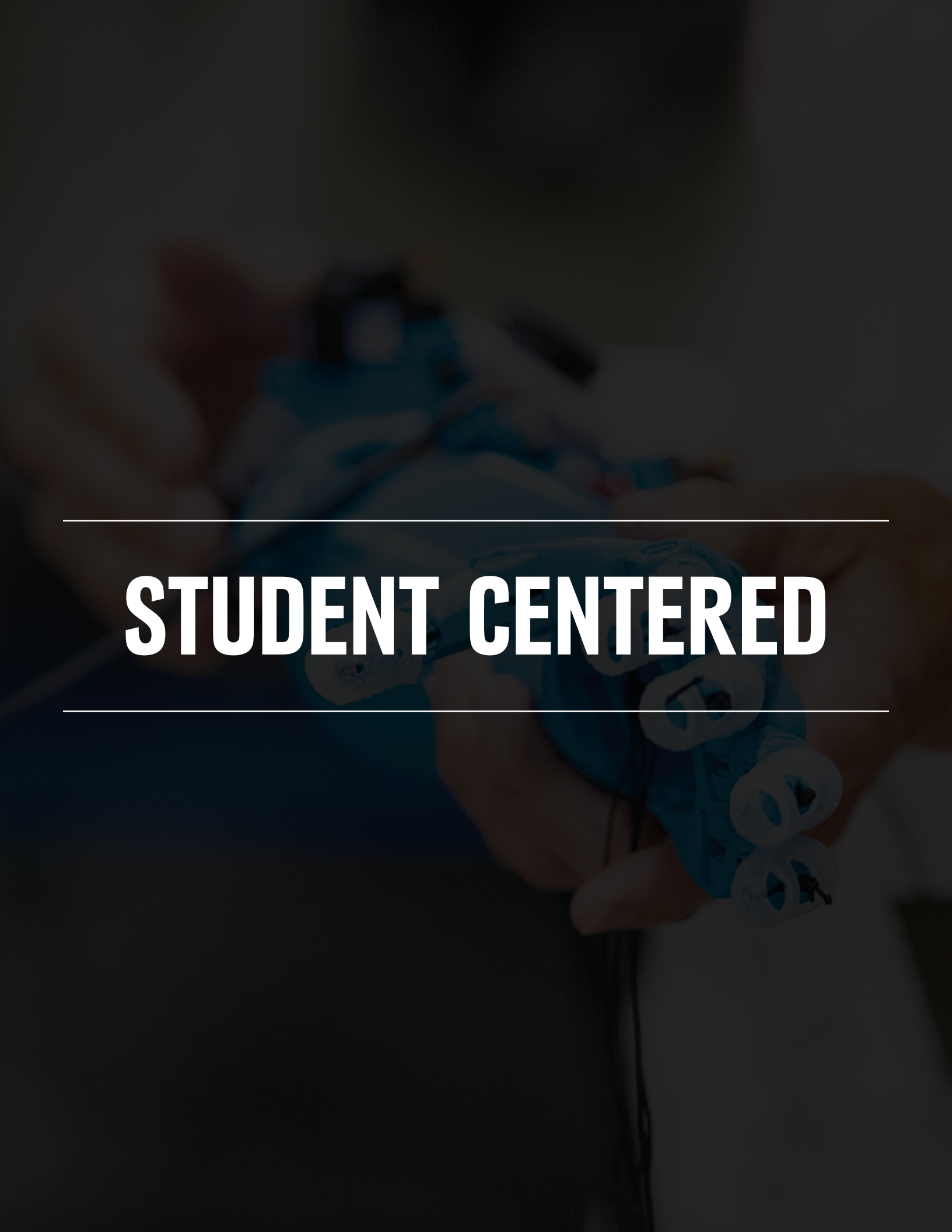
DR. YURY SALKOVSKIY
ASSISTANT PROFESSOR

Dr. Yury Salkovskiy joined the Department of Biomechanics as an Assistant Professor in January of 2021. He received his Ph.D. in Engineering Mechanics from the University of Nebraska-Lincoln. His research focuses on target-specific design of nanostructured materials for respiratory protection and protective clothing, as well as for biomedical applications, including wound care, cardiovascular devices, tissue engineering, and prosthetics.

DR. MAJID JADIDI
ASSISTANT PROFESSOR

Dr. Majid Jadidi joined the Department of Biomechanics as an Assistant Professor in January 2021. He graduated from the University of Nebraska-Lincoln in December 2020 with a Ph.D. in Mechanical Engineering and a Business Administration minor. Dr. Jadidi's research is focused on understanding the interplay of biology and mechanics in human arteries and vascular repair materials. He has extensive experience in characterizing mechanical and structural features of soft tissues and developing mathematical and machine-learning models to describe their mechanobiological behavior.

As a faculty member at the Department of Biomechanics, his goal is to further pursue translational research in cardiovascular mechanobiology and contribute to the Departmental research and teaching missions by solving complex problems in cardiovascular biomechanics, improving diagnostic and treatment methods, and recruiting and educating graduate and undergraduate students.



STUDENT CENTERED

PURSUING A B.S. IN BIOMECHANICS

MEGHAN PRUSIA

My junior year of high school I begrudgingly took a tour of UNO not realizing it would change my life. The lady who gave the tour told us that UNO offered a wide array of majors to choose from, ranging from art to the newest major, biomechanics. As soon as my dad and I heard the word "biomechanics" we started researching what it was and what careers you could go into. When the tour ended, UNO had representatives from each college with their business cards, so my dad and I went on the hunt to find a person who knew about biomechanics. No one from the Department of Biomechanics was there that day, but they gave me the business card of Dr. Amelia Lanier and told me to contact her for a tour of the building. As soon as I got home, I emailed her and asked if I could tour the Biomechanics Research Building. A few weeks later she gave me a tour and I knew I found my place. Fast forward to my junior year of college, I am currently pursuing a Bachelor of Science in Biomechanics and giving tours of the building to high school students wondering about their future majors.

For a little over a year now, I have been working with Dr. Marmelat as an undergraduate research assistant. I started volunteering on Dr. Marmelat's team in October of 2019, then was offered a paid position on his team December 2019 and have been working on the team since. My first project involved investigating the effects of using handrails on walking in people with Parkinson's Disease. The project helped me to quickly learn how to use various pieces of equipment and software found in the BRB. The project also gave me the chance to learn how to teach others how to use the equipment and software that I had only just recently figured out myself. It was a challenge at first, but now it has become second nature as I train the incoming volunteers. Being a research assistant has also given me the opportunity to create my own research project. I am currently in the beginning stages of the process, but it has taught me so much already. I have also been given the opportunity to be a student ambassador for the Biomechanics Research Building which allows me to give tours to my peers looking into my major, high school students who were just like me, and anyone else who is interested in learning more about our building. Being a student ambassador and a research assistant allows me to use everything I have learned in my classes and apply them to the real world. I am able to have a deeper understanding of the concepts I have learned or am currently learning, because I am using them hands on or have to figure out how they can help me do something better. This has helped me advance my education exponentially.

The classes I have taken while pursuing a Bachelor of Science in Biomechanics have challenged me and made me stronger. The very first Biomechanics class I took was Analytical Methods of Biomechanics. In that class you learn how to use the programming software called Matlab. This being the first coding language I have learned it was an extremely difficult class. However, I am able to use the basic concepts that I learned and apply it to my job as a research assistant. My other biomechanics classes, such as Biomechanics Statics and Dynamics, gave me Biomechanics specific examples of the concepts that we learn in physics. The upper-level Biomechanics courses have opened my eyes to the countless opportunities the field of Biomechanics offers. I learned that I could use biomechanics to study the forces in car crashes, or build bioinspired robots, or build better devices and more. Not only have the classes taught me a lot about Biomechanics, but they have given me a close community of people that I can rely on. Since Biomechanics is a newer and smaller major, most of the people I met my first semester I have had classes with every semester since. This has brought us all close and we are able to help each other in the classes or with research. Pursing a Bachelor of Science in Biomechanics has given me many unique experiences and opportunities, as well as connections and friends I hope to carry with me throughout the future.

After I graduate with my Bachelor of Science in Biomechanics, I hope to continue here at UNO to pursue a Master of Science in Biomechanics since research has really become a passion for me. While I am looking forward to graduating and continuing on to my masters, I still have a year left of my undergraduate schooling and so much more to learn. I will continue to use the knowledge I am gaining from my classes and apply them to my work and future work, so I can become a better researcher. I appreciate all of my professors and staff that have helped me learn and have changed my life!

PURSUING A MINOR IN BIOMECHANICS

SYDNEY ANDREASEN

Going into my undergraduate career at UNO, I was majoring in Biomechanics with the goal of becoming an occupational therapist. During my first semester, I was introduced to my first programming language and was fascinated by what I could do with simple logic and commands. The topics surrounding anatomy and physics that continued in my other Biomechanics courses continued to interest me, but I felt a need to spend more time programming. To accommodate both interests, I changed my major to Computer Science, but I maintained a minor in Biomechanics, as well as my position as an undergraduate researcher in Biomechanics. By minoring in Biomechanics, I have been able to supplement my programming with unique perspectives that are not so easily found in pure Computer Science. The way that my Biomechanics minor has helped to round out my skills is invaluable to me.

For the last two years, I have been an undergraduate research assistant on Dr. Knarr's research team in UNO Biomechanics. Along with my minor, this position has provided me with many opportunities to learn about real-world clinical problems and the biomechanical methods we can use to solve them, while also allowing me to specialize in my area of utmost interest at the same time. My first project pushed me to improve my programming skills as I was tasked to analyze and extract meaning from a large physical activity dataset. Now, I work to develop and test virtual reality games that simulate therapy methodologies for the subset of stroke survivors with unilateral spatial neglect. All of these projects have allowed me to get hands-on experience with designing, collecting, analyzing, and disseminating scientific studies and their results. From the hard technical skills, to the soft skills of developing the best product for the end-user, developing virtual reality games in my research has directly prepared me for my future career. Further, my experience in Biomechanics has helped me to practice communicating complex ideas to audiences of all backgrounds. This will be an especially important skill for me to utilize in my career in order to effectively communicate to those of technical and non-technical backgrounds. I am grateful for the greatly interdisciplinary nature of Biomechanics, which has allowed me to grow immensely through specialized applications of my field.

After I graduate with my Bachelor of Science in Computer Science and minor in Biomechanics, I plan to continue my education part-time toward a Master of Science in Computer Science at UNO while working full-time in software development. The well-rounded skillset I have gained in Biomechanics and the collaborative connections I have made through research set me apart from my peers as I near a full-time career. I am very thankful for the lessons learned and relationships built through Biomechanics, and I will be applying soft and hard skills that I acquired through the Biomechanics program in my career for years to come.

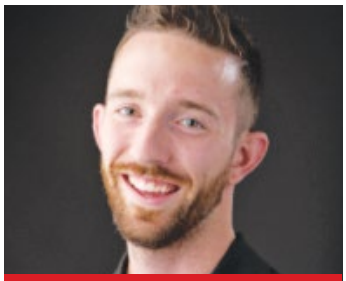
BIOMECHANICS UNITED

2020–2021 CHAPTER OFFICERS:

PRESIDENT:
Todd Leutzinger, Doctoral Student

TREASURER:
Corbin Rasmussen, Doctoral Student

MEETING CHAIR:
Sheridan Parker, Doctoral Student



PROGRAM CHAIR:
Tyler Hamer, Doctoral Student

SECRETARY:
Erica Hedrick, Doctoral Student

FACULTY ADVISOR:
Dr. Brian Knarr, Associate Professor

CO-ADVISOR:
Dr. Amelia Lanier, Instructor and Outreach Coordinator

CO-ADVISOR:
Laura Rotert, Academic Program Coordinator

Biomechanics United is an official Student Chapter of the American Society of Biomechanics and a registered student organization at UNO. Being part of the American Society of Biomechanics student body chapters allows students at UNO to network with other students across the country and provides opportunities to meet professionals in the field. Biomechanics United as a student organization at UNO provides both graduate and undergraduate students the opportunity to 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 faculty advisor, and several graduate students to provide academic, professional, and social events to students interested in biomechanics. Every month the group hosts a social and a professional event to provide its members an outlet from the stresses of school and research while also helping form them into strong young professionals in the field. Some of these events have included panels with professionals to provide insight on jobs in industry, seminars highlighting the different disciplines in biomechanics, and how to perform well in interviews, as well as team building events such as an escape room, happy hours, intramurals, virtual game nights, 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 and Great Plains Biomechanics Conferences hosted that we host as UNO Biomechanics every 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 students together to build comradery and prepare its members for their future careers.

MY EXPERIENCE AS A GRADUATE ASSISTANT

ERICA HEDRICK

I've enjoyed my time as a graduate assistant here at the Biomechanics Research Building (BRB) for the past 4 years. I am originally from Omaha, so I was glad I found such a great graduate school with many resources close to home. I started out in the BRB pursuing my Master's and working with Dr. Kota Takahashi. On his team, I was able to work with a novel prosthetic emulator, as well as do work on other projects related to foot and ankle biomechanics. I was able to learn how to form research questions, collect and analyze data, as well as improve my scientific writing and presentation skills.

Upon graduating with my Master's, I decided to transition into more clinical and translational research for my Ph.D. I currently work on Dr. Brian Knarr's team focusing on research questions involving improving walking for individuals post-stroke. This opportunity has allowed me to form connections with local rehabilitation hospitals for patient recruitment, as well as further improve my research skill set.

My career goal and long-term research interests are to become the director of a research institute in a rehabilitation hospital, and I believe that all my experiences here at the BRB have given me the background to attain my goal.

Dr. Brian Knarr's research team

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 Biomechanics Research Building.

2019-2020 FUSE Grants:

Cody Anderson
Sydney Andreasen
Jose Anguiano-Hernandez
Benjamin Frazier
Kaitlyn Guhl
Kalina Mavrov
Alissa Miller
Michael Thompson

2019-2020 GRACA Grants:

Prokopios Antonellis
Ayisha Bashir
Claudia Cortes Reyes
Alex Dzewaltowski
Kaitlin Fraser
Tyler Hamer
Erica Hedrick
Namwoong Kim
Stephanie Mace
Ryan Meidinger
Rahul Raj
Lindsey Remski
Corbin Rasmussen
Takashi Sado
David Salazar

2020-2021 Vaya Stergiou Distinguished Scholarship in Biomechanics:

Sarah Sternberger

2020-2021 NASA Nebraska Space Grant Fellowship:

Kaitlin Fraser
David Salazar
Chris Copeland
Will Randby
Stephanie Mace
Alissa Miller

2020 Office of Research and Creative Activity Fair Awards:

Best Graduate Oral Presentation
Nikolaos Papachatzis

Outstanding Graduate Oral Presentation
Corbin Rasmussen

Meritorious Graduate Oral Presentation
Zachary Motz

Outstanding Graduate Poster Presentation
Tyler Hamer

Meritorious Graduate Poster Presentation
Namwoong Kim

Meritorious Undergraduate Poster Presentation
Cody Anderson

Honorable Mention Undergraduate Poster Presentation
Sydney Andreasen

2021 Office of Research and Creative Activity Fair Awards:

Best Graduate Oral Presentation
Erica Hedrick

Best Graduate Poster
Namwoong Kim

Honorable Mention Graduate Student Poster
Tyler Hamer

2020 Human Movement Variability and Great Plains Biomechanics Conferences Awards:

Promising Graduate Student Award
Corbin Rasmussen

Outstanding Poster Award
Abderrahman Ouattas

Outstanding Poster Award
Alissa Miller

Outstanding Poster Award
Rebecca Wagner

2020 College of Education, Health, and Human Services Outstanding Graduate Student Award

Sheridan Parker

2021 Human Movement Variability and Great Plains Biomechanics Conferences Awards

Promising Graduate Student Award
Nikolaos Papachatzis

Delsys Best Scientific Impact Award
Cody Anderson

Outstanding Poster Award
Meghan Prusia

Outstanding Poster Award
Stephanie Mace

Outstanding Poster Award
Taylor Wilson

Outstanding Poster Award
Takashi Sado

THESIS AND DISSERTATION

DEFENSES

THESIS DEFENSES

CHRISTOPHER COPELAND

Defense: August 12th, 2020

Development and Validation of a Low-Cost 3D Printed Upper Limb Prosthetic Simulator

CLAUDIA CORTES REYES

Defense: August 13th, 2020

Assessment of Inter-limb Coordination in Pediatric Prosthetic Users

LINDSEY REMSKI

Defense: April 15th, 2021

Force Control Variability during Leg Press Exercise in Individuals Following ACL Reconstruction

DISSERTATION DEFENSES

ZACHARY MOTZ

Defense: November 23rd, 2020

Innovative analysis of coordination in human movement

MASTER'S COMPREHENSIVE EXAM COMPLETION

JENNY ANNE MAUN

Spring 2021

RAHUL RAJ

Spring 2021

GRADUATION

In spring 2020, Jaclyn Taylor graduated with a Bachelor of Science in Biomechanics and was the commencement speaker for the College of Education, Health, and Human Sciences. She completed her degree during the pandemic and had inspiring words for her fellow graduates.

"If you would have told me a year ago that we would be graduating virtually, I would have said you are crazy. Similarly, if you would have told me a year ago that my life would have revolved around something other than volleyball, I also would have said you would be crazy, but here we are graduating nonetheless and here I am getting a degree in Biomechanics. Like me, maybe you have found yourself at a crossroads before. A feeling of uncertainty, doubt, and fear creeps over you. During my junior year here at UNO, I began to feel a change. As a volleyball player, that had been my life, and I wouldn't have wanted it any other way. But I thought it was time to turn a page and start a new chapter. This is when I began to get more involved in the Biomechanics Department here at UNO. This helped me really solidify my career path for the future. I leaned on my parents, family, friends, teammates, coaches, advisors, and professors. I look at this as a turning point of my college career. Although it felt weird at first, focusing more on my passion and goals for the future and less of my life of volleyball, I knew it was the right choice. At times I questioned myself, but I like to think I came out stronger on the other side. I owe this largely in part to my support system for pushing me. My parents, family, friends, teammates, coaches, advisors and professors here at UNO have all had a lasting impact on who I am today and my goals for the future. That is the one thing I want to leave you all with today. Yes, we are in a season of change. From the global pandemic and the uncertainty of the future, to graduating college and moving on to the next chapter of life, but we have the perseverance and resilience to graduate from college in this extremely difficult time. So let's get out in the world and use that for the lasting good to make an impact on others the way our support system did for us."

IN THE NEWS

Faculty, staff, and students from UNO Biomechanics are often included in various news stories featuring our groundbreaking research and world renowned academic programs. Included in this year's newsletter is just a sample of some of those stories!

Dr. Prokopios Antonellis, Research Associate in Biomechanics, was featured in The International Society of Posture and Gait Research (ISPGR) blog.

"WALKING MOSTLY UPHILL OR DOWNHILL? CHOOSE YOUR SHOES BASED UPON WHICH WAY YOU ARE WALKING!"

PUBLISHED: July 2020

EXCERPT: Remarkably, shoes that exactly offset the grade did not minimize the metabolic rate. Instead, shoes that compensated for about half of the grade (by using a raised heel for uphill walking and a raised toe for downhill walking) proved to be optimal. Shoe inclination primarily influenced (distal) ankle joint parameters (e.g., soleus activity, ankle moment, and work rate), whereas grade influenced (whole-body) ground reaction force and center-of-mass parameters, as well as (distal) ankle joint parameters. Walking on uneven terrain with uphill and downhill sections, the metabolic rate is mostly affected by the uphill portions. As such, it could be advantageous to use shoes with a slight downward shoe inclination in these situations. It could also be possible to design shoes that allow for changing the inclination depending on the grade of the terrain to avoid repetitive overstretching of the calf muscles.

LINK: ispgr.org/walking-mostly-uphill-or-downhill-choose-your-shoes-based-upon-which-way-you-are-walking/

UNO Biomechanics was mentioned in an Omaha World Herald editorial.

"EDITORIAL: COMMERCIALIZATION OF NU RESEARCH IS A KEY ECONOMIC ASSET FOR OMAHA"

PUBLISHED: September 2020

EXCERPT: Another help, Runge says, is UNO's innovative work in the study of biomechanics. Through development of new research methods and big-data analysis, UNO is discovering insights connecting bodily motion and health. Those findings are opening up new opportunities for product development, including a self-pacing treadmill and concussion-detection technology.

LINK: omaha.com/opinion/editorial/editorial-commercialization-of-nu-research-is-a-key-economic-asset-for-omaha/article_44afa537-be82-5759-bafe-111e58edb353.html

Dr. Philippe Malcolm, Assistant Professor in Biomechanics, was featured in a UNO news article and press release about an article published in Public Library of Science (PLOS) Computational Biology.

"UNO RESEARCHERS ESTIMATE FLUCTUATIONS IN OXYGEN COST WHILE WALKING"

PUBLISHED: November 2020

EXCERPT: "These simulations can help us understand which phases of a person's gait cycle contribute to increased oxygen consumption in patients," Malcolm said. "Our estimations of fluctuations in oxygen cost matched relatively well with coarse predictions from perturbation experiments, but there are considerable differences between estimations using different equations. Improved estimation methods could be useful for applications in exercise therapy and assistive device design." Such applications could be useful for patients who suffer from cardiovascular and lung diseases. Knowing which phase in someone's gait cycle causes them problems could allow for the developing exercise therapies that target the most costly phase or devices such as exoskeletons that assist right when it is most needed.

LINK: unomaha.edu/news/2020/11/oxygen-cost-walking.php

Dr. Jorge Zuniga, Associate Professor in Biomechanics, had his 3D printed prosthetic initiative "The Cyborg Beast" featured in an All3DP article about the most common 3D printed prosthetics in 2021

"THE MOST COMMON 3D PRINTED PROSTHETICS IN 2021"

PUBLISHED: January 2021

EXCERPT: The Cyborg Beast is a low-cost, 3D printed hand designed using Blender and printed using PLA and ABS. The Cyborg Beast kit is available on E-Nable and it's one of their most popular designs. The hand was developed by 3D Universe and you can buy the materials kit and assemble it following the detailed instructions. Thanks to 3D printing, the Cyborg Beast is customizable; the hand can be printed from 100% to 160% of the file size.

LINK: m.all3dp.com/2/the-most-common-3d-printed-prosthetics/

Dr. Kota Takahashi and Dr. Philippe Malcolm, Assistant Professors in Biomechanics, were featured in the Humotech blog.

"CUSTOMER SPOTLIGHT: HOW UNO IS PUSHING THE PARAMETERS OF EXO AND PROSTHETIC RESEARCH"

PUBLISHED: March 2021

EXCERPT: To help these patients, researchers like Takahashi are looking to better understand the complex and nuanced relationships between different biomechanical properties of gait. One of his ongoing lines of research involves studying ankle joint stiffness and metabolic cost. Research suggests that reducing ankle joint stiffness in prosthesis wearers reduces the energy demands during normal walking. But, what happens when weight is added during normal everyday activities, such as wearing a backpack or carrying bags of groceries? In research terms, how does ankle stiffness affect metabolic cost during walking with extra load? That was one question that hadn't yet been answered when Takahashi's team set out to study it in 2017. "One of the biggest challenges in the field is trying to optimize the prosthesis for a variety of walking tasks that we may encounter on a day-to-day basis," Takahashi says.

LINK: www.humotech.com/blog/customer-spotlight-how-uno-is-pushing-the-parameters-of-exo-and-prosthetic-research

Biomechanics Doctoral student Ryan Meidinger was featured in a KVNO News story about research for his dissertation.

"HOPING TO HELP PARKINSON'S PATIENTS TO WALK BETTER TO THE BEAT OF A METRONOME"

PUBLISHED: April 2021

EXCERPT: Meidinger is about to begin his work of monitoring people and recording their brain activity when they tap their fingers at a certain beat of a metronome.

"So, with cross-education, you can train one limb and the other will get stronger and larger. It's not a complete transfer, but you can transfer these things across limbs so our body, in some way, is able to just pass this stuff back and forth between sides and between limbs," Meidinger explained. "So, the thought is that hopefully, the mechanisms that are active with this process education are also active with this finger tapping, and the walking transfers."

LINK: kvnonews.com/2021/04/hoping-to-help-parkinsons-patients-to-the-beat-of-a-metronome/

Biomechanics Master's student Kolby Brink was featured in a National Strategic Research Institute article about a student working on an NSRI project. Kolby works with Dr. Aaron Likens, Assistant Professor in Biomechanics.

"STUDENT OF NSRI: KOLBY BRINK AIMS TO ADVANCE SOLDIER READINESS, EFFECTIVENESS"

PUBLISHED: December 2020

EXCERPT: Kolby is working on a project through the National Strategic Research Institute at the University of Nebraska under NSRI principal investigator Dr. Aaron Likens, assistant professor for the UNO Center for Research in Human Movement Variability. The project aims to create a better soldier through advancement and measurement of readiness and effectiveness of both physical and cognitive performance under operational scenarios. Briefly describe what you are working on. "We are conducting a systematic review to gain a better understanding of previous literature on the topic of soldier readiness. This will be followed by collaborative efforts to develop code capable of measuring the relevant biomechanical variables indicative of increased injury risk and 'unreadiness' before the physically and cognitively demanding tasks soldiers face."

LINK: nsri.nebraska.edu/news/news-releases/2020/12/student-of-nsri-kolby-brink-aims-to-advance-soldier-readiness-effectiveness

The UNO Biomechanics Pitching Lab was featured in a UNO Gateway article.

"INTO THE LAB: HOW A STATE-OF-THE-ART FACILITY AIMS AT GIVING MAVERICK PITCHERS AN EDGE ON THE COMPETITION"

PUBLISHED: May 2021

EXCERPT: The new age of baseball has slowly found its way into the college ranks. In the basement of the biomechanics research building, you'll see how UNO has joined that trend with a state-of-the-art pitching lab. Tyler Hamer, a current Ph.D. student in biomechanics, is a driving force behind all of it. A former Division I pitcher himself, Hamer specializes in bodily movements, specifically those of a pitcher. To use an oversimplified definition, the lab uses high-speed motion capture cameras to determine how well a pitcher throws a baseball. This is measured in a multitude of different ways through numerous variables.

LINK: unothegateway.com/into-the-lab-how-a-state-of-the-art-facility-aims-at-giving-maverick-pitchers-an-edge-on-the-competition/

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.

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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