8th Annual (Virtual) Meeting
June 24-25, 2021
MPS Leadership 2020-2021

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Technology Chair & Web Master
Wayne State University
12:00 pm – 1:00 pm  TRAINEE PHYSIOLOGY QUIZ CHALLENGE

12:00 pm  Preliminaries
12:35 pm  Finals (top 3 teams from prelims)

2:00 pm – 4:00 pm  FEATURED SYMPOSIUM

"Research and Teaching during COVID-19: Challenges, Opportunities, and Lessons Learned"

2:00 pm  Opening Remarks - John Durocher and Steve Elmer

2:10 pm  Featured Student Presentation
Isaac Wedig, Michigan Technological University
“Exercise is medicine on campus at Michigan Tech: Promoting physical activity during the COVID-19 pandemic.”
Student moderator: Carmen Scarfone, Michigan Technological University/Lake Superior State University

2:20 pm  Thematic Poster Session

Attendees select break out room of choice

Breakout Room #1:
Kelly Hoehing, Central Michigan University
“Impact of wearing a face mask on peak values obtained from a graded exercise test.”

Breakout Room #2:
Colleen Toorongian, Purdue University Northwest
“Chassell fitness trails project: Removing barriers to exercise.”

Breakout Room #3:
Madison Blankenship, Lakeland University
“The use and effectiveness of coping strategies among physical therapists during the COVID-19 pandemic.”

Breakout Room #4:
Carmen Scarfone, Michigan Technological University/Lake Superior State University
“Promoting physical activity during the COVID-19 pandemic: A call to action for Michigan Physiological Society students and trainees.”
Breakout Room #5:
Isaac Wedig, Michigan Technological University
“Collaborative group testing implemented online using Zoom.”

Breakout Room #6:
Travis Wakeham, Michigan Technological University
“Teaching anatomy and physiology during the pandemic.”

3:00 pm **Featured Student Presentation**
Makenzie Rajewski, Alma College
“Exercising virtually during the pandemic and beyond: The Community Adult Fitness Program.”
Student moderator: Greg Miodonski, Michigan Technological University

3:10 pm **Movement Activity Break!**
Sitting more and moving less during the pandemic? During this session, student teams will help us take a break from sitting to promote good health!

Get “UP and Moving” with Michigan Tech
Promoting “Exercise is Medicine On Campus” at Central Michigan University
Virtual Training with Alma College

3:30 pm **Round Table Discussion** – COVID-19 Lessons Learned AND Moving Forward
This round table session will take place in small breakout rooms. Moderators will lead a guided 20 minute discussion. Audience members will select their breakout room of choice and remain in that breakout room for the duration of the session. At the end of the breakout room session, panelists will report out their lessons learned and strategies for moving forward.

*Breakout Room #1 – “Moving research forward during the pandemic”*
Faculty Moderators - John Durocher (Purdue Northwest University), Alex Montoye (Alma College), Steve Elmer (Michigan Tech)
Overview: The pandemic has posed an enormous challenge for conducting research. This session will discuss tips for navigating the IRB process, COVID-19 laboratory protocols, considering remote research, teaching-focused research, and strategies to continue scientific development.

*Breakout Room #2 – “Teaching and learning during the pandemic and beyond”*
Faculty Moderators - Beth Zimmer (Ferris State), Jennie Vranish (Alma College), Harold Bell (Central Michigan University)
Student Moderator - Audrey Plouffe (Alma College)
Overview: We will discuss how teaching and learning has been impacted by the pandemic, and how things may change moving forward. We hope students, instructors, and advisors will join us, as we think about higher education from all perspectives.

*Breakout Room #3 – “Taking the next step in your academic career during the pandemic”*

Faculty Moderators - Naveen Sharma (Central Michigan University), Brianna Harfmann (Alma College), Clint Fitzpatrick (Central Michigan University)

Overview: How did the pandemic impact your professional development and how did you adapt to obstacles? Whether you are an undergraduate student, graduate trainee, or current faculty member, you are invited to join us for this discussion. Topics may range from shadowing for pre-professional students, to applying for graduate school or even faculty positions.

3:55 pm  **Closing Remarks** - John Durocher and Steve Elmer
2021 MPS Distinguished Lecture
Friday, June 25, 2021
12:00 pm – 1 pm

James A. Pawelczyk, PhD
Associate Professor
Kinesiology and Medicine
Pennsylvania State University

“Human Limits to Exploring Mars”

It is our honor to present Dr. James A. Pawelczyk, our Keynote Speaker for the 8th annual Michigan Physiological Society meeting hosted virtually on Zoom. Dr. Pawelczyk is a distinguished physiologist, with an extraordinary history of contributions to the discipline of physiology across the domains of research, teaching, and service. He holds degrees from the University of Rochester, Pennsylvania State University, and University of North Texas.

Full Bio
James A. (Jim) Pawelczyk received Bachelor of Arts Degrees in Biology and Psychology from the University of Rochester in 1982, a Masters of Science in Physiology from Penn State University in 1985, and a Ph.D. in Biology (Physiology) from the University of North Texas in 1989. He completed a post-doctoral fellowship at the University of Texas Southwestern Medical Center at Dallas in 1992, then joined the faculty as an Assistant Professor of Cardiology and Bioengineering. In that capacity he served as the Director of the Autonomic and Exercise Physiology Laboratories and a founding member
of the Institute for Exercise and Environmental Medicine, a clinical research collaboration between UT Southwestern and Presbyterian Hospital of Dallas. In 1995 he joined the faculty of the Pennsylvania State University where he is now an Associate Professor of Physiology, Kinesiology and Medicine. He founded and directs the University's novel dual-title Ph.D. program in Clinical and Translational Sciences, and has received College and University awards for his contributions to the University's teaching and outreach missions.

Dr. Pawelczyk's research focuses on the dynamic regulation of blood pressure, and how disuse atrophy affects blood pressure regulation. Problems with moment-to-moment regulation of blood pressure lead to orthostatic intolerance, an inability to maintain adequate blood flow to the brain that affects as many as 500,000 Americans. The condition is routinely observed following spaceflight, which Dr. Pawelczyk has studied as a NASA funded investigator for the past six years. In 1995 he was selected as a Payload Specialist for the Neurolab space shuttle mission, and flew aboard STS-90 on the space shuttle Columbia in April and May of 1998. He logged 16 days and 6.4 million miles in space, circling the earth 256 times and conducting neuroscience experiments that addressed changes in the development of the nervous system, balance, blood pressure regulation, sleep, and control of movement during spaceflight.

Dr. Pawelczyk assists the formation of U.S. space life sciences strategy. He has testified before the United States Senate Subcommittee on Science and Space, and is an active member of the NASA Advisory Council's Research Subcommittee for Human Exploration, the National Research Council's Committee on Biological and Physical Sciences in Space, and the Institute of Medicine's Committee on Aerospace Medicine and Extreme Environments. The latter two are part of the National Academies, chartered by Congress to address critical national issues and give advice to the federal government and the public.
1:00 pm – 3:40 pm  TRAINEE PRESENTATION SESSION

1:00 pm  Devika Bahal  
“ADAP regulates multiple aspects of invariant natural killer T cell homeostasis and function.”

1:10 pm  Elissa Hult  
“Lyz2Cre+HBEGF-/- Mice Are Protected From Bleomycin-Induced Lung Fibrosis: Are MoAMs The Reason Why?”

1:20 pm  Sujuan Wang  
“Suppression of E4BP4 SUMOylation sensitizes mice to HFD-induced fatty liver disease by promoting lipid droplet formation.”

1:30 pm  Manas Warke  
“A cell culture model to investigate effects of soil-arsenic exposure through dermal contact.”

1:40 pm  Natasha Chinoy  
“Assessing student desire for professional skills development within the undergraduate science curriculum: a focus on teamwork.”

BREAK – 10 MINUTES  
Movement Activity Break!

2:00 pm  Jessica Bruning  
“Short-chain fatty acid induced glutamatergic activation in the hypothalamic paraventricular nucleus elicits sympathoexcitatory and pressor responses.”

2:10 pm  Xingian Chen  
“Periphery orexin system is altered in salt-sensitive hypertension.”

2:20 pm  Shivansh Desai  
“Quantifying the effects of the dicrotic notch on splanchnic sympathetic nerve activity in rat models.”

2:30 pm  Sarah Haidar  
“Expression of tissue plasminogen activator in the rostral ventrolateral medulla of physically active versus sedentary rats.”

2:40 pm  Emma Wodwaski  
“Potential increases in neuronal activity in subregions of the PVN in sedentary versus physically active rats evaluated through the use of manganese-enhanced MRI.”
BREAK – 10 MINUTES
Movement Activity Break!

3:00 pm  Ahmad Baiyasi
“Resident heart rate variability during cataract surgery.”

3:10 pm  Laura Chambers
“Sexual dimorphisms in hypertension-associated cerebrovascular damage.”

3:20 pm  Grace George
“Sympathetic nerve activity responses to glutamatergic excitation of the rostral ventrolateral medulla of sham and ovarectomized females.”

3:30 pm  Aditi Vyas
“Effects of 8-weeks mindfulness and stress management on neurocardiovascular and psychological outcomes: a preliminary analysis.”
“ADAP regulates multiple aspects of invariant natural killer T cell homeostasis and function.”

Devika Bahal, Trevor Gohl, Hyun Hee Lee, Rupali Das
Michigan State University

Invariant natural killer T cells (iNKTs) are innate T lymphocytes that are critical in modulating immune response in cancer, infection and inflammation. However, the mechanisms that regulate iNKT cell development and function are not fully known. In the current study, we demonstrate that adhesion and degranulation promoting adaptor protein (ADAP) is dispensable for iNKT cell thymic development but is required for their peripheral maintenance. Strikingly, ADAP-deficient (Adap−/−) mice have significantly reduced iNKTs in the periphery that is associated with decreased surface expression of the critical homing receptor (CXCR6), homeostatic proliferation and increased apoptosis. Consistently, Adap−/− iNKTs have markedly reduced expression of pro-survival factors (PLZF, ICOS, GATA-3 and Id2) but increased levels of pro-apoptotic molecules (Bax, Bad and Bim). Functionally, Adap−/− iNKTs have significantly reduced cytokine production and bystander immune cell activation as well as poor anti-tumor response, both in vitro and in vivo. In agreement with these findings, ADAP-silenced human iNKTs have remarkably impaired cytokine production and cytotoxicity against leukemia targets in vitro. Mechanistically, preformed transcripts for interleukin (IL)-4 and IFN-gamma as well as several microRNAs are reduced in Adap−/− iNKTs. Additionally, these cells exhibit reduced capacity to form conjugates and have diminished actin polymerization at the immunological synapse. Collectively, our findings establish a novel and pivotal role for ADAP in iNKT cell homeostasis and function.
“Resident heart rate variability during cataract surgery.”

Ahmad Baiyasi BS, Shibandri Das MD, Ferris Bayasi BS, and Faisal Ridha Al-Timimi MD.
Wayne State University

Purpose: To evaluate ophthalmology resident anxiousness and cardiovascular response by tracking resident heart rate (HR) when performing cataract surgery during their last year of residency.

Methods: A prospective analysis of 31 cataract cases, completed by PGY-4 residents at the Kresge Eye Institute in August and September 2020 was performed. Inclusion criteria for cases included all cataract cases performed by PGY-4 residents at the Kresge Eye Institute who downloaded the Heart Graph app supported by iOS. Residents with android mobile devices or any residents taking beta-blocking medications were excluded from the study. Informed consent was obtained from all residents who utilized the MOOFIT tracker and no incentives or penalties were utilized by the department during this study.

Results: Residents were divided by gender. Total HR mean (SD) was significantly elevated for female residents with a HR of 107.4(13.0) for females and 81.4(11.5) for males (P<0.0001). Further analysis also showed that female residents’ heart rate was significantly higher at the beginning and end of performing cataract surgery with P<0.0003 and P<0.0002, respectively. Female residents also had significantly higher minimum and maximum heart rates achieved than males (P<0.05).

Conclusion: Our study shows significant difference in peak and sustained HR response between female and male ophthalmology residents while performing cataract surgery. The cumulative effect of high HR on the overall health of residents, training in the surgical specialty of ophthalmology, needs further investigation.
"The use and effectiveness of coping strategies among physical therapists during the COVID-19 pandemic."

Madison J. Blankenship, Hunter L. Frisk, William P. Ebben
Lakeland University

The response of physical therapists (PT) to the coronavirus disease-2019 (COVID-19) have been studied in New York City1 and abroad.2,3 PURPOSE: This study examined the use and effectiveness of coping strategies of PT in the United States during the COVID-19 pandemic. METHODS: Seventy-six (Age = 54.9 ± 4.3 years) randomly selected members of the American Physical Therapy Association participated and provided informed written consent. The study was approved by the Institutional Review Board. This study used a validated hard-copy mailed survey instrument which contained open-ended and fixed choice questions. Quantitative data were analyzed with SPSS 27.0. Pearson’s correlation coefficients were used to assess the relationship between coping strategy frequency of use, and strategy effectiveness. Answers to open-ended questions were content-analyzed using inductive and deductive methods.4 Independently, raw data and higher order themes were generated using inductive analysis. These themes were compared until consensus was reached at each level of analysis. Then, deductive analysis was used to confirm raw data themes were present. RESULTS: Participants included 65 women and 11 men, from 31 states. Data revealed that frequency of use of specific coping strategies was highly correlated with the strategies’ effectiveness (r = 0.90, p ≤ 0.001). The coping strategies and their mean effectiveness were based upon a five-point Likert scale in which a higher number is indicative of higher efficacy. The top five most commonly reported coping strategies and their mean effectiveness include physical activity/exercise (n = 71, 4.55/5.00), family support (n = 66, 4.42/5.00), social support (n = 60, 4.32/5.00), spirituality (n = 57, 4.12/5.00), and distraction (n = 45, 3.78/5.00). Based on seven-point Likert scale questions in which a higher number indicates a higher ability to cope, participants reported their beliefs about how well they are able to cope with COVID-19 at work (6.07/7.00) and in their life in general (6.10/7.00). They also identified their ability to manage their physical (6.13/7.00), mental (5.85/7.00), and relational (5.90/7.00) health during COVID-19. A Likert scale in which a higher number is indicative of higher stress related to COVID-19, yielded an average score of 4.51/7.00 for the top seven stressors. DISCUSSION: Despite relatively high stress across a number of variables, on average PT used a variety of effective coping strategies. Physical therapists reported high levels of belief that they are able to cope and manage well their physical, mental, and relational health. Previous research on PT response to COVID-19 focused on recommendations for how to adapt in hospital settings,1 decrease the risk of disease transmission,2 and to provide operational suggestions.3 This is the first study to demonstrate that the most commonly used coping strategies are also likely to be the most effective.

CONCLUSION/RELEVANCE: Physical therapists can use these data as a guide for effective coping strategies. Despite significant COVID-19 related stress, on average, most PT cope well.
“Short-chain fatty acid induced glutamatergic activation in the hypothalamic paraventricular nucleus elicits sympathoexcitatory and pressor responses.”

Jessica R. Bruning, Ryan B. Ghannam, Greg J. Miodonski, Andrew D. Chapp, Stephen Techtmann, Zhiying Shan, Qing-Hui Chen
Michigan Technological University; University of Minnesota

Elevated sympathetic outflow is an important contributor to salt-sensitive hypertension. It’s been established that the paraventricular nucleus (PVN) of the hypothalamus regulates autonomic control of cardiovascular function, and increased PVN activity contributes to elevated sympathetic nerve activity (SNA) in salt-sensitive hypertension (SSH). Accumulating evidence indicates a correlation between gut microbial composition and hypertension. Interestingly, data also suggests there is an increased neural communication between the gastrointestinal tract and PVN neurons in hypertensive animals. Moreover, it’s been reported that a high salt diet significantly increased the production of microbial-derived metabolites, such as short chain fatty-acids (SCFAs). We have reported microinjection of acetate, a SCFA, into the central nucleus of amygdala, significantly increased SNA and arterial blood pressure (ABP). Our objective here was to determine the potential role of microbiota-produced SCFAs, acetate and lactate on PVN regulation of SNA and ABP. In anesthetized rats, microinjection with acetate or lactate (0.2 µmol/100nl, n=3~4) into the PVN produced significant increases in splanchnic and renal SNA and ABP (p <0.05~0.01), respectively. Also, pre-treatment of kynurenic acid (KYN, 7.2 nmole/100 nl), an ionotropic EAA receptor antagonist, significantly (p <0.05) attenuated the sympathoexcitatory responses evoked by either acetate or lactate. Moreover, our immunohistochemistry studies demonstrated NMDA receptor expression in pre-sympathetic PVN neurons with projections to the rostral ventrolateral medulla. These data suggest that activation of glutamatergic receptors expressed in the PVN, contribute to sympathoexcitatory and pressor responses elicited by SCFAs. Alterations of microbiota communities’ impact human host physiology and pathophysiology but a clear cause/effect relationship has yet to be established. Often researchers use fecal matter to determine a microbiome profile to make health inferences. While the mucosa-associated bacterial communities may be more informative regarding the impact on the host, little investigation into differences between fecal and mucosal bacterial communities has occurred. Gathering information about the microbiome from feces and making inferences to the host’s health may not be an optimal method. We extracted feces and mucosa tissue from the small intestine (SI), the location within the SI where absorption occurs. Bacterial composition was determined using 16S rRNA sequencing. Analysis of rat mucosal tissue from the SI (n=6) and feces (n=6) confirmed the bacterial community composition was significantly different (p =5.4x10-5) between the two locations. Collectively, this data supports the continuation into the investigation of mucosa bacteria-derived SCFA involvement in the increase in sympathetic outflow and SSH. Our next aim is to test the hypothesis that shifts in mucosa associated bacteria induce changes in SCFAs concentrations in circulation, which may underlie the neural mechanisms of increased sympathetic outflow in SSH.
Hypertension is a major risk factor for cerebral small vessel disease (CSVD), which increases stroke and dementia risk. Hypertension alters artery structure, impairing blood flow regulation and nutrient delivery to neurons. We previously showed angiotensin II (AngII)-hypertension in male mice reduces pial blood flow measured by scanning laser Doppler and causes inward hypertrophic remodeling in cerebral parenchymal arterioles (PAs). Epidemiological evidence suggests sex differences exist in CSVD, with large vessel damage occurring more in males and small vessel damage occurring more in females. We hypothesized hypertensive female mice would be protected from pial blood flow reduction and inward PA remodeling observed in hypertensive male mice. AngII-filled osmotic minipumps (800ng/kg/min, 4 weeks) were implanted in 16-18-week-old male C56BL/6 mice. Age-matched female mice received either an AngII dose that matches that in male mice (800ng/kg/min) or a dose (1200ng/kg/day) that produces similar blood pressure elevation. Sham mice served as control. Pial artery blood flow was measured in the frontal, parietal, and temporal areas of both brain hemispheres. After euthanasia, PAs were isolated and mounted on a pressure myograph for structure assessment by increasing intraluminal pressure from 3 to 120mmHg in 20mmHg increments. Data are presented as means ± SEM (n=6-9). PA data are reported at an intraluminal pressure of 40mmHg. Systolic blood pressure was elevated in AngII-treated male mice (sham: 133 ± 10, AngII: 181 ± 11mmHg; p<0.05) and in 1200ng AngII-treated female mice (sham: 146 ± 8, 800ng AngII: 161 ± 13, 1200ng AngII: 179* ± 7mmHg; p<0.05) vs sham. There was a sex difference in blood flow alterations during hypertension. Male AngII-treated mice had reduced flow in the parietal region (sham: 361 ± 19, AngII: 301 ± 9.A.U.; p<0.05) but not frontal (sham: 359 ± 19, AngII: 327 ± 11.A.U.; p=0.19) or temporal regions (sham: 292 ± 13, AngII: 284 ± 15A.U.; p=0.68) vs sham. AngII-treated female mice had reductions in pial flow in the parietal (sham: 403 ± 9, 800ng AngII: 336* ± 19, 1200ng AngII: 314* ± 33 A.U.; p<0.05), frontal (sham: 378 ± 7, 800ng AngII: 314* ± 13, 1200ng AngII: 279* ± 24 A.U.; p<0.05), and temporal (sham: 338 ± 8.4, 800ng AngII: 273* ± 11, 1200ng AngII: 278* ± 25 A.U.; p<0.05) regions vs sham. PAs from male AngII mice had reduced outer diameter (sham: 56 ± 3, AngII: 46 ± 2m; p<0.05) but not frontal (sham: 359 ± 19, AngII: 327 ± 11.A.U.; p=0.19) or temporal regions (sham: 292 ± 13, AngII: 284 ± 15A.U.; p=0.68) vs sham. AngII-treated female mice had reductions in pial flow in the parietal (sham: 403 ± 9, 800ng AngII: 336* ± 19, 1200ng AngII: 314* ± 33 A.U.; p<0.05), frontal (sham: 378 ± 7, 800ng AngII: 314* ± 13, 1200ng AngII: 279* ± 24 A.U.; p<0.05), and temporal (sham: 338 ± 8.4, 800ng AngII: 273* ± 11, 1200ng AngII: 278* ± 25 A.U.; p<0.05) regions vs sham. PAs from male AngII mice had reduced outer diameter (sham: 56 ± 3, AngII: 46 ± 2m; p<0.05), lumen diameter (sham: 47 ± 1, AngII: 40 ± 2m; p=0.05), and wall area (sham: 719 ± 115, AngII: 405 ± 24m2; p<0.05) vs sham, reproducing previous findings. PAs from AngII-treated female mice did not exhibit significant reductions in outer diameter (sham: 57 ± 3, 800ng AngII: 50 ± 5, 1200ng AngII: 47 ± 4m; p=0.17) or lumen diameter (sham: 49 ± 2, 800ng AngII: 43 ± 5, 1200ng AngII: 41 ± 4m; p=0.22, but showed a modest reduction in wall area (sham: 647 ± 64, 800ng AngII: 534 ± 78, 1200ng AngII: 439 ± 58m2; p=0.09) vs sham. These data suggest the mechanism of hypertension-induced vascular damage differs between sexes.
“Periphery orexin system is altered in salt-sensitive hypertension.”

Xinqian Chen, Huanjia Gao, Qinghui Chen, Zhiying Shan
Michigan Technological University

Brain orexin system plays a crucial role in the control of blood pressure and cardiovascular function, and hyperactivity of central orexin system function has been demonstrated to be implicated in the pathology of several form of hypertension including salt sensitive hypertension (SSH). However, whether or not peripheral orexin system activity is altered in SSH remains unknown. In this study, we compared plasma orexin A levels and adrenal orexin receptors including orexin 1 receptor (OX1R) and orexin 2 receptor (OX2R) expression in Dahl salt-sensitive (Dahl S) rats under high salt diets with their normotensive Dahl S cohorts. Seven-week-old male and age-matched female Dahl S rats were divided into two groups and were fed either a normal diet (NS, 0.4% NaCl) or a high salt diet (HS, 4%NaCl). Six weeks following different diet treatments, all rats were euthanized and their plasma orexin A levels were measured using ELISA. Their adrenal glands were collected and subjected to real time PCR for OX1R and OX2R mRNA measurements. The results showed that HS diet increased plasma orexin A levels in both male (HS: 6.97±0.98 vs. NS 4.34±0.95 pg/ml; n=3; p=0.053); and female (HS: 6.17±0.65 vs. NS: 3.65±0.15 pg/ml; n=4; *P<0.05) rats. No significant difference was observed in orexin A level between male and female rats in both NS and HS groups. We therefore performed the rest of the experiments using female Dahl S rats. In the female Dahl S rats, OX1R mRNA levels were increased by 3-fold (n=5; *P<0.05) and OX2R mRNA level was increased by 1.9-fold (n=5; *P<0.05) in HS diet treated rats compared to control rats. Immunohistochemistry assay showed that OX1R and OX2R are expressed in both adrenal cortex and medulla, and with higher expression in the adrenal medulla. In adrenal medulla, OX1R and OX2R are co-localized with tyrosine hydroxylase, an enzyme that catalyzes the first and rate limiting step in the synthesis of catecholamines including norepinephrine. These results coupled with the evidence that plasma norepinephrine levels are increased in HS loaded Dahl S rats suggests that increased orexin system activity in the adrenal gland may increase norepinephrine production and its subsequent release, therefore contributing to the development of SSH. Further studies will be performed to investigate whether blockage of the adrenal orexin receptors will decrease norepinephrine level and prevent or attenuate SSH in Dahl S rats.
“Assessing student desire for professional skills development within the undergraduate science curriculum: a focus on teamwork.”

Natasha Chinoy, Hayden Stoub, Yvonne Ogrodzinski, Katelyn Smith, Devika Bahal, John Zubek
Michigan State University

Professional skill development has emerged as an increasingly important facet of undergraduate training, specifically within science curricula. The demand for these skills has been driven by employers and graduate/professional schools, and to this end, instructors in higher education have begun to integrate professional skill development into their course design and student learning goals. However, the attitudes of students themselves on the importance of different professional skills, the inclusion of these skills in their coursework, level of improvement and end confidence has yet to be thoroughly characterized. Here we detail these attitudes in biomedical science undergraduates at Michigan State University. By using the Science Student Skills Inventory (SSSI), a previously validated assessment tool, we observed differences in student perceptions of professional skills when compared to previous SSSI studies. We also observed significant differences in attitudes between age groups in respect to writing and communication skills, differing perceptions of what constitutes teamwork, as well as gender differences in respect to attitudes around communication and ethical thinking skills. Our results give valuable insight into student perspectives on how professional skills are developed in their program. These data may be used to inform curriculum development within and across institutions.
“Quantifying the effects of the dicrotic notch on splanchnic sympathetic nerve activity in rat models.”

Shivansh Desai, Patrick J. Mueller
Wayne State University

Information related to the prevailing level of arterial pressure (AP) is communicated from the aortic arch and carotid sinuses to the brain by way of baroreceptors, which are responsive to vascular stretch. Baroreceptor afferent neurons synapse in the nucleus tractus solitarius (NTS) of the medulla. Downstream, tonically active neurons in the rostral ventrolateral medulla (RVLM) synapse on sympathetic preganglionic neurons, which in turn excite postganglionic sympathetic nerve fibers. Postganglionic sympathetic nerve fibers stimulate the heart to increase cardiac output and peripherally they promote vasoconstriction to maintain AP. Via the baroreceptor reflex, acute blood pressure changes occurring with each cardiac cycle produce cyclical increases and decreases in sympathetic nerve activity (SNA), known as sympathetic bursts. In addition, the AP waveform during a single heartbeat includes a segment referred to as the dicrotic notch, an event which occurs when the rapid fall in AP due to ventricular relaxation, is interrupted by the closure of the aortic valve and is then followed by a slower, more gradual fall in AP. However, it is unknown whether the hemodynamics associated with the dicrotic notch are faithfully communicated to the brain to the extent that the specific AP waveform detected by the baroreceptors influences the shape and amplitude of the resultant SNA bursts. The purpose of this new study is to test the hypothesis that baroreceptors faithfully relay AP waveform patterns before and after the dicrotic notch and that recordings of splanchnic SNA (SSNA) will reflect these patterns in the sympathetic bursts in response to the cardiac cycle. To this end, we will examine experiments from anesthetized, male Sprague Dawley rats outfitted with indwelling catheters to measure beat-by-beat AP over time. SSNA was measured and quantified as sympathetic bursts from 4-week-old male rats. Influences of the waveforms before and after the dicrotic notch on SSNA bursts will be quantified in the number of peaks occurring per burst and by analyzing the events in the AP waveform and SNA burst as estimates of conduction time. I expect to see multiple peaks in recorded sympathetic bursts. I also expect to see a widening of individual sympathetic bursts due to staggered recruitment of vasoconstrictor neurons caused by events associated with the shape and timing of the dicrotic notch. These results would imply that SSNA does not simply increase proportionately to the absolute decrease in MAP during the cardiac cycle. Rather SSNA increases and decreases in a pattern that mirrors the waveforms surrounding the dicrotic notch. The successful utilization of this analysis methods is expected to enable us to make further comparisons including comparison at baseline SNA in intact male and female rats, and in ovariectomized female rats before and after the onset of the female estrous cycle. The goal of our studies is to determine if female hormones have an attenuating effect on the relationship between the waveforms produced by the dicrotic notch and resultant SSNA. (Supported by HL096787)
Cardiovascular disease (CVD) is the leading cause of death globally and one of the major risk factors for CVD is high blood pressure. Strong evidence supports physical inactivity as one of the leading modifiable factors for CVD. Risks of CVD are also lower in young women compared to age-matched men, possibly due to protection afforded by ovarian hormones. For example, women have lower blood pressure than men but following menopause, they are at high risk for hypertension. Blood pressure is controlled by a region of the brainstem known as the rostral ventrolateral medulla (RVLM), which directly regulates vasoconstriction via the sympathetic nervous system. In previous studies from our laboratory, four-week-old female rats exhibited surprisingly greater sympathoexcitation following activation of the RVLM when compared to age-matched males. Although these data suggest inherent sex differences prior to the start of the estrous cycle, the contribution of endogenous ovarian hormones to sympathoexcitation produced by direct activation of the RVLM is currently unknown. The purpose of our study was to examine the influence of endogenous ovarian hormones on sympathoexcitation produced by activation of the RVLM. We hypothesized that ovariectomy in female sedentary rats would produce enhanced centrally-mediated sympathoexcitation by activation of the RVLM when compared to intact (sham-operated) female, sedentary rats. We also predicted that physically active conditions would offset the loss of ovarian hormones and blunt centrally-mediated sympathoexcitation by the RVLM in ovariectomized (OVX) active, females compared to OVX sedentary, females. In our preliminary studies, female Sprague-Dawley rats underwent OVX or sham surgical procedures at 5-6 weeks of age. Following recovery, active rats were placed in cages with 24-hr access to running wheels and sedentary rats were placed in cages without access to running wheels. At 16 weeks of age, splanchnic sympathetic nerve activity (SSNA) and blood pressure were recorded from Inactin-anesthetized, sham-operated or OVX, active or inactive females (n=2 ea). Microinjections of glutamate [30 nl] at 100 mM were performed in the RVLM. Our preliminary data indicated that glutamate microinjected into the RVLM increased SNA in all groups but appeared to produce a greater increase in SNA in OVX sedentary versus sham-operated sedentary rats (2.2+0.9 mV vs. 0.9+0.3 mV, respectfully). In contrast, glutamate produced a greater increase in SNA in active sham-operated versus OVX rats (1.9+0.1 mV vs. 1.0+0.1 mV, respectfully). Our results suggest that ovarian hormones appear critical to RVLM neuroplasticity and attenuate glutamatergic excitation in sedentary but not active females. They also demonstrate the complexity of sedentary lifestyles and the loss of female reproductive hormones in contributing to risks of CVD and hypertension.
“Expression of tissue plasminogen activator in the rostral ventrolateral medulla of physically active versus sedentary rats.”

Sarah W Haidar, Bozena E Fyk-Kolodziej, and Patrick J Mueller
Wayne State University

The rostral ventrolateral medulla (RVLM) is an integrative region in the brainstem containing sympathoexcitatory neurons that control blood pressure by regulating sympathetic nerve activity. The regulation of sympathetic activity is crucial in maintaining long-term cardiovascular health but likely also contributes to cardiovascular disease, the leading cause of death. RVLM neurons adapt structurally and functionally in response to sedentary or physically active conditions. For example, previous studies from our laboratory show that RVLM neurons of sedentary animals have increased dendritic branching compared to physically active animals, suggestive of greater excitability in inactive conditions. Dendritic branching is regulated by brain-derived neurotrophic factor (BDNF). BDNF is initially synthesized in its pro-form, proBDNF, before undergoing proteolytic cleavage to release its mature form, mBDNF. Unpublished studies from our laboratory indicate that chronic physical activity increases proBDNF in subregions of the RVLM; whereas, mBDNF is higher in subregions of the RVLM following sedentary conditions. The conversion of proBDNF to mBDNF is facilitated by the serine protease, tissue plasminogen activator (tPA). It is possible that differences in expression of tPA in the RVLM contributes to physical activity- and inactivity-induced neuroplasticity. The purpose of this ongoing study is to determine whether physically active or sedentary conditions affect the expression of tPA in the RVLM. We hypothesize that the rate of conversion from proBDNF to mBDNF will be decreased in physically active versus sedentary animals as reflected by decreased tPA levels in the RVLM of active animals compared to sedentary animals. To test this hypothesis, we will divide 4-week-old male Sprague-Dawley rats into two groups: Physically Active (24-hour access to in-cage running wheel, n=6) and Sedentary (no running wheel, n=6), that are housed for 12 weeks. Rats will be sacrificed for fresh tissue removal, and the brainstems will be cryosectioned at 80 μm. Serial sections will be collected on uncoated slides. Bilateral tissue punches will be retrieved from cryostat sections and placed in centrifuge tubes containing lysis buffer and protease inhibitors. Post-punched sections will be stained with cresyl violet to determine the location of the RVLM relative to the caudal pole of the facial nucleus. Punches will be pooled for western blotting to examine the expression levels of tPA using validated antibodies. Since our previous studies indicate that physically active rats have decreased mBDNF levels in the RVLM compared to sedentary rats, we expect that tPA levels will be lower in active versus sedentary rats. Decreased tPA levels in physically active individuals could translate to decreases in mBDNF, leading to decreased dendritic branching and lowered sympathetic nerve activity. Alternatively, increased tPA levels in sedentary individuals could translate to increases in mBDNF, dendritic branching, and sympathetic nerve activity. Increases in sympathetic nerve activity are associated with increased blood pressure and higher rates of cardiovascular disease in individuals leading a sedentary lifestyle. In contrast, decreased sympathetic nerve activity could potentially lower blood pressure and reduce the prevalence of cardiovascular disease in individuals leading a physically active lifestyle. (HL096787)
“Impact of wearing a face mask on peak values obtained from a graded exercise test.”

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BACKGROUND: Graded exercise testing (GXT) is a fundamental component of the diagnosis/treatment of patients with suspected/known cardiovascular disease (CVD). Due to the current pandemic patients must wear a facemask when performing a GXT. However, the impact of wearing a face mask on GXT outcomes has not been evaluated in individuals at risk of developing CVD. PURPOSE: To examine potential differences in outcomes from a GXT performed with vs. without a facemask among moderate risk adults. METHODS: Using a randomized, crossover study design, 16 overweight (28.0 ± 5.3 kg/m²), adults (57.4 ± 3.9 years) classified as “moderate” risk for the development of CVD based on age, participated in two nearly identical experimental trials (i.e., wearing a facemask vs. no facemask). Each trial included a treadmill GXT using the Modified Bruce Protocol where peak speed, grade, heart rate (HR), and rating of perceived exertion (RPE) were collected. Treadmill speed and grade during the last completed stage of each GXT were used to calculate estimate maximal oxygen consumption (VO2peak) and peak METs (VO2peak/3.5).

RESULTS: Total exercise time (17:10 ± 2:04 vs. 15:58 ± 1:51 p=0.0005) and peak heart rate (170 ± 11 bpm vs. 164 ± 11 p=0.01) were higher under no facemask vs. facemask conditions. Additionally, peak speed (3.9 ± 0.6 vs. 3.5 ± 0.5 mph, p=0.004), grade (15.1 ± 1.5 vs. 14.3 ± 1.2, p=0.004), and thus estimated VO2peak (42.3 ± 8.9 vs. 36.8 ± 6.6 ml/kg/min, p=0.005), and estimated METs (12.2 ± 2.6 vs. 10.5 ± 1.9 p=0.005) were higher under no facemask vs. facemask conditions. However, peak RPE was similar between the no facemask vs. trial (18.1 ± 1.3 vs. 18.3 ± 1.2, p=0.84).

CONCLUSION: Despite participants reporting a similar peak effort, these findings indicate that facemask use during a GXT results in lower peak values, potentially affecting the diagnosis and prognosis of patients with known or suspected CVD.
“Lyz2Cre+HBEGF-/- mice are protected from bleomycin-induced lung fibrosis: are MoAMs the reason why?”

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Introduction: Idiopathic pulmonary fibrosis (IPF) is characterized by alveolar epithelial cell injury, deposition of extracellular matrix, and chronic inflammation consisting of monocytes and macrophages. Monocyte-derived alveolar macrophages (MoAMs) drive lung fibrosis via unknown mechanisms. Heparin-binding epidermal growth factor-like growth factor (HBEGF) has essential roles in angiogenesis, wound healing, keratinocyte migration, and epithelial-mesenchymal transition but a nuanced role in fibrotic and inflammatory diseases, requiring further study.

Methods: We examined bleomycin-induced fibrosis in Lyz2Cre+HBEGF-/- compared to wild type Lyz2Cre+ mice (WT) and quantified lung fibrosis. We characterized specific macrophage populations after 7, 14, or 21 days of bleomycin-induced fibrosis in WT and Lyz2Cre+/+HBEGF-/- mice by flow cytometry. We isolated bone marrow-derived macrophages (BMDMs) and polarized some in the presence of the HBEGF receptor inhibitor, Erlotinib (1uM) in vitro.

Results: Lyz2Cre+HBEGF-/- mice are protected from bleomycin-induced fibrosis. HBEGF-/- mice have decreased amounts of hydroxyproline, decreased levels of collagen 1, collagen 3, and fibronectin mRNA transcript, lessened interstitial thickening, and increased day 21 survival compared to Lyz2Cre+ animals. Interestingly, in vitro administration of recombinant mouse HBEGF (rHBEGF) showed both profibrotic and antifibrotic effects. rHBEGF increased fibroblast migration in a concentration-dependent manner but had marginal effects on fibroblast proliferation and expression of collagen 1, alpha-smooth muscle actin, and periostin, suggesting decreased concentration of HBEGF in the lung milieu of HBEGF-/- animals is not the sole cause of protection. To explore if HBEGF intrinsically alters macrophages, we isolated BMDMs from HBEGF-/- and WT animals and treated each with Erlotinib. Although Erlotinib robustly decreased Fizz1 as well as IL10 expression in the BMDMs, there was no functional difference in fibroblast migration or protein expression in fibroblasts that received control BMDM supernatant and those that received BMDM supernatant+Erlotinib. We compared relative abundance of resident and recruited macrophages in WT and Lyz2Cre+HBEGF-/- mice using flow cytometry. Despite similar numbers of lung macrophages at baseline, HBEGF-/- mice have nearly 50% fewer lung macrophages present at both day 7 and day 21 post-bleomycin treatment. This suggests differences in susceptibility to bleomycin between the genotypes may be rooted in the overall presence of fibrotic lung macrophages, which in turn could be the result of differences in local proliferation, regional migration, or apoptosis. Recent work by Joshi et al. (2020) demonstrated that signaling through the macrophage colony-stimulating factor 1 (MCSF) receptor pathway helps control self-maintenance and persistence of moAMs after fibrotic lung injury. As such, we investigated this pathway in the HBEGF-/- mice post-bleomycin and found that lung homogenate and profibrotic macrophages taken from these mice have decreased levels of MCSF and CSF1R. These preliminary results may imply reduced MCSFR signaling in the moAM population is the source of protection in the HBEGF-/- mice.

Conclusions: Myeloid HBEGF regulates development of lung fibrosis, but we do not yet know the mechanism of action. Our data suggest differences in lung macrophage numbers (proliferation, migration, and/or apoptosis) are likely drivers of HBEGF-mediated lung fibrosis and that these differences may be attributable to alterations in the MCSF/MCSFR signaling pathway within the moAM population.
“A cell culture model to investigate effects of soil-arsenic exposure through dermal contact.”

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Rice is a staple food for more than three billion people around the world. It is one of the most important commercial food crops. There have been reports of rice in the US containing four times more Arsenic (As) compared to other regions. The extensive use of arsenical pesticides until 2010 in the U.S. has led to the accumulation of As in soil. Soil contamination with toxic elements including arsenic from pesticides and wood preservatives have been reported for the Great Lakes region including Michigan. Arsenic is a Class I carcinogen that causes cancers of the lungs, kidneys, skin, and prostate. It is also linked to diabetes, obesity, and various cardiovascular diseases. Arsenic exposure through rice is the second major source of As to humans and is a major concern. Arsenic accumulation in rice takes place due to high levels of As in the agricultural soils, especially in the southern states of the US. Arsenic in the soil can be taken up by rice leading to exposure through ingestion. However, there is also the risk of direct exposure to soil-As that remains understudied. Currently, only the European Union has set an advisory safety limit of 20 mg/kg for soil-As; no other environmental or health organization has recognized As exposure from the soil as a threat to human health. There are no studies that report the effect of soil-As on cellular morphology, biochemical pathways, and gene expression. This is due to the lack of a working model to extract the bioavailable As from soil to simulate real-life conditions. This work is a pilot study on the effect of soil-As on healthy Human Immortalized Keratinocyte (HaCaT) cells as a model. The experiments were performed by combining soil chemistry and cell culture techniques.

The skin cell fractionation model was based on extracting the water-soluble fraction of As from Immokalee soil, a sandy soil from Florida with low As retention capacity. The extracted water-soluble As was exposed to the keratinocytes (HaCaT). The treatments were based on 10-year use of arsenical-pesticides, four treatments of soil-As (45, 225, 450, and 900 mg/kg), and two controls – Negative control (Pure media) and Positive control (0 mg/kg As-soil). Cell viability, cell migration, wound healing, and protein expression was observed.

Low levels of soil-As (45 mg/kg) did not affect cell viability, migration, and protein expression. With an increase in the As levels at 225 mg/kg, 450 mg/kg, and 900 mg/kg the cell viability decreased. Protein expression was altered at higher concentrations of As indicating the toxic effect of soil-As and the possible carcinogenic impact of As in soil through direct contact. The cell model developed can be used to study the effect of soil-As exposure using keratinocytes. Through a systematic study of the various possible exposure routes, we will gain a better understanding of the effects of soil-As on human health. Identification of the pathways that are affected by soil-As exposure will further aid in a better understanding of the hazards of such exposures, prevention, and mitigation strategies.
“Exercising virtually during the pandemic and beyond – The Community Adult Fitness Program.”

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Introduction: Low-income individuals and those with chronic disease are less likely to engage in structured exercise despite the potential benefits, and COVID-19 has exacerbated this situation. Our study pilot tested a fully virtual, home-based, supervised exercise program to assess acceptability, adherence, and change in health/fitness markers during the pandemic. Methods: Participants (n=8 [7 female]; age 57.5±13.8 years, body mass index = 38.2±8.0 kg/m2), all of whom were low income or had chronic disease (e.g., kidney disease, heart disease, diabetes) completed a 12-week exercise training program called the Community Adult Fitness Program. Originally designed to be in person, the program had to be moved to a virtual format due to the COVID-19 pandemic. Exercise training sessions took place on Microsoft Teams video meeting software, and all participants were given a yoga mat, resistance bands, and 3-10 lb. free-weight dumbbells. Participants attended 2 sessions/week for 60 minutes/session, completing both aerobic and resistance training portions. Sessions were guided by trained collegiate health science students and were tailored to individual goals and health needs. At baseline and post intervention, fitness (body mass index, waist/hip ratio, step test, chair stand test, arm curl test, sit-and-reach test, back scratch [shoulder flexibility] test, and timed up-and-go), mental health (NEF, ONS, PHQ-9), and physical activity (wrist-worn accelerometer) measures were taken and compared using paired-samples t-tests. For comparison, a control group (n=8 [7 female], age 53±11.6 years, body mass index 29.2±5.3 kg/m2) continued normal activity but also completed the fitness, mental health, and physical activity measures at baseline and post-intervention. Results: Adherence (72.9%) and acceptability of the exercise program were high, and no injuries were associated with the program. Intervention and control groups both improved in most fitness measures, although magnitude of change was largest in the intervention group. Intervention participants lost an average of 3.1 kg, 1.2 kg/m2 in body mass, and had a 3% decrease in waist/hip ratio. Additionally, step test performance improved by 16%, arm curls by 21%, chair stands by 16%, and timed up-and-go by 9%. In contrast, control participants had no change in body composition measures but did see fitness improvements (12% in step test, 11% in arm curl test, 7% in chair stand test, no change in timed up-and-go). Improvements in the intervention group are similar in magnitude to an in-person fitness program offered in previous years. Flexibility was not improved in either group. Mental health improved in both groups, and to a similar extent. For physical activity assessment, the intervention group trended toward being less active after completion of the intervention than at baseline. In contrast, the control group became more active across the study protocol. Conclusion: Virtual, at-home exercise training can be conducted safely and effectively for low income, high risk individuals with chronic disease. Additionally, such programs may provide a strategy to get individuals active who likely would not be on their own. Virtual training can be employed beyond the pandemic to reach individuals who may not have access to equipment or facilities to exercise.
“Exercise is medicine on campus at Michigan Tech: promoting physical activity during the COVID-19 pandemic.”

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During the COVID-19 pandemic, physical activity levels have decreased by ~30% and sitting time has increased by ~30%. Recent call to actions by the ACSM and Physiological Society have urged widespread promotion and implementation of physical activity to keep communities healthy. PURPOSE: We leveraged Exercise is Medicine on Campus (EIM-OC) to promote healthy living behaviors in our rural community during the pandemic. Specifically, we aimed to: 1) assess current physical activity levels of adults in the community, 2) increase public awareness about staying physically active during the pandemic and 3) offer a community physical activity program.

METHODS: A team of kinesiology students (n=10) led our EIM-OC initiative. Levels of physical activity were assessed in the community through an online survey. Public awareness about physical activity was promoted through an infographic, virtual town hall, and discussion with health care providers. A virtual physical activity program was delivered weekly (3x/wk) through ZOOM and social media and included live workouts consisting of home-based activities (e.g., aerobic exercise, resistance exercise using common household items, yoga).

RESULTS: Forty-nine adults (44±18yrs, 28±8BMI) responded to the survey. Majority of adults (65%) reported that they were less physically active during the pandemic and 50% indicated that they had been encouraged by a health professional to remain physically active. Our public health message of remaining physically active during the pandemic was communicated through a website, email, radio, newspaper, social media, and state health department. A total of 132 guided virtual workouts (30-60 min) were delivered to a broad range of adults including healthy individuals and those with reduced mobility. The physical activity program was also expanded to create a University-wide physical education course (50 students, 1 credit). For our efforts to create a culture of wellness on campus during the pandemic, Michigan Technological University earned a silver level designation and COVID Conquer badge from the Exercise is Medicine On Campus program.

CONCLUSION: Adults in our rural community reported that they were moving less and not well informed about the importance of staying physically active during the pandemic. As local health departments are currently overburdened with managing COVID-19, it is imperative for exercise specialists to help facilitate and communicate the importance of physical activity. EIM-OC enabled us to deliver physical activity resources quickly and effectively and keep our community physically active during the pandemic.
“Promoting physical activity during the covid-19 pandemic: a call to action for michigan physiological society students and trainees”

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To date, there are over 176 million reported cases of COVID-19 and 3.8 million deaths across more than 200 countries worldwide. As more information about the novel coronavirus continues to evolve, the important role that regular physical activity plays in combating COVID-19 has become increasingly evident. Our purpose was to: 1) review the available evidence on the protective role of physical activity against COVID-19 and 2) call upon Michigan Physiological Society (MPS) students and trainees to act by promoting physical activity during the pandemic.

Accumulating evidence indicates that regular physical activity can reduce the risk for severe COVID-19 outcomes in those individuals who become infected with the virus. Sallis and colleagues (2021) reported that patients with COVID-19 who were physically active (≥150 min/week) were less likely to be hospitalized, admitted to the ICU, and die compared to those who were physically inactive (<10 min/week). Similarly, Cho and colleagues (2021) reported that the association between physical activity level and risk for severe COVID-19 outcomes was dose-dependent with a lower risk of mortality in individuals who were more physically active. Related work by Cunningham (2021) demonstrated that counties across the United States that were more physically active had fewer COVID-19 deaths. Moreover, other than advanced age and organ transplant history, physical inactivity is the strongest risk factor for severe COVID-19 outcomes, more so than smoking, hypertension, obesity, heart disease, diabetes, and cancer.

Aside from vaccination and basic strategies to reduce viral transmission (i.e., hand washing, social distancing, mask wearing), engaging in regular physical activity may be the single most important action that can be taken to enhance COVID-19 resilience. Because it may take considerable time for widespread vaccinations and for populations to reach levels of herd immunity, it is imperative that physical activity be promoted and implemented immediately to help keep individuals and their communities safe and healthy.

We call upon MPS students and trainees to do their part and take the following actions: 1) promote the importance of staying physically active by encouraging a family member or friend to go for a walk, 2) share this new evidence with the University student health clinic, and 3) join the larger critical mass calling for the Centers for Disease Control and Prevention to identify physical inactivity as a risk factor for severe COVID-19 outcomes. For substantial health benefits adults should engage in at least 150 min of moderate-to-vigorous intensity physical activity each week (~20 min/day) and limit time spent sitting. Importantly, any amount of activity, even below the ideal range, provides health benefits as well as protection against severe COVID-19 outcomes. Now, with more evidence that physical activity can reduce the severity of COVID-19 and increase survival rate, promoting behaviors that increase physical activity during the pandemic is paramount. As future leaders in health science and healthcare, we urge you to help us move this evidence into practice.

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“Chassell fitness trails project: removing barriers to exercise.”

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The Chassell Fitness Trails was a project started in the summer of 2019, and will be fully completed by the end of Summer 2021. The purpose of this project is to promote health and wellness in the local community by removing barriers to exercise. These barriers include tangible aspects such as high costs, as well as intangible aspects such as the anxiety of a crowded gym. Not only are the Chassell Fitness Trails free, they are accessible 24/7. You will find people on the trails year round skiing, snowshoeing, running, and biking, all while enjoying the natural beauty of the western upper peninsula of Michigan. The exercise stations and bridge replacement portions of this project were completed at a perfect time, just preceding gym closures stemming from the COVID-19 pandemic. Not only were people able to continue progress on their aerobic fitness, they were also able to maintain their resistance training regime, all while maintaining social distancing guidelines. It is currently estimated that approximately 600 people have utilized Chassell Trails in the last month. In addition the latest Facebook post has had 946 engagements, with 37 likes/loves, 8 comments, and 13 shares. Not only are we working on increasing awareness and promoting fitness in the local community, we are dedicated to ensuring safety. This includes safety regarding COVID-19, as well as proper usage of the equipment. We have already created a video which is posted on the Chassell Township website demonstrating proper techniques. We are now working to develop 18 x 24” signs for each station that will include the major muscle groups targeted by each exercise.
“Effects of 8-weeks mindfulness and stress management on neurocardiovascular and psychological outcomes: a preliminary analysis.”

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In recent years, non-pharmacological treatment methods have been viewed as more valuable in managing many cardiovascular and psychological conditions. Among these methods, mindfulness is up-and-coming in regard to managing stress, reducing anxiety, and improving the ability to decenter. Mindfulness based stress reduction (MBSR) is noted to reduce blood pressure, but the effects on muscle sympathetic nerve activity and arterial stiffness are unknown. The primary aim of this study was to compare the effects of 8-weeks MBSR and stress management education (SME) on neurocardiovascular outcomes such as systolic arterial blood pressure (SAP), diastolic arterial blood pressure (DAP), muscle sympathetic nerve activity (MSNA), and arterial stiffness in adults. The study also investigated the effects of these active interventions on state-trait anxiety, five facets of mindfulness, and decentering. A total of 10 participants with seated clinical blood pressure of more than or equal to 120/80 mmHg, and pre and post-study MSNA recordings, have completed the study so far. The participants were randomly assigned into either MBSR (n=5) or SME (n=5). In the laboratory testing sessions, the participants completed questionnaires on state-trait anxiety, decentering and five facets of mindfulness. Then their seated blood pressure was measured. Next, their arterial stiffness measurements were taken using applanation tonometry. Aortic augmentation index (Alx), aortic augmentation index @ 75 bpm (Alx @75), and carotid-femoral pulse wave velocity (cfPWV) were the variables measured for arterial stiffness. Finally, MSNA was measured using a technique called microneurography by inserting a tungsten microelectrode into the peroneal nerve in the right leg. The results of the preliminary analysis showed that there was no significant change in blood pressure (SAP & DAP), arterial stiffness (Alx, Alx @75, & cfPWV), or MSNA (bursts/minute & bursts/100 HB) in MBSR and SME groups after 8-weeks (p>0.05). Alx @75 (p=0.09) tended to be reduced after 8-weeks of the active MSBR and SME interventions. Results from the questionnaires showed a reduction in trait anxiety (p<0.01) after 8-weeks in MBSR Δ-8 ± 5 a.u. & SME Δ-4 ± 1 a.u. Scores on the five facets of mindfulness increased in the MBSR group Δ13 ± 9 a.u. and SME Δ7 ± 1 a.u. The participants also had improved ability to decenter after 8-weeks (p<0.04) of MBSR Δ2 ± 2 a.u. & SME Δ3 ± 2 a.u. The results of this study are preliminary, but suggest several positive responses to participating in active MBSR and SME. Both past research, and results of this study, have demonstrated that practicing mindfulness and stress management can reduce anxiety, and improve decentering and the five facets of mindfulness. This is the first study to our knowledge to assess MSNA and arterial stiffness before and after 8-weeks of MBSR and SME. However, further analysis with a larger sample size is required to conclude the effectiveness of these active interventions on neurocardiovascular outcomes.
“Suppression of E4BP4 SUMOylation sensitizes mice to HFD-induced fatty liver disease by promoting lipid droplet formation.”

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Background: Increased lipid droplet formation have been shown to attribute to excessive lipid accumulation within hepatocytes during high-fat diet (HFD)-induced non-alcoholic fatty liver disease (NAFLD). Our recent microarray analysis revealed reduced expression of lipid droplet binding gene, fat specific protein 27β (Fsp27β), in the liver of E4bp4 liver-specific KO (E4bp4-LKO) mice. Given the critical role of hepatic Fsp27β during the expansion of lipid droplet pool in promoting lipid accumulation in NAFLD, we set out to determine whether hepatic E4BP4 regulates lipid droplet formation and HFD-induced liver steatosis via Fsp27β. In addition, we discovered SUMOylation of E4BP4 by mass spectrometry and investigated how this post-translational modification of E4BP4 impacts lipid droplet formation process in hepatocytes.

Results: E4bp4-LKO mice exhibited decreased lipid accumulation in the liver despite similar body weight gain after 12 weeks of HFD feeding. Restoring E4bp4 expression was sufficient to induce lipid droplet formation and Fsp27β expression in E4bp4-LKO primary hepatocytes, Overexpression of Fsp27β increased lipid droplets and triglycerides in E4bp4-LKO primary mouse hepatocytes while promoting lipid accumulation in the liver of E4bp4-LKO mice after HFD feeding. To study the impact of hepatic E4BP4 SUMOylation, we generated E4BP4-5KR mutant, which failed to be SUMOylated in our in vitro SUMOylation assay. Transfection of hepatocytes with E4bp4-5KR vs. E4bp4-WT led to reduced droplet formation. Lastly, the abundance of SUMOylated E4BP4 was reduced in the liver of HFD-fed mice vs. regular chow-fed mice.

Conclusion: All together, our study demonstrated that deSUMOylated E4bp4 drives lipid droplet formation and liver steatosis in HFD-fed mice likely through its regulation of Fsp27β.
“Collaborative group testing implemented online using zoom.”

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Collaborative group testing can facilitate meaningful discussion, cooperation, and improved understanding of course material. While this format is used in face-to-face classroom settings, it is less clear if it can be adapted for online settings. With the rapid shift to online instruction because of the COVID-19 pandemic, we explored whether collaborative group testing could be implemented online through video conferencing. Our hypothesis was that online collaborative group testing would be feasible and effective for facilitating student learning. Students enrolled in five sections of an introductory kinesiology course (2018-2021) took exams individually and then immediately again in small groups (3-6 students). In total, 274 exams were taken in a face-to-face setting and 46 exams were taken online due to the COVID-19 pandemic. Online group exams were delivered using Zoom “breakout rooms”. Individual and group scores for each exam were evaluated along with student’s perceptions relating to the collaborative group testing format. Two-way mixed repeated measures ANOVA procedures were used to assess differences in exam scores and student perceptions. As expected, group exam scores were higher than individual scores (94±5% vs. 78±13%; P<0.05). Additionally, all students recommended that the collaborative group testing format be implemented in future courses. Of the students who completed group exams both in-person and online (i.e., Spring 2020), the majority strongly agreed (67%) that the level of interaction with group members and overall experience was similar. In summary, preliminary results suggest that collaborative group testing can be implemented online effectively, that it provides a similar experience compared to face-to-face implementation, and that it was favorably perceived by students.
Cardiovascular disease (CVD) is the leading cause of death globally. Factors including physical inactivity, sleep quality, stress levels, and body weight affect the development of CVD. The paraventricular nucleus of the hypothalamus (PVN) is a critical part of the brain and plays a role regulating blood pressure. The neuronal activity in the PVN stimulates sympathetic nerve activity (SNA) and constricts blood vessels resulting in higher blood pressure. However, it is currently unknown whether sedentary conditions produce differences in neuronal activity in subregions of the PVN. The purpose of the study was to test the hypothesis that the sedentary rats have greater neuronal activity within the PVN when compared to the physically active rats. A group of four-week-old male, Sprague Dawley rats were divided into 11 active (access to a running wheel) and 12 sedentary (no access to a running wheel) rats and were observed over a 12-week period. Manganese (Mn2+)-enhanced MRI (MeMRI) was used to assess neuronal activity. Prior to each MRI scan, rats were injected with MnCl2 (66 mg/kg, i.p). Eight MRI slices of the PVN were obtained at 260-μm intervals (range 0-1820 μm). Prior to designation into active and sedentary groups, rats demonstrated significant decreases in neuronal activity in the central three slices (520-1040 μm) of the PVN. Although higher neuronal activity in subregions of the PVN appeared to occur in sedentary versus active rats, this difference did not reach significance (p=0.074). Our data suggest that sedentary conditions may alter neuronal activity in the PVN in ways not previously detected in other studies. Therefore, since CVD is more common in sedentary humans, alterations in the PVN of inactive rats may relate to mechanisms by which CVD is increased in sedentary humans.

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