PORTAGE HEALTH FOUNDATION

ANNUAL REPORT

AY 2021-2022

Michigan Technological University

UNDERGRADUATE RESEARCH INTERNSHIP PROGRAM

Undergraduate Research Internship Program awards (URIPs) are open to all Michigan Tech undergraduates who are interested in engaging in a research experience in a faculty member's laboratory. Award recipients conduct a research project under the guidance of a Michigan Tech faculty mentor during the academic year, giving them first-hand access to the science and engineering processes that drive discovery.

For this cycle, eight Michigan Tech students conducted research with support from the Portage Health Foundation. Many of them also presented at the spring Undergraduate Research Symposium organized through the Pavlis Honors college. We have highlighted a few of their projects in the following pages, as explained by PHF funding recipients in their own words.

ZACHARY ALESCH

BIOMEDICAL ENGINEERING

Conjugation of Serum Albumin with Horseradish Peroxidase Enables a Novel Protein Adsorption Imaging Technique on Biodegradable Metal

Introduction

Biodegradable metal implants encounter a variety of proteins from the moment they enter the body. Albumin is among the most abundant and earliest blood proteins to interact with the surface and therefore has significant consequences for the wear, corrosion, and biocompatibility of candidate metals. Many methods exist for assessing the adsorption of proteins onto metal surfaces, but the high costs and complexity of these techniques limit widespread use, especially with biodegradable metals. This project aims to address this need using conjugation of albumin and horseradish peroxidase (HRP), enabling chemiluminescent imaging of protein adsorption on metal sample surfaces.

Materials and Methods

Conjugation of HRP to albumin was accomplished using the Lightning-Link kit (ab201807, Abcam plc., Cambridge UK), and the success of the conjugation was determined by western blot. Immersion experiments were conducted with 316L stainless steel and pure magnesium discs in DMEM. Imaging was performed by removing the discs from media and drying the discs in air, then adding enhanced chemiluminescence (ECL) substrate directly to the metal surface. By performing chemiluminescent imaging on the surface using Azure 600 (Azure Biosystems Inc., Dublin CA), the reaction of ECL and the adsorbed conjugate proteins can indicate the amount of protein adsorbed. The surface is subsequently washed to remove leftover substrate and returned to the immersion solution for continued study of the dynamic surface at multiple timepoints.

Results and Discussion

Conjugation methods for bovine serum albumin (BSA) and HRP have been successfully developed and verified by this project. The conjugate maintains reactivity of the HRP domain with ECL substrate, while unconjugated BSA has no reaction with ECL. Preliminary testing with 316L stainless steel has confirmed that the conjugate maintains reactivity when adsorbed to the 316L surface after immersion for various durations. Using this chemiluminescent technique, the adsorption of BSA suspended in solutions of Hank's Balanced Salts and DMEM replicates the findings of a study that utilized fluorescently labeled albumin. In this project, the chemiluminescent detection of BSA adsorption to degradable magnesium surfaces is developed for feasibility and efficacy as a novel cost-effective tool compared to alternative methods of surface analysis.

AYODOTUN ALUKO

BIOMEDICAL ENGINEERING

Characterization of the Focused Ultrasound Effect on Active Agent Release Behavior from Fibrin Composite Hydrogels for Tendon Repair

Introduction

Tendon injuries are a problem due to their prevalence, and there are no effective treatments that resolve the injury without a resultant deficit in function or long-term effects on tissue stability that lead to reinjury. One advancement is the development of hydrogels to treat tendinopathy; hydrogels have the unique ability to stabilize the structural environment of a tendon while also being capable of delivering therapeutics. This aids in restoring normal tissue function and properties as well as speeding up the natural healing process. Therapeutic release needs to be controlled and this can be done with thermal/mechanical loading via focused ultrasound.

Materials and Methods

Fibrin particles were synthesized via emulsion polymerization of a fibrinogen solution and a thrombin/CaCl2 solution. The emulsion is cooled, and particles are recovered by vacuum filtering and an acetone rinse to separate particles. To make SNAP-Fibrin particles, PBS is added to SNAP and then NaOH until SNAP dissolves. HCl is then added until the desired pH is reached. A small portion of this solution is mixed with a base fibrinogen solution, and emulsion steps are repeated as previously described. Polyethylene-glycol (PEG)-fibrin microparticle hydrogels were synthesized using an established protocol.

To determine nitric oxide release behavior, each sample (particle or hydrogel) is placed in a cell trap and their release behavior was assessed using an NO analyzer with or without the application of thermal/mechanical loading via a custom focused ultrasound (FUS) system. Release was recorded for two hours for all sample preparations. Samples were treated with continuous-wave FUS with an amplitude of 150 mVpp using the 3.5 MHz transducer.

Results and Discussion

Fibrin-only particles showed zero NO release before and after FUS stimulus was applied. This result was expected because the sample has no SNAP. NO release from SNAP-fibrin particles without FUS stimulation showed rapid NO increase until it reached a peak of 1.0 moles/(min*cm2) and then rapidly decreased till NO levels plateaued at 0.1 moles/(min*cm2). NO release from FUS-stimulated SNAP-fibrin particles showed a similar behavior except its peak was higher. NO release of non-stimulated PEG-fibrin hydrogels showed a more controlled release profile. The NO release of FUS-stimulated PEG-fibrin hydrogels was similar except in the duration when FUS stimulus was applied and spikes in NO release occurred. These results indicate that FUS stimulation with PEG-fibrin hydrogels shows tight temporal control of NO release.

SOPHIA BANCKER

MEDICAL LABORATORY SCIENCE

The Role of Orexin A in Salt Sensitive Hypertension

Introduction

Hypertension (HTN) is a long-term condition in which the force of the blood against the artery wall is higher than normal pressure. It is a major risk factor for cardiovascular disease (CVD), and CVD is the number one killer in the United States and worldwide. Despite its prevalence among individuals, the pathophysiological mechanism of salt sensitive hypertension (SSHTN) is still not clear, given the fact that SSHTN is an extremely complex condition which involves multiple mechanisms. Many factors such as increased sympathetic outflow and dysfunctional renin-angiotensin-aldosterone system are implicated in the development of SSHTN. Most recently, studies suggest that hyperactivity of brain-orexin signaling may also be involved in the development of SSHTN.

Materials and Methods

I will determine whether high-salt-diet intake increases orexin system activity including plasma OXA level, and OX1R and OX2R expression in adrenal glands and kidney. Ten six-week-old male Dahl-salt sensitive (DSS) rats will be randomly divided into two groups and receive either normal diet (0.4% NaCl) or high salt (4% NaCl) for six consecutive weeks. Blood pressure of each rat will be measured once a week via tail-cuff method. At the end of the protocol, animals will be euthanized and their blood, adrenal glands, and kidneys will be collected. Plasma will be used to ELISA for OXA and corticosterone measurements. Adrenal glands and kidneys will be used to isolate RNA and proteins to measure OXA, OX1R, and OX2R expression. The results will be compared between the two groups.

Results and Discussion

The BSA results include findings that the DSSM-HSD rats in the lung and spleen showed a decreased ACE, while the intestine showed that ACE increased. For ACE2, the DSSM rats showed decreased ACE2 in the heart and lung, but increased ACE2 in the intestine. Western Blot results are being collected this February.

KATHLEEN HEUSSER

BIOMEDICAL ENGINEERING

Effect of Extracellular Matrix Density on Traction Force Transmission by Fusion Protein Positive versus Negative Rhabdomyosarcoma

Introduction

Rhabdomyosarcoma (RMS) is the most common childhood soft tissue cancer, with 4.5 cases per million adolescents per year. Research has shown a 75% cure rate for localized RMS, but metastatic RMS patients' survival rate is 30%. A major factor determining metastatic malignancy is the fusion protein PAX-FOXO1. The two histological subtypes, alveolar and embryonal rhabdomyosarcoma, are fusion-protein-positive and fusion-protein-negative, respectively. In brief, FPRMS cells produce much less of the extracellular matrix (ECM) proteins than FNRMS cells. This study will investigate cellular mechanical response to the induced difference in ECM protein density.

Materials and Methods

Bovine Collagen II of thick (5ug/mL) and sparse (0.1ug/mL) density, coated on top of 0.7 kPa or 12.5 kPa Qgel 920 silicone gel from Quantum Silicones, creates the 2D "ECM" for experiments. This will be coated with 40nm fluorospheres, then cells will be placed on the substrate and imaged live under a total internal reflection microscope (TIRF) with 60x oil-immersion objective lens. Images of beads will be processed with TFM software in MATLAB to reconstruct traction, whereas the images of cells will be analyzed for membrane protrusion and adhesions. RH41 cells are the first RMS cells to be used in live-cell imaging experiments, as they grow most quickly due to PAX-FOXO1 expression; also RH30 (FPRMS), RH18 (FNRMS), and SMS-CTR (FNRMS) cells will be used.

Results and Discussion

Two independent parameters, i.e., gel stiffness and ECM density, will be tested for traction and migration. Two different gel stiffness, i.e., soft (0.7 kPa) and stiff (12 kPa), and two different collagen II densities, i.e., sparse (0.1 ug/mL) and dense (50 ug/mL) will be used. The aim of the project is to determine the cellular response, in terms of cell spread area, traction force exerted, and migratory pattern, to different stiffnesses of gel and different thicknesses of collagen layer, particularly as the presence of the fusion protein influences ECM protein secretion. As I started the project in January, the current stage is the culture of Rh41 cells and training of TFM substrate fabrication. The outcome of this study will shed light on the relationship of fusion-protein presence to the tumor microenvironment (TME), and in turn, the TME's mechanical impact on the cells. Knowledge of this relationship will help us to target RMS therapies more specifically depending on the type of cancer present.

CHLOE LOOMIN

BIOLOGICAL SCIENCES

Optogenetic Stimulation of the Internal Globus Pallidus for the Treatment of Depression

Introduction

Deep brain stimulation via an electrode has been proven effective in treatment for Parkinson's disorder; however, such technology often diminishes in effectiveness over time. Optogenetic stimulation via a photosensitive vector and an implanted optic fiber is being studied as treatment for both Parkinson's and the frequently co-occurring depression. Two potential target regions include the excitatory subthalamic nucleus (STN) versus the inhibitory globus pallidus interna (GPI). This study investigates the effectiveness of deep brain optogenetic stimulation to the lesser-studied GPI region for treatment of depressive and motor symptoms in a Parkinson's rat model.

Materials and Methods

Ten rats' dopaminergic brain regions were leisioned using 6-hydroxydopamine (6-OHDA) to induce Parkinson's disorder (PD). Six of these rats were assigned the PD group. The remaining four were assigned the PD-implant test group and were injected with the photosensitive (AAV5-CaMKII-GFP) and fitted with a fiber-optic implant reaching the GPI region. Two untreated rats were assigned to the control group. Following a week of recovery, behavioral tests were conducted. These tests included a novel-environment and sucrose splash test, designed to measure how long rats would explore and groom themselves when placed in a novel environment. A sucrose-consumption test measured the rats preference for sucrose water versus plain tap water. A Rotarod device quantified how long the rats could balance on a rotating cylinder, and the adjusting-steps test counted how many adjusting steps were made when dragged across a smooth surface. Behavioral tests were conducted every other week. After two rounds of behavioral tests, optogenetic DBS was conducted five days per week on the PD implant test rats at 130Hz, 10s on and 20s off, for 240 blocks for six weeks, with behavioral tests continuing every other week to track progress.

Results and Discussion

The results of the behavioral tests were analyzed for trends pre- and post-DBS and between each of the three test groups. The novel-environment/splash test tracked changes in behavior regarding tendency to explore versus sit, and level of grooming in a fifteen-minute span. Following the start of DBS at week 5, the PD-implant group showed a marked increase in grooming behavior compared to the other test groups that continued upwards throughout the remaining weeks. The sucrose-consumption test analyzes preference for the favorable sucrose water over plain tap water as a measure of anhedonia and depression. While both the PD and PD-implant group trend closer to the control group over time, it is unclear if the PD-implant group varies significantly following treatment. The Rotarod and adjusting-steps tests show similarly unclear trends. A second round of testing is ongoing with two additional PD and two PD-implant test rats. We hope that the additional data will model the effectiveness of DBS treatment at lessening depressive and motor symptoms of Parkinson's disease, clarifying the efficacy of the GPI as a target region for treatment.

KATHERINE SCHNABEL

BIOMEDICAL ENGINEERING

Evaluating the Influence of Age on Balance Recovery in Decreased Lighting Conditions

Introduction

Little research has been done to see how people recover their balance when beginning to fall. Vison plays a vital role in the detection of a loss of balance so that effective balance recovery mechanisms can be initiated. As adults get older, their vision acuity to light or dark decreases, making it more challenging to detect visual cues in conditions of decreased lighting (e.g., night time). The purpose of our study was to determine if decreased lighting conditions like those experienced in poorly lit environments affect older adults' ability to recover their balance in the beginning of a fall. This research is particularly helpful for the older adult population, which has more falls than other age groups. The information from this study can hopefully be used to improve environmental designs or prevent falls in areas like homes, long-term care facilities, and public buildings.

Materials and Methods

We are currently collecting data from 12 healthy, community-dwelling older adults (ages: 65-80 years). All older adults are free of any musculoskeletal or neurological impairments that would affect balance. All participants performed a series of forward lean-and-release balance recovery trials in three lighting conditions (light, nightlight, dark). In each condition, participants started at a release angle of 10º. The release angle was increased incrementally between trials by 2º until the participant could not recover their balance with only one step. During all trials, kinematics were recorded with an 11-camera optical motion capture system (Qualisys, Sweden). Small reflective balls will be used for passive motion capture and placed on limbs and trunk of the participant to capture full body kinematics. COM kinematics (maximum velocity and acceleration), stepping temporal-spatial parameters (step length and velocity), and stepping onset latency were obtained between loaded and unloaded conditions at the greatest lean angle. This data will be compared to data previously collected from young and healthy adults (age: 18-40 years).

Results and Discussion

Data collection is ongoing and will be completed by the symposium. Given the visual system's ability to detect changes in motion, I expect to see that the balance recovery is slower in older adults as well as in lower lighting conditions. This will also result in a smaller maximum lean angle that participants will be able to achieve without taking multiple steps or falling in the dark and nightlight conditions. Furthermore, given older adult's greater reliance on visual cues to detect changes in motion, I expect the effect of the decreased ambient lighting conditions on maximum lean angle, response onset, and response characteristics (e.g., step length, center of mass velocity) will be greater for older adults when compared to young adults.

MORGAN SMITH

BIOCHEMISTRY AND MOLECULAR BIOLOGY
(BIO FOCUS)

The Effect of Prolonged Probiotic Supplementation upon a Model of Chronic Obesity

Introduction

According to a 2015 Global Burden of Disease Study, an estimated third of the world population is overweight or obese, and the prevalence of obesity is still climbing worldwide. Obesity is a multifactorial chronic disease that leads to many health complications, including a higher risk of mortality. Manipulating the gut microbiome (the symbiotic microorganisms of the intestines) shows great potential as a treatment for obesity, and may help to lower the risk of mortality. Thus, this study was designed to elucidate the effect of probiotic supplementation on length of life (longevity) using a drosophila model of obesity.

Materials and Methods

In this study, adult drosophila melanogaster flies were fed a diet containing 10% vegetable shortening by volume to induce an obesity phenotype. Within the experimental group, this diet was supplemented with 1.0 x 10^8 CFU per mL of lactobacillus plantarum. Flies were maintained on their respective diets for the remainder of their life and their longevity was recorded.

Results and Discussion

Obesity causes dysbiosis within the gut microbiome, and probiotic supplementation helps to stabilize this dysbiosis. Previous experiments have shown dietary supplementation with 1.0 x 10^8 CFU per mL of lactobacillus plantarum to have significant benefits upon the longevity of drosophila melanogaster. As such, it is expected that probiotic supplementation will extend the longevity of obese flies. This research is ongoing. Results from this study will encourage and guide future research into the effect that the gut microbiome has on human health. Furthermore, as this study spans the entire lifetime of a chronically obese model, it will provide data on the effect of supplementing the gut microbiome throughout the entirety of adult life.

LILLY VAN LOON

MEDICAL LABORATORY SCIENCE

The Role of Orexin A in Salt-Sensitive Hypertension

Introduction

Orexin A (OXA) is a neuropeptide, produced in a small group of lateral hypothalamic (LH) neurons, with numerous physiological functions including blood pressure regulation. Orexin A exerts its function by binding to orexin 1 receptors (OX1R) and 2 receptors (OX2R). Hyperactivity of orexin system has been found in several form of HTN including SSHTN, and blockage of orexin A receptors in the brain attenuated HTN, demonstrating the potential role of brain orexin system on BP regulation. However, the role of orexin system in periphery on the development and maintenance of SSHTN has not been determined.

Aim 1. Determine if a high-salt diet increases activity of peripheral orexin system in DSS rats.

Aim 2. Determine if a high-salt diet induced increase in peripheral orexin system has a sex difference.

Materials and Methods

We will be using Dahl-Salt Sensitive (DSS) rats and measuring OXR protein levels in the adrenal glands, heart, and kidneys using Western Blot. Half the DSS rats were fed with a normal diet and half with a high salt diet. Blood pressure was recorded for the female rats using CODA system.

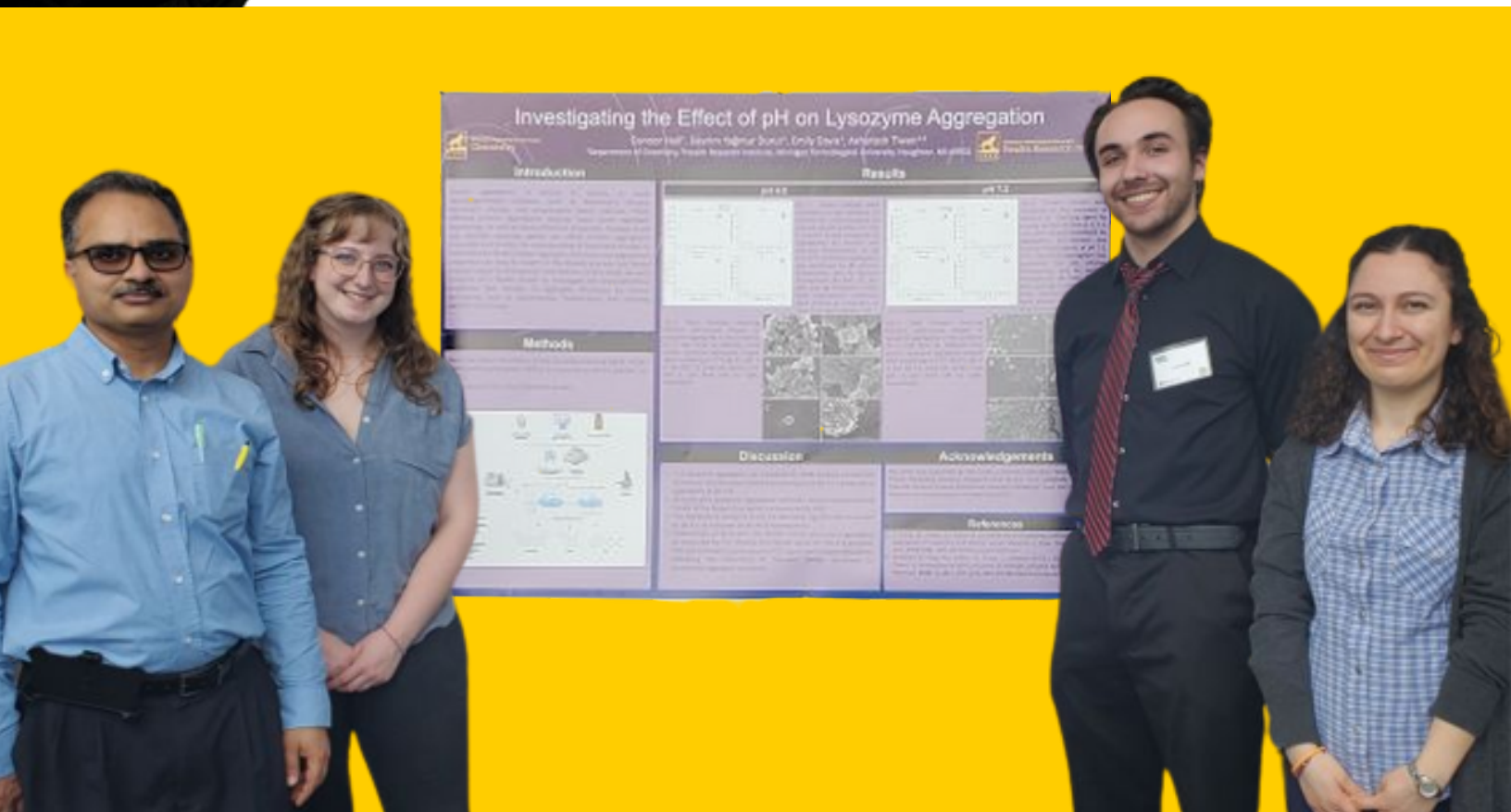
Results and Discussion

We observed that DSS female rats on the high salt diet had an increasingly higher blood pressure than the DSS female rats on the normal diet. We have isolated the proteins from the tissues of the DSS female and male rats. This research is ongoing and Western Blot data will be collected and analyzed in February and March to complete this project.

Symposium

After taking a virtual hiatus, the Undergraduate Research Symposium returned in March 2022.

The purpose of the symposium is to highlight the cutting-edge research conducted on Michigan Tech's campus by some of our best and brightest undergraduates. Presenting students represent a wide array of scientific and engineering disciplines across campus and highlight the diversity of research areas being explored, many with URIP support from funders like the Portage Health Foundation.



MAKING A DIFFERENCE SCHOLARSHIPS

The Making a Difference scholarship provides opportunities for local students to positively impact the health of our region. This award directly impacts all of our futures by supporting education for students from Baraga, Houghton, Keweenaw, or Ontonagon counties who have plans for a career focused on improving human or community health in the four-county area.

For this cycle, 27 Michigan Tech students received awards catalyzing their education with the Making a Difference scholarship. A few highlights from the last year are spotlighted in this report - primarily from the students' point of view.

LILY BAKER

Making a Difference Award Spotlight

B.S. EXERCISE SCIENCE
MINOR IN PSYCHOLOGY

I patrolled my first semester on Mont Ripley's Ski Patrol, which was an amazing experience that I feel has helped to prepare me for my desired career path and application to physical therapy school. This is an organization where I feel I have an opportunity to make a difference for the rest of my time at Michigan Technological University. I have been able to have an impact through working as an outdoor emergency technician on the ski hill and responding to incidents that commonly need medical attention. During this experience, I am allowed to give back to the local community that I grew up in - which has been very important to me.

I have also been able to make a difference in the work I have done in the Human Biomechanics Lab by working on studies that are aiming to improve the health of the general, and specifically, local population. During one study, we worked on tracking physical activity levels of local individuals with and without diabetes; another study focused on testing the balance of healthy adults in different lighting conditions.

The ultimate goal of the diabetes study is to implement better and more accessible exercise programs, specifically during the winter months, for those who could benefit from them locally. During the other study, we tested the balance of healthy adults in different lighting conditions: one completely dark, one nightlight, and one fully lit. The goal of the study is to ultimately improve building lighting codes to prevent falls while at home or in the workplace and therefore reduce injury and hospitalizations.

Lastly, at the end of the semester, I began to shadow in physical therapy and had a great experience. I learned so much about what it means to be a physical therapist and thoroughly enjoyed each opportunity I had to go to the clinic and observe. I am looking even more forward to the rest of my time at Michigan Tech and beyond since I have found a career path I am so passionate about. This experience has solidified my career choice and I feel is something I can truly make a difference in.

I feel I have learned a lot in the past year and have had many opportunities I am grateful for, along with looking forward to any that may cross my path in the future. ***Many of these opportunities were possible thanks to the Portage Health Foundation.*** *I aim to keep doing all I can to make a difference in Houghton County's local community!*

MARYELLEN TREWHELLA

Making a Difference Award Spotlight

B.S. BIOMEDICAL ENGINEERING
MINOR IN PRE-HEALTH PROFESSIONS

Healthy living is essential for societies to function properly. As technology usage and the consumption of refined sugar rises, we need to continue to promote healthy living and exercise. This needs to happen all over the nation, but that cannot be done by just one person alone.

As a resident of the Houghton community, it is my goal to help promote a healthy lifestyle to the people of my hometown. Over this past year, I have helped promote a healthy lifestyle by helping with some of the Houghton Varsity basketball practices. I also have worked the Michigan Tech Little Huskies Basketball camps for young children. While this contribution may seem small, it was the beginning of a larger goal.

I am attending Michigan Tech to become a biomedical engineer, with hopes of being able to study MCL and ACL tears in the future. This will allow me to educate young athletes on how to prevent these injuries and help those who suffer with them. However, in order to attain my goal I first need to work hard in the classroom to get my degree.

This past year, I have worked very hard academically to gain the most out of my courses. I was on the Dean's list both semesters, earning a cumulative 3.95 GPA for the year. In addition to learning new things academically, I was able to learn a lot about myself this past year. Through engineering classes, I learned how to more efficiently and effectively communicate with a team. I was able to realize that sometimes I need to take a step back and listen to what is being said by someone else and work with them. I learned how to effectively manage my time with classes, practices, family, and a social life. It seemed nearly impossible to fit everything into my schedule; however, after some trial and error I learned that if you just take everything one step at a time, it is not nearly as overwhelming as trying to cram it in all at once.

*This past year of college has taught me **life long lessons and has allowed me to come closer to reaching my goal** of becoming a biomedical engineer.*

JADYN HUUKI

Making a Difference Award Spotlight

B.S. MEDICAL LABORATORY SCIENCE
MINOR IN PSYCHOLOGY

My time at Michigan Tech has been an adventure filled with the most educational classes, the best professors, and amazing people who share the same passions and goals that I do. I've gotten to work in an intricate lab setting to get hands-on experience, gotten involved in some cool volunteering opportunities, and I have also been able to be part of some incredible studies including one concerning the health of astronauts which was done for NASA.

My biggest concern when choosing studies to participate in is how it impacts the health of others. Each study and volunteering opportunity I've been able to experience has followed that trend as my main focus is the betterment of health for those around me.

In the fasting study, the purpose was to determine how the effects of fasting change the body's response to gravitational forces. This study was done for NASA to determine if astronauts would be better off fasting upon return to Earth to minimize negative effects. Meanwhile, in the aging and cognition lab study, we aimed to determine how aging affects cognition to gauge what habits help to maintain peak performance throughout the years.

I have been fortunate to be able to help out with patient intake at the COVID testing center. It's been a cool opportunity to see how campus has handled the pandemic and what the inner workings are to make sure everyone stays safe. I was also able to help run the Red Cross blood drive doing patient intake and recruiting donors.

I have a goal to graduate with all the skills necessary to go out and help those in need and I've already learned so many ways in which I can do that once I complete my degree. I personally am quite interested in histology and am looking forward to getting a closer look into that field.

It is my hope is that the things I've been able to participate in will positively impact not only the Michigan Tech community but also the local community, from study-approved health advice to ensuring local hospitals are able to maintain a supply of blood.

I would like to take this opportunity to thank you all for helping me pursue my dreams of attending Michigan Tech for the Medical Lab Science program. I have always wanted to work in a health related field and ***with the scholarship I received it was made possible for me to find the profession that I believe is my calling.***

JILLIAN CYRUS & KORA JOHNSON

Making a Difference Award Spotlights

JILLIAN: B.S. MEDICAL LABORATORY SCIENCE MINOR IN PRE-HEALTH PROFESSIONS

Ever since I was a young girl, I have always been acutely curious about the physiology of living beings. Whether these beings were ants, sea turtles, monkeys, or humans, my curiosity consumed my imagination. With this, I have participated in ample research/project opportunities that Michigan Tech has offered me. One such opportunity includes Michigan Tech's newest Enterprise, the H-STEM Enterprise. Put into action in the Fall of 2021, I was a part of the start-up process as secretary of this new, medically-focused Enterprise. We started out with four projects, two of them being outreach-oriented and the other two more mechanically focused.

I am a part of the Heavy-weight Supported Treadmill Project. In this project, we are working to develop a harness and cage attachment to the average treadmill that can lift a certain percentage of weight off of the patient's body with a simple press of a button. So far, we have created a demo of the cage of the attachment, and have tested on multiple different types of harnesses, checking for varying levels of comfort based on body types and movements. Once we have accomplished our goal of creating an affordable heavy-weight supported treadmill attachment, we hope it can be implemented within hospitals and nursing homes throughout the Keweenaw.

KORA: B.S. ENVIRONMENTAL ENGINEERING

My passion for research stems from a general curiosity about our world that was fostered in me at a young age. I've always enjoyed learning about the processes that govern how we live, but even more interested in how they've been discovered. This summer I've been working for University of Wisconsin Oshkosh as a lab assistant. My coworkers and I split our time between taking water samples off various beaches up and down the shores of Lake Michigan and analyzing and documenting the results of those samples back in the lab. These results allow us to inform the public which beaches are safe to swim in and which are potentially hazardous due to high concentrations of coliforms. Additionally, this summer my coworkers and I have had the unique opportunity to conduct the first season of a research project funded by a NOAA grant focused on finding the sources of (and thus potential solutions to) microplastics in the Great Lakes.

I would love to see later editions of this microplastics research begin closer to my home in Lake Superior. Microplastics pose a hazard to our wildlife and our drinking water. Not knowing the source of a pollutant that's so difficult to remove is concerning. I would also really like to see more thorough beach testing done on local beaches. Having a better understanding of the quality of the Portage Canal, for example, can help us understand the damage that events like the Father's Day Flood and a recent oil truck spill can cause.

INTERNSHIPS AND FELLOWSHIPS

There are numerous opportunities for students to grow in their understanding and expertise on health disciplines. Whether this entails the hands-on work or a multidisciplinary research project, internship and fellowship opportunities like these are what will propel the health field forward as they advance in their careers.

What follows is a collection of spotlights featuring the pre-med internship and graduate student fellowship.

CHRISTIAN JOHNSON

Pre-Med Internship Spotlight

B.S. HUMAN BIOLOGY
B.A. ENGLISH
MINOR IN PRE-HEALTH PROFESSIONS

Christian Johnson is a highly dynamic undergraduate student pursuing a degrees in both English and Human Biology with a pre-health professions minor. His diverse passions and stellar academic accomplishments led to his selection as the Departmental Scholar for both Humanities and the Pavlis Honors College; Christian was subsequently selected for the prestigious Provost's Award for Scholarship in 2022.

Christian serves as a Crisis Line volunteer with Dial Help, where he has honed his interest in mental health - specifically, the health of children and adolescents. He cites his experiences in Houghton as pivotal in shaping his career path, including the opportunity to shadow at the health department made possible by the pre-med internship award. "The vast difference of living in Detroit and going to school in Houghton," he says, "along with the experiences I have had (including shadowing, Dial Help, other volunteering) made me realize that I want to be a rural physician and give back to rural communities, whether that be in Michigan or somewhere else in the country or the world." It is Christian's goal to attend medical school to become a child and adolescent psychiatrist.

With his passion for health sciences, he has also served as an undergraduate research assistant in Qing-Hui Chen's Cardiovascular Physiology lab in Kinesiology.

A well-rounded and creative person, his passion for writing led to his recent essay, "Je t'aime," being accepted for publication by Free Spirit publishers in their book *Love Stories*. The essay is about taking chances, developing independence, and finding love.

On top of this scholarly endeavors, Christian has also repeatedly embrace opportunities as a student mentor. He has served as a peer coach in Michigan Tech's Writing Center; a resident assistant with Residence Education; Husky Connect Mentor with the Center for Diversity and Inclusion; and a mentor to fellow pre-health students.

*The **PHF has helped tremendously in my journey** as a pre-med student at Michigan Tech with the internship award. I was able to gain valuable knowledge, and to experience medicine from a different perspective by shadowing at the health department. The award helped me get the experience of shadowing the amazing people that I met and helped support me in the very expensive and arduous process of applying to medical school.*

LAMIA ALAM

Graduate Assistantship Spotlight

PHD CANDIDATE,
APPLIED COGNITIVE SCIENCE &
HUMAN FACTORS

Lamia Alam joined the Department of Cognitive and Learning Sciences at Michigan Tech in 2018. The Graduate School invited her to share her experiences in her own words:

I come from Dhaka, the heart of beautiful Bangladesh where I obtained a BS in computer science and engineering from the Military Institute of Science and Technology. I was very keen to understand how to make human-system interaction more efficient, and therefore I started my journey for graduate studies in the Department of Cognitive and Learning Sciences at Michigan Tech in the summer of 2018. I completed my master's degree in Applied Cognitive Science and Human factors in 2020 and currently, I am pursuing my Ph.D. in the same department under the supervision of Dr. Shane T. Mueller. I recognize myself as a human factors researcher working closely in the interdisciplinary area of public health, artificial intelligence (AI), and cognitive psychology.

I am exploring the human factors issues in patient-AI interactions within the context of diagnostic healthcare. Working on my master's thesis, I found the empathetic aspects are important in physician-patient communication and it may have some prospects within AI-patient communication as well. While it is very challenging to incorporate cognitive empathy elements within an artificial agent, I started thinking about how this issue can be addressed and chose these research questions to pursue my dissertation, I have extracted cognitive empathic elements of patient-physician communication by interviewing first-time mothers to understand their interactions with their physicians and midwives. Currently, I am examining the effectiveness of these elements within the context of patient-AI communication. My research objective is to bridge the gap between patient and AI using cognitive empathy elements, develop common ground in patient-AI communication, and help people trust the available AI resources.

I am extremely grateful to the Portage Health Foundation (PHF) for acknowledging my work with patient-physician communication by awarding me the graduate assistantship for Summer 2022. ***With this assistantship, I believe I will make good contributions to the health research for the community*** *by developing resources for expecting mothers based on my research so that they may build a rapport with their providers. The assistantship will also help me to exclusively focus on my dissertation and work towards achieving my goals.*