DMU Research Symposium

December 1, 2016
Des Moines University
3200 Grand Avenue
Des Moines, IA

Des Moines University's Research Vision is to be…

A cultivator of distinctive faculty and student researchers who discover and disseminate new knowledge.

Welcome

Welcome to the seventh annual Des Moines University (DMU) Research Symposium! This year DMU is hosting 500 attendees, showcasing an engaging and relevant keynote address, and presenting 72 multidisciplinary posters and podium talks given by our research community.

One of DMU's four vision statements is to become "a cultivator of distinctive faculty and student researchers who discover and disseminate new knowledge." There is no event that captures this vision better than our Symposium where the entire DMU campus comes together to recognize the efforts of our students, faculty, and colleagues from the medical and scientific community.

For some of the students it is their first step into the more formal world of research and academia. This Symposium is more than an opportunity to present research. It is an opportunity to discuss their work, receive constructive feedback from affiliated faculty and fellow students, and to establish relationships between future peers in the health professions. We celebrate their success by demonstrating the critical role research plays in the advancement of health care, providing a forum for the collaboration of ideas, and fostering the production of new hypotheses.

In addition to the student and resident awards for the best quality oral abstract and poster presentation, new this year, DMU will recognize faculty and clinicians who have demonstrated research and scholarly excellence over the past year. The awards will focus on researchers who have had an impact on advancing knowledge in science, health, education, wellness or other field of study. I hope you're able to join us at the conclusion of the Symposium as we celebrate the countless hours of research conducted over the past year.

We are excited to have Dr. Charles Brenner as our keynote speaker this year. Dr. Brenner has an extensive history doing yeast genetics and molecular biology research at various organizations including Chiron Corporation, DNAX Research Institute, and Stanford University. In 2003 at Dartmouth Medical School, Dr. Brenner made the seminal discovery of nicotinamide riboside as a vitamin precursor of NAD and earned additional funding from the National Institute of Health, the National Science Foundation, and the Lung Cancer Research Foundation. In 2009, he was recruited to the University of Iowa as head of Biochemistry. There, he continued his groundbreaking research on nicotinamide riboside using quantitative metabolomics, animal models and human clinical trials to dissect its functions as a nutritional supplement and candidate drug. Dr. Brenner has won a number of national and international awards, serves on prestigious peer review panels for NIH and other agencies, and is a tireless mentor for trainees and faculty members.

DMU is a leader in its research culture and environment. This Symposium demonstrates the strong research that is occurring on the DMU campus and in our community. While attending the oral presentations and viewing the posters, I hope you will reflect on how the discoveries we are making in research today will impact the scientific and medical community and the future of our patients.

Keep asking questions, enjoy the Symposium, and thank you for attending!

Jeffrey T. Gray, PhD
Vice President for Research and Global Initiatives, Des Moines University

DES MOINES UNIVERSITY

Agenda

Time	Session	Location
9 am	**Informal Poster Viewing**	**SEC First Floor** (Near the Bookstore)
12 pm	**Lunch**	**SEC Auditorium**
12:30 pm	**Keynote Address: Nicotinamide Riboside: From Discovery to Human Translation** Charles Brenner, PhD *Roy J. Carver Chair and Head of Biochemistry, Professor of Biochemistry and Internal Medicine, Carver College of Medicine, University of Iowa* • Connect knowledge of micronutrients to the function of NAD+ coenzymes in metabolism and regulation of cellular stress responses. • Discuss uses of nicotinamide riboside as a nutritional supplement and candidate therapeutic compound for improvements in human health.	
1:30 pm	**Break**	
1:45 pm	**Poster Presentations** Odd Numbered Posters Will Be Judged	**SEC First Floor**
2:45 pm	**Poster Presentations** Even Numbered Posters Will Be Judged	**SEC First Floor**
3:45 pm	**Break**	
4 pm	**The Unmet Needs of Family Planning in Rural Dominican Republic Communities in the Context of Zika Virus** **Michaela Simmons, DO'19,** Corrine Nelson, DO'18, Brooke Bachelor, DO'19, Shant Adamian, DO'19, Rebecca Shaw, MD	**SEC Auditorium**
4:15 pm	**Prehospital Quality Improvement and Education in Care for PARCA Patients** **T. Jesse Yuan, BS, NREMT-P, DO'19,** Mark Pinchalk, MS, EMT-P, Ron Roth, MD, Paul Paris, MD	
4:30 pm	**Reduced Leucine Availability Inhibits the Growth of Bone Sarcomas by Stimulating the Fuel Sensing Enzyme AMPK** **Shailer Martin II, DPM'19,** Michael Boyer, BS, Elitsa Ananieva, PhD	
4:45 pm	**Comparing the Effects of Medicaid Expansion According to States' Medicaid Expansion Status** **Kevin Wang, DO'18,** Pamela A. Duffy, PhD, Simon Geletta, PhD	
5 pm	**Awards Presentation** Awards will be given to the winning presenting author(s) (students and residents only) with the best quality oral abstract and poster presentation. New this year, DMU will recognize faculty and clinicians who have demonstrated research and scholarly excellence over the past year. The awards will focus on researchers who have had an impact on advancing knowledge in science, health, education, wellness or other field of study.	

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Purpose

The Research Symposium aims to recognize the research efforts of those at Des Moines University and in the surrounding medical and scientific community by providing a forum for the collaboration of ideas, the production of new hypotheses, and to demonstrate to the attendees the critical role that research plays in the advancement of health care.

Mentored Research Program

DMU Students

The mentored research program is a competitive program which encourages DMU students to work in one of the wide range of research projects at DMU. Funding for this program is provided by the research and grants committee in which participants are paid $11 per hour. The program began in 2002 and is a robust and active research opportunity at DMU. The eight week program also includes additional learning opportunities such as research presentations from our own DMU faculty, a closing program consisting of a guest speaker, poster and power point presentations. DMU students are also required to submit a statement of support, preferably from their potential mentor, supporting their placement in the program. All application materials are due by February 10, 2017. Late or incomplete packages will not be considered. Additional information can be found at https://www.dmu.edu/research/student-research-opportunities/.

Undergraduate Students

The undergraduate mentored research program is committed to providing an array of research experiences to undergraduate students. Selection of applicants is based upon academic performance in the sciences, statement of career and academic goals and letter of recommendation from a biology or health science faculty member. Selected students will work with faculty researchers for an eight-week period usually in June and July, on projects in including but not limited to microbiology, pharmacology, physiology, biochemistry, public health, and physical therapy. Students receive a stipend of $11 per hour, but no housing is provided. Students are required to work up to 40 hours per week. All application materials are due by February 10, 2017. Late or incomplete packages will not be considered. Additional information can be found at https://www.dmu.edu/research/student-research-opportunities/.

Continuing Education Credit

- **DPM:** Des Moines University (DMU) is approved by the Council on Podiatric Medical Education as a provider of continuing education in podiatric medicine. DMU has approved this activity for a maximum of 4.0 continuing education contact hours.
- **DO:** Des Moines University (DMU) is accredited by the American Osteopathic Association (AOA) to provide osteopathic continuing medical education for physicians. DMU designates this program for a maximum of 4.0 AOA Category 2-A credits and will report CME and specialty credits commensurate with the extent of the physician's participation in this activity.
- **MD:** This activity has been planned and implemented in accordance with the accreditation requirements and policies of the Iowa Medical Society (IMS). Des Moines University (DMU) is accredited by the IMS to provide continuing medical education for physicians. DMU designates this live activity for 4.0 *AMA PRA Category 1 Credit(s)*™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

- **Nurse:** Des Moines University is Iowa Board of Nursing approved provider #112. This live activity has been reviewed and approved for 4.8 continuing education contact hour(s). No partial credit awarded.
- **Other Professionals:** This live activity is designated for 4.0 *AMA PRA Category 1 Credit(s)*™.

Keynote Speaker

Charles Brenner, PhD

Roy J. Carver Chair and Head of Biochemistry, Professor of Biochemistry and Internal Medicine, Carver College of Medicine, University of Iowa

Dr. Charles Brenner is a 1983 graduate of Wesleyan University, who spent 5 years doing yeast genetics and molecular biology research in industry at Chiron Corporation and DNAX Research Institute before conducting his graduate research at Stanford University. He earned his PhD for purification and characterization of the Kex2 prohormone convertase and then served as a post-doctoral fellow at Brandeis University, training in X-ray crystallography. He took his first independent position at Thomas Jefferson University in 1996, where he earned funding from the National Institutes of Health, the Burroughs Wellcome Foundation, the Arnold & Mabel Beckman Foundation, and the March of Dimes Birth Defects Foundation.

Recruited to Dartmouth Medical School in 2003, he rose to serve as the Associate Director of the Norris Cotton Cancer Center, among other leadership positions. At Dartmouth, Dr. Brenner made the seminal discovery of nicotinamide riboside as a vitamin precursor of NAD and earned additional funding from the National Institute of Health, the National Science Foundation, and the Lung Cancer Research Foundation. In 2009, he was recruited to the University of Iowa as head of Biochemistry. There, he continued his groundbreaking research on nicotinamide riboside using quantitative metabolomics, animal models and human clinical trials to dissect its functions as a nutritional supplement and candidate drug. He is also known for contributions to molecular oncology, biochemistry and molecular biology education, recruiting 8 faculty members to the Department of Biochemistry, building the high throughput screening shared resource, and establishing the University of Iowa Obesity Research and Education Initiative.

He has won a number of national and international awards, serves on prestigious peer review panels for NIH and other agencies, is a tireless mentor for trainees and faculty members, and is a long time contributor to the American Society for Biochemistry and Molecular Biology in multiple capacities.

Relevant to the content of the CME activity, Dr. Brenner indicated he is a consultant for ChromaDex, Inc., co-founder and self-managed stock shareholder for ProHealthspan, LLC., and founder of NRomics.

How to Read a Poster Abstract

A common approach for evaluating posters involves considering the following factors in the technical, visual and presenter categories. This tool can be used when reviewing posters at this meeting and as a helpful guide for constructing your posters in the future.

Category	Notes
Technical	
Research topic clearly described with adequate introduction and a clear hypothesis.	
Good use of the space of the poster with sections on methods, results, and discussion as appropriate.	
Conclusion section which emphasizes the relevance of the research in the field of study.	
Visual	
Title, author(s), affiliations, and contact info included.	
Poster design logical and easy to follow with appropriate visuals (methods, results, etc.).	
Text easy to read, understand and free of errors.	
Graphics clearly contribute to the overall presentation.	
Presenter	
Able to communicate in-depth technical information in an easy-to-understand manner.	
Able to interpret the data properly, and clearly answer questions related to project.	
Recognize limitations of the project's procedures.	
Courteous and professional.	

♦ 1 G ♦

The Effect of the α-glucosidase Inhibitor, Acarbose, on the Growth of Pathogenic Trichomonads

Alexander Tokarski, DPM'19, Wayne Wilson, PhD, Andrew Brittingham, PhD

Des Moines University, Des Moines, IA

Trichomoniasis caused by the parasitic protist *Trichomonas vaginalis* is the most common non-viral sexually transmitted disease. Currently, only two drugs, tinidazole and metronidazole are approved to treat the infection. Both medications are from the same drug class, and drug resistance is increasing among *T. vaginalis*. Consequently, there is a need for more therapies. *T. vaginalis* requires carbohydrates for growth. Glucose polymers and oligomers, especially glycogen, are the most abundant source of carbohydrate in the vagina. Previous studies have shown that *T. vaginalis* secretes both alpha and beta amylases that can break down these polymers and oligomers. A related species, *Trichomonas foetus* causes a disease in cattle that is similar to human trichomoniasis. Our studies aimed to determine the effect of an alpha glucosidase inhibitor, acarbose, on the growth of these trichomonads *in vitro*. Studies were performed growing *T. vaginalis* and *T. foetus* in the presence of the carbohydrates glucose, maltose, or glycogen with or without the addition of acarbose. Cell counts were then collected over a growth period of four days. Preliminary results show that the addition of acarbose caused a decrease in the growth of both species in the presence of maltose and glycogen. There was no decrease in growth of either species when grown in glucose in the presence of acarbose, suggesting that the action of acarbose was directly related to the ability of the protist to breakdown and metabolize glucose polymers. This data suggest that glucosidase inhibitors may be a novel therapeutic approach to treating trichomoniasis.

♦ 2 UG ♦

Study of Daily Genistein Ingestion on Spatial Memory and Olfaction in Triple Transgenic Alzheimer's Mice

Hayley R. LeBlanc[1], Alyson C. Williamson[2], Craige C. Wrenn, PhD[2]

[1] Department of Neuroscience, Drake University, Des Moines, IA
[2] Department of Pharmacy, Drake University, Des Moines, IA

Alzheimer's Disease (AD) is a neurodegenerative disease characterized by the accumulation of beta amyloid plaques and the formation of neurofibrillary tau tangles. These plaques and tangles lead to the learning and memory deficits characteristic of AD. Estrogen and estrogen-like compounds have been shown to slow the development of plaques and tangles. Though estrogen receptors are found in the male hippocampus, it is unclear how estrogen affects learning and memory in the male hippocampus. Male triple-transgenic (3xTg-AD) mice mimic the pathology and learning and memory deficits of AD in humans. To examine the potential effects on the male hippocampus, 3xTg-AD mice were either fed a dose of 10 mg/kg of genistein, a phytoestrogen found in soy, or a placebo of sucrose and tested behaviorally in the Morris Water Maze and Olfactory Habituation-Dishabituation tasks. The 3xTg-AD mice had significantly longer swim paths to find a hidden platform as well as a lack of selective search in the platform location when the platform was removed. There was no significant difference between the 3xTg-AD and wildtype mice during the olfactory task of habituation-dishabituation. As the pathology of the AD develops in the 3xTg-AD mice, the mice will be retested to examine the differences in learning and memory. Presently, the 3xTg-AD were impaired in successfully learning the location of a hidden platform but were not impaired in their olfactory abilities.

♦ 3 G ♦

A Comparative Molecular Analysis of the Leucine Metabolic Pathway in T Cells and EL-4 Lymphoma Cells

Michelle Brenner, DO'19[1], Ashley Torres[2], Elitsa Ananieva, PhD[1]

[1] Biochemistry and Nutrition Department, Des Moines University, Des Moines, IA
[2] Mercy College of Health Sciences, Des Moines, IA

Cancer and T cells use leucine to support their biosynthetic and energy demands. Leucine is a nutrient that stimulates protein biosynthesis by activating complex 1 of the mammalian target of rapamycin (mTORC1) while leucine degradation provides energy. Leucine degradation comprises two steps, the first is catalyzed by the branched-chain aminotransferases (BCATc and BCATm) and the second is catalyzed by the branched-chain α-ketoacid dehydrogenase complex (E1α and E2 enzymes). The gene regulation of these enzymes is largely unknown but important to understand how cancer and T cells interact on metabolic level in the tumor microenvironment.

Bioinformatic analysis revealed that the promoter regions of the genes encoding for BCATm, BCATc, E1α and E2 contain binding sites for the transcription factors c-Myc and NFAT (nuclear factor of activated T cells). To explore the gene regulation of these enzymes in T cells and their cancerous counterpart, EL-4 lymphoma cells, we utilized cyclosporine A (CsA), rapamycin, and 10058-F4, which inhibit NFAT, mTORC1 and c-Myc, respectively. mRNA and protein expression analysis revealed that 10058-F4 and rapamycin inhibited the two steps in leucine degradation in all cells suggesting that T cells and EL-4 cells use c-Myc and mTORC1 to up-regulate the leucine metabolic pathway. CsA inhibited the protein expression of BCATc and E2 in T cells only implying that NFAT is a specific activator of leucine metabolism in T cells. This research will aid in exploring possibilities to modulate the leucine metabolic pathway in a direction that provides an advantage to T cells to better combat cancer.

♦ 4 G ♦

BMP2-Inducible Kinase (BMP2K) Reduces Hypoxia/Reoxygenation Injury in Cardiomyocytes

Nathaniel R. Nelson, DO'19, Samuel I. Engman, MBS'19, Eric M. Wauson, PhD

Department of Physiology and Pharmacology**,** Des Moines University, Des Moines, IA

A small percentage of the 518 kinases in the human genome are known to play important roles in the pathophysiology of ischemia/reperfusion (I/R) injury in cardiomyocytes. However, there are many understudied kinases that may impact the damage to cardiomyocytes caused by I/R. Thus, there are likely unmet therapeutic opportunities in targeting kinases to reduce death caused by myocardial infarction. By using a novel mass spectrometry affinity chromatography method, we discovered that the activity of bone morphogenic protein 2-inducible kinase (BMP2K) was elevated in cardiomyocytes exposed to simulated ischemia/reperfusion (sI/R) injury. We determined that a reduction in the expression of BMP2K in cardiomyocytes using siRNA reduces apoptosis and overall cell death caused by sI/R injury. BMP2K was cloned from a cell line that was induced to differentiate into an osteoblastic phenotype with BMP2. While no physiological substrates have been identified, BMP2K was observed to phosphorylate myelin basic protein and autophosphorylate *in vitro.* To identify potential BMP2K substrates and interacting proteins, we immunoprecipitated Flag-BMP2K from HEK-293 cells, performed SDS-PAGE, and visualized proteins with coomassie blue stain. We observed a 75 kD protein that was identified by mass spectrometry analysis as mortalin. Mortalin, which is member of the heat shock protein 70 (Hsp70) family, can function to suppress cell death during glucose deprivation. We validated our mass spectrometry results with co-immunoprecipitation assays followed by immunoblotting with a mortalin antibody. Our future goals are to determine if mortalin is a direct substrate of BMP2K and to identify the functional significance of the BMP2K/mortalin interaction.

♦ 5 G ♦

The Calcineurin Homologous Protein-1 Facilitates the Na^+/H^+ Exchanger-3 Traffic Through the Golgi Complex

Garrett S. Crosby, MBS'20[1], Victor Babich, PhD[2], Francesca Di Sole, PhD[1]

[1] Department of Physiology and Pharmacology, Des Moines University, Des Moines, IA
[2] School of Liberal Arts and Sciences, Mercy College of Health Sciences, Des Moines, IA

Hypertension is a leading risk factor for cardiovascular and renal diseases, and a major burden for the health care system. It is characterized by disturbance in kidney function that increases sodium (Na^+) re-absorption and decreases Na^+ output below Na^+ intake. The Na^+/H^+ exchanger-3 (NHE3) is a major regulator of body Na^+, and blood volume and pressure. Physiological functions of NHE3 are dependent on NHE3 trafficking and precise localization to the cell surface. The Calcineurin Homologous Protein-1 (CHP1) is a calcium-binding protein and binding partner of NHE3. Defect in CHP1 action on NHE3 leads to hypotension via a reduction in cell surface NHE3 protein expression. The long-term goal of the study is to determine whether CHP1 facilitates NHE3 transport from the endoplasmic reticulum (ER), through the Golgi Complex, to the cell surface. Here, we report results on CHP1 action to facilitate NHE3 localization to the Golgi Complex. NHE3-mGFP alone or in combination with CHP1-mRFP was expressed in renal epithelial cells and NHE3 localization to specific cellular compartments (determined using biomarkers) was analyzed by immunocytochemistry. NHE3 did not co-localize with biomarkers of the ER (PDI), Golgi Complex (GM130) and early endosomes (EEA1). When NHE3 was co-expressed with CHP1, NHE3 colocalized with both CHP1 and GM130.These findings suggest that CHP1: (1) co-localized with NHE3 during its early steps in the biosynthetic pathway and (2) facilitated NHE3 traffic through the Golgi Complex. This study advances our understanding on the role of CHP1 in the control of NHE3 function and blood pressure.

♦ 6 G ♦

Serum-Nutrient Starvation Mediates Acidification of Extracellular pH in Human Chondrosarcoma Cells

Serena S. Luong, DO'19[1], Ross McKenzie[1], Garrett S. Crosby, MBS'20[1], Elitsa Ananieva, PhD[2], Victor Babich, PhD[3], Francesca Di Sole, PhD[1]

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[3] School of Liberal Arts and Sciences, Mercy College of Health Sciences, Des Moines, IA

Chondrosarcoma is a common malignant bone tumor that increases the production of cartilage matrix. The metabolism of cartilage is dependent on the chemical characteristics of the matrix microenvironment and extracellular acidity is fundamental for the regulation of cartilage synthesis. This study goal was to determine the effects on proton dynamics mediated by the chondrosarcoma-dependent transformation of the metabolic microenvironment. We discovered that the Na^+/H^+ exchanger-1 (NHE1) was the major regulator of pH homeostasis in human chondrocytes with characteristics of grade II chondrosarcoma (SW1353 cells). Zoniporide, a highly selective NHE1 inhibitor, inhibited NHE activity in a concentration-dependent manner; a $5 \cdot 10^{-9}$ M zoniporide treatment completely blocked NHE activity (-98.8%), with a 50% inhibition (IC50) of $3.6 \cdot 10^{-11}$ M (measured using spectrofluorometry). A tumor's metabolic microenvironment with a low level of growth factors was mimicked by serum removal (serum deprivation). NHE1 activity is significantly inhibited by serum deprivation in non-cancerous cells; while, it was activated (+30%) by 24 hours of serum deprivation in SW1353 cells. In summary, these findings support: (1) a central role of NHE1 as a key regulator of pH homeostasis in chondrocytes, (2) an increase in NHE1 activity under microenvironmental stress which might increase the extracellular acidity of the cartilage matrix and the production of cartilage in chondrosarcoma. Future studies aim to delineate the mechanisms that control NHE1 activity in chondrosarcoma cells. Accomplishment of these studies will aid in determining the potential benefits of targeting NHE1 activity as novel anti-cancer therapeutics.

♦ 7 G ♦

Renal Inflammatory Response Mediated by Chronic Pain and Related Stress

Brittany Duong, DO'19[1], Misty Carder, MBS[1], Garrett S. Crosby, MBS'20[1], Vanja Duric, PhD[1], Victor Babich, PhD[2], Francesca Di Sole, PhD[1]

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Chronic pain is one the most distressing symptoms among patients with chronic kidney disease (CKD). The prevalence of pain in CKD patients has been associated with development of depressive symptoms, while major depression episodes have been linked with a substantially increased risk of death. These evidences suggest that an effective treatment of chronic pain-related stress and depression may reduce mortality in people with CKD. Moreover, chronic pain-related stress can correlate to the development of mood disorders and disease of peripheral organs, such as kidney disease, via chronic systemic inflammation and elevation of proinflammatory cytokines.

This study aims to determine whether an immune reaction is the mechanism that links depressive behavior induced by chronic pain and anomalies of kidney function. The neutrophil gelatinase-associated lipocalin (NGAL) and IL-18 are early diagnostic inflammatory biomarkers. They accumulate in the kidney in response to inflammation, kidney injury and decreased kidney function. Protein levels of NGAL and IL18 were analyzed by immunocytochemistry in rat models of neuropathic (spared nerve injury) and inflammatory (injections of complete Freund's adjuvant) pain, and their controls. NGAL and IL18 protein levels were significantly increased in both pain models; with prevalent increase in NGAL and IL18 in the inflammatory model (~40% increase in both glomeruli and tubules, quantified using novel MATLAB algorithm).

These observations suggest that chronic pain and related stress effects induce renal inflammation and possibly a reduction in kidney function. In summary, this study might support a mechanistic understanding of a bidirectional pathway between chronic pain related-stress and kidney dysfunction.

♦ 8 UG ♦

Prevalence of Genetic Polymorphisms in the Glutathione S-Transferase P1 (GSTP1) Promoter in Dogs

James Sacco, PhD[1] and **Sarah Mann[2]**

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[2] College of Arts and Sciences, Drake University, Des Moines, IA

Glutathione S-transferases (GSTs) are a family of enzymes, found in all organisms, that catalyze the conjugation of glutathione (GSH) with carcinogenic xenobiotics to create harmless metabolites. Polymorphisms in human *GST* genes that decrease enzyme functionality may cause higher risk of developing certain cancers. However, canine *GST* genes have not been widely studied. The purpose of the present study was to characterize the type and prevalence of polymorphisms in the promoter region of the canine *GSTP1* gene and to predict their effects on gene functionality across a variety of dog breeds. The sample population was comprised of 130 pure-bred dogs representing 90 breeds in 6 breed groups. Nine single nucleotide variation (SNV) polymorphisms and deletion-inversion variation (DIV) polymorphisms were found from position -522 to -68 (with respect to the start codon) and 13 polymorphic alleles of the GCC repeat region (-66 to -18) were found. The minor allele frequency and observed heterozygosity varied widely between breed groups. A 9 base pair insertion was also discovered in the GCC region, appearing only in $(GCC)_{16}$ and $(GCC)_{22}$. Several polymorphisms affected potential human transcription factor binding sites, including Wilm's Tumor Protein. Comparisons between the canine *GSTP1* promoter those of closely-related species also indicates that the highly polymorphic GCC region is unique to dogs. Some regions of the promoter were well-conserved, indicating that they may influence gene function. These results indicate that the *GSTP1* promoter varies widely across breed groups. Functional characterization of these variants are underway to assess their effect on canine *GSTP1* expression.

♦ 9 ♦

Genetic Variation, Expression, and Comparative Genomics of the Canine TMF-1 Regulated Protein (*TRNP1*) Gene

James Sacco, PhD[1], Alyssa Weaver[1], Muhammad Spocter, PhD [2]

[1] College of Pharmacy and Health Sciences, Drake University, Des Moines, IA
[2] Department of Anatomy, Des Moines University, Des Moines, IA

Cortical folding (i.e., gyrification) is intrinsically related to the functional organization of the brain and has long been studied as a marker of both normal and pathological brain function. The TMF-1 regulated protein (TRNP1) is known to regulate the expansion and folding of the mammalian cerebral cortex. The objective of this study was to sequence the gene coding for TRNP1 in dogs and provide evidence of its expression in the canid brain. Since this gene is not annotated in the most recent version of the dog genome (CanFam3.0), comparative genomics tools were utilized to predict the DNA sequence and identify its chromosomal location. We identified a genome assembly error in CanFam3.0, and experimentally confirmed this genome misassembly by amplifying and sequencing the *TRNP1* exonic region in 20 purebred dogs (*Canis familiaris*), one Gray wolf (*Canis lupus*) and one coyote (*Canis latrans*). Six novel polymorphisms (one synonymous, five in the 3' untranslated region) in dogs and wolf were identified, while an additional three polymorphisms (two nonsynonymous) were unique to coyote. Canine RNA was extracted from a single dog brain and expression was qualitatively analyzed using *TRNP1*-cDNA specific primers by PCR. A partial length *TRNP1* transcript was detected in cerebral cortex and hippocampus. While the *TRNP1* sequences of the three canid species are comparable to other mammals, they all exhibit a unique 15-base pair deletion in the coding region. This finding is particular important since the evolutionary loss of five amino acids may have had a significant effect on TRNP1 protein function.

♦ 10 G ♦

Intraoperative Infiltration of Liposomal Bupivacaine vs. Bupivacaine HCL for Pain Management in Primary Total Hip Arthroplasty – a Double-Blind Randomized Controlled Trial

John Walsh, DO'20[1], Itay Perets[1], Mary Close[1], Edwin Chaharbakshki[1], Benjamin Domb[1,2]

[1] American Hip Institute, Westmont, IL
[2] Hinsdale Orthopaedics, Westmont, IL

Background: Clinical outcomes of Total Hip Arthroplasty (THA) have been successful; however, we continue to refine surgical techniques and peri-operative protocols. Pain management after Total Hip Arthroplasty (THA) is well studied. Nevertheless, there is no consensus regarding the peri-articular infiltration (PAI) "cocktail". Liposomal bupivacaine (LB) is a slow release local anesthetic that can be infiltrated during surgery. In this study, we compared LB to bupivacaine HCL.

Methods: Between September 2014 and March 2016, 107 patients were enrolled in this double-blind randomized controlled study. Patients were separated into LB and Control groups. LB group (43) received PAI with LB and the Control group (48) received PAI with bupivacaine HCL. Patient morphine equivalent consumption, pain score, time to first ambulation greater than 20 feet, time to discharge, drug-related side effects and patient falls were documented. Data was collected up to 72-hours post-operation.

Results: The LB group had significantly reduced morphine equivalent consumption in the first 12 hours following primary THA. There was no significant difference in morphine equivalent consumption in the following 12-hour time blocks, up to 72-hours. No patient falls were documented in either group. Time to first ambulation greater than 20 feet, time to discharge and drug-related side effects were analyzed with no significant differences.

Conclusions: Intra-operative PAI with LB resulted in a significantly reduced opioid consumption compared to bupivacaine HCL in patients undergoing primary THA in the first 12-hours. There were no patient falls within 72-hours. Consequently, LB should be considered for implementation in THA pain management protocols.

Level of Evidence: Level I.

♦ 11 G ♦

Outcomes of Hip Arthroscopy in Adolescents: A Comparison of Acute vs. Chronic Labral Tears - Two Year Minimum Follow-Up

John Walsh, DO'20[1], Lyall Ashberg[1], Mary Close[1], Itay Perets[1], Edwin Chaharbakshki[1], Benjamin Domb[1,2]

[1] American Hip Institute, Westmont, IL
[2] Hinsdale Orthopaedics, Westmont, IL

Background: Hip arthroscopy in adolescent patients is becoming more common and is effective in managing hip pathologies. The purpose of this study was to ascertain if hip arthroscopy outcomes differ in adolescents being treated for labral tears. We present the outcomes of the largest prospectively collected study on hip arthroscopy performed for labral tears in adolescent patients.

Methods: Patient reported outcome scores (PROs) for patients undergoing hip arthroscopy between April 2008 and December 2013 were prospectively collected and retrospectively reviewed. Patients that were under the age of 18, treated for labral tears, and eligible for 2-year follow-up were included. The overall cohort was assessed for outcomes and a comparison was made between patients who presented acutely and chronically. Data was analyzed using t-test, Mann-Whitney U, Welch test and Chi-square analyses; p value <0.05 considered statistically significant.

Results: A total of 194 patients met all the inclusion and exclusion criteria, with 157 (80%) having minimum 2-year follow-up. There was significant improvement in all PROs for the overall cohort. Lower pre-operative PROs and greater change in VAS for the acute group was significantly different. Revision surgery rate was significantly higher in the acute group.

Conclusions: Hip arthroscopy in adolescent patients being treated for labral tears is safe and effective at 2-year follow-up. PROs are significantly improved over a minimum of 2-year follow-up. While preoperative PRO scores were lower in patients presenting acutely, there were no significant differences in final PRO scores; however, reoperation rate was significantly higher in patients with an acute presentation.

Level of Evidence: Level II.

♦ 12 G ♦

Nasal Cavity and Maxillary Sinus Ontogenesis: Landmarking Protocols

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Different human populations present nasal adaptions to match the climate in which they live; for example, individuals living in hot-wet climates have wider nasal cavities. Previous studies have suggested that the nose's ability to expand is related to the surrounding maxillary sinus air chambers. One area of research focuses on the relationship between maxillary sinus volume and nasal cavity breadth in adults. There is an inverse relationship identified between the maxillary sinus volume and the nasal cavity size showing that wider noses are often found with smaller sinuses and vice versa. There is very little research looking at juveniles and digging deeper into when this relationship actually begins during development. Using the program 3D Slicer, I am collecting linear measurements based on 3D landmarks from MRI (magnetic resonance images) scans of the nasal cavity and sinuses of male and female patients aging from 4-18 years old. These linear measurements will be size standardized by cranium size and used to measure nasal cavity and maxillary sinus dimensions. I am investigating this relationship across these age ranges to identify when this relationship begins during development. Currently, I am in the process of gathering the necessary measurements and will run statistical analysis in the future. Based on previous studies on maxillary growth, I hypothesize that we will not see an inverse relationship between the nasal cavity and maxillary sinus in juveniles, and that this relationship begins shortly before the teen years because the sinuses will be large enough to affect the nasal cavity.

♦ 13 G ♦

Effects of Stress on the Human Gut Microbiome

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The central nervous system (CNS) and gastrointestinal (GI) tract interact via bidirectional communication, and the microbiota of the gut play an important role in mediating this signaling. Our interest lies in the effect of stress on GI microbiota and the role the microbiome plays in coping with stress. We intend to investigate the relationship between chronic stress and the gut microbiota in our own medical students, by comparing the taxonomic composition present in fecal samples before and after various amount of time in medical school.

Incoming first-year medical students were recruited (n=31) for the study. Using stress/anixety surveys and physiological measures such as blood cortisol levels, we evaluate their levels of stress before their first year starts and at two additional time points (October and December) throughout their first semester. Additionally, GI microbiome samples are taken to assess gut microbial populations at each time point. Initial findings suggest that the level of depression in the mid-term was elevated comparing with the beginning of the semester, which was accompanied with a significant increase in the ratio of *firmicutes*:*bacteroidetes (F:B)*, the largest phyla in human gut microbiome. Increased F:B ratio has been linked with poorer health/obesity in humans. Additional data analysis of gut microbial changes to stress and depression is underway.

Results yielded from this study, once it is completed, may shed light on potential treatment to reduce stress/anxiety in general, as well as to promote wellbeing of our future health care providers and physicians.

♦ 14 G ♦

The Effect of Leptin on Blood Pressure in the Ovariectomized Rat

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Hypertension is less prevalent in pre-menopausal women compared to males of a similar age. Once women become postmenopausal, the incidence of hypertension develops at the same rate as men. Although it has been established that estrogen plays a protective role against the development of hypertension in pre-menopausal women, it is not clear what the underlying mechanisms might be. Most menopausal women experience significant increase in body weight in the form of adipose tissue. Increases in adiposity is accompanied by increased levels of the adipocyte derived hormone leptin. Leptin has been described to have cardiovascular regulatory properties. Thus, we sought to test the hypothesis that leptin plays a role in increasing blood pressure and heart rate after menopause. Rats were ovariectomized to simulate the post-menopausal model. Four weeks post-surgery, ovariectomized animals had a significant increase in blood pressure, heart rate, and body weight when compared to control animals. When leptin was injected into the lateral ventricle, both blood pressure and heart rate increased significantly. However, when leptin was injected into the lateral ventricle of control animals, blood pressure and heart rate was significantly decreased. These data suggest that estrogen can dampen leptin effect on blood pressure and heart rate.

Supported by The Iowa Osteopathic Educational Research Foundation.

♦ 15 G ♦

Therapeutic Development for RSV Disease Among Newborns in Neonatal Lambs

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Respiratory Syncytial Virus (RSV) is the most common cause of lower respiratory infection, hospitalization and mortality in preterm and newborn infants. This viral infection targets those with lowered immune response, encompassing infants, young children and elderly. Each year in the United States, more than 57, 000 children younger than 5 years old are hospitalized due to RSV infection, and about 14,000 adults older than 65 years die from it. Currently, there are no fully effective therapies or vaccines for RSV, although creative anti-RSV therapeutic compounds have been developed over the last decade. Some of these have been and are being tested in a neonatal lamb model of human RSV infection, which closely mimics RSV disease in newborn infants. Two separate and extremely effective compounds; an RNA polymerase inhibitor and in another case, a camelid antibody with affinity to the RSV F protein, were assessed for both prophylactic and therapeutic efficacy and found to reduce RSV replication and disease severity in lambs infected with hRSV. Both of these compounds have successfully entered human trials in adults and infants.

♦ 16 G ♦

National Multicenter Registry of Hallux Abducto Valgus Surgical Correction Outcomes

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There are currently well over 130 surgical procedures described in the literature for the correction of Hallux Abducto Valgus (HAV). The outcome of HAV surgery is highly unpredictable and associated with a high rate of deformity recurrence, with recent studies reporting rates of recurrence ranging from 25% to 76%. To better understand the long-term outcomes of the most popular surgical techniques and determine the best practices for HAV surgery, a prospective, multicenter, nationwide assessment of HAV surgical outcomes is needed. With over 300,000 surgeries for the correction of HAV performed yearly in the US, identifying the most effective procedures is vital to improve outcomes, reduce morbidity and lower health care costs for a large population of patients. We are currently designing a prospective, multicenter, multi-surgeon registry of HAV surgical outcomes. A longitudinal protocol will include detailed data point collection for patient demographics, pre-operative symptoms, physical and radiographic findings, intraoperative findings, procedures and complete post-operative results for a follow-up period of 10 years following the surgical procedure. Electronic data bases will be designed to collect and analyze the data to answer a variety of questions regarding the effectiveness of surgical procedures, patient reported outcomes and objective measures of deformity correction. The data set will be the largest existing registry of HAV surgical outcomes and will serve as the basis for multiple scholarly research papers.

♦ 17 G ♦

Making Sense of Variation in Brain Size, White Matter Volume and Metabolism in the Domestic Dog

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Domestic dogs exhibit a tremendous range of variation in body size, shape and color, the mechanisms of which are of great informational value as we seek to understand the processes that control the limits on morphological variation. The following study was aimed at assessing the range of variation in brain and associated white matter volume in a sample of domestic dogs (N = 10, breed = mixed beagle; age range = 243-1634 days). Using quantitative magnetic resonance imaging (qMRI), we derived in situ cortical white matter volumes and brain volumes and compared these using allometric analyses to evaluate the range of variation. Using previously published data on the volume-specific glucose metabolic rate based on the internal capsule, corpus callosum and whole brain (Karbowski, 2007) we calculated the predicted glucose utilization rate for our sample of domestic dogs. These results indicate a proportional increase in white matter volume with increases in brain volume and predict that despite wide ranges in brain and body size in domestic dogs (e.g., 200 lbs great Dane versus 6 lbs Chihuahua), the metabolic requirements of white matter and cortical brain volume remain bound within a narrow range across all canines to support the wide range of brain sizes observed in this species. While preliminary, this data suggests that domestication may have allowed for greater variation in morphology by uncoupling the relationship between metabolism and brain or body size, thus keeping metabolic requirements largely invariable across members of the same species.

♦ 18 G ♦

Role of Carotid Body Chemoreceptors in Renal Inflammation, Oxidative Stress, and Fibrosis in Chronic Heart Failure

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Renal impairment occurs in approximately 25% of patients with chronic heart failure (CHF) and is associated with higher morbidity and mortality. Decreased renal blood flow (RBF), inflammation, and oxidative stress are thought to contribute to renal fibrosis and decline in renal function in CHF. Previous studies indicate that decreased RBF in CHF is mediated in part by tonic increases in carotid body chemoreflex (CBC) control of renal sympathetic nerve activity. The extent to which CBC activity affects renal inflammation, oxidative stress, and development of fibrosis is undetermined. We hypothesized that CBC-mediated reductions in RBF in CHF would result in increased superoxide levels, increased expression of pro-inflammatory cytokines, and development of fibrosis.

Chronic heart failure was induced by coronary artery ligation in rats. Selective CBC denervation (CBD) was performed to remove CBC drive in the CHF state. CBC sensitivity was assessed as the ventilatory response to isocapnic hypoxia (Hx) and RBF was measured using ultrasound. At the end of the experimental period, renal cortical tissue was assayed for superoxide levels using electron paramagnetic resonance (EPR), and for protein expression of SOD-1 and IL-1β (western blot). Tri-chrome stain of kidney sections were performed to determine renal collagen content.

Ventilatory responses to Hx were enhanced in CHF and abolished after CBD. RBF was decreased in CHF and was improved in CHF-CBD. Superoxide levels and renal collagen content (indicative of fibrosis) were increased in CHF. Superoxide levels and collagen content were attenuated in tissue from CHF-CBD animals.

♦ 19 G ♦

Incidence and Predictors of MRI Scan Utilization in Patients Receiving MRI-Conditional Pacemakers: A Multi-Center, Real World Experience

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Patient and device characteristics, higher device costs, and vendor contracts likely prevent the use of MRI-conditional pacemakers (MPM) in all PM-eligible patients at present. It thus becomes important to identify patient subgroups that benefit the most from MPM. The purpose of this multicenter study was to identify the incidence as well as demographic and clinical predictors of MRI scan utilization in patients with MPM. Analysis was performed on 451 patients who received an MRI-conditional dual chamber PM and leads (Medtronic Revo™ or Advisa™) in 4 centers within the Catholic Health Initiatives network. Incidence and details of MRI scans following MPM were collected from hospital records and corroborated with patient phone calls. Multivariate stepwise regression was used to identify predictors of MRI utilization during follow up. In this multicenter cohort of MPM, a small proportion of patients required MRI scans during follow-up, mainly for brain and spine conditions. Having an MRI risk factor at baseline strongly predicted the need for MRI scan during follow-up whereas prior MRI did not. These data can help identify patients who can potentially benefit from MPM.

♦ 20 G ♦

Renal Denervation Modulates Brain NMDA Receptor Subunit Expression in Experimental Hypertension

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Hypertension remains a major problem clinical challenge. Blood pressure is regulated in the central nervous system; however, the contribution of neuroplasticity within the central cardiovascular control centers to the development of hypertension is not known. In addition, how the periphery feeds back to effect central nervous system gene expression has not been well studied. We hypothesized that renal denervation would alter the expression of a marker of neuroplasticity, the NMDA receptor. To test this hypothesis, we performed RT-qPCR for the NMDA receptor subunits: NR1, NR2A-D on cortical, hypothalamic, and medullary brain tissue from animals that underwent renal denervation and given a hypertensinogenic stimulus. We found expression of NR2A, NR2C, and NR2D decreased specifically in the medulla, but not the cortex or hypothalamus. We also found differential changes in the expression of NR1. These results suggest renal denervation has specific effects on gene expression in the central cardiovascular control centers and may provide evidence that the beneficial mechanism of renal denervation in the setting of resistant hypertension may be through neuroplastic changes in the central nervous system.

♦ 21 G ♦

Cardioprotective Estrogen Modulation of ACE2/MasR Gene Expression in the Anti-Hypertensive Renin-Angiotensin System

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Background: Estrogen has been shown to have cardioprotective effects through its modulation of the renin-angiotensin system (RAS). Though estrogen's effect on the traditional pro-hypertensive ACE/AngII/AT1 RAS pathway has been studied extensively, many questions still remain regarding its influence on the counteracting anti-hypertensive RAS arm. Specifically, it is unclear how estrogen affects the expression of ACE2 and MasR.

Methods: Gene expression of ACE2 and MasR in the brainstem was compared in (1) sham, (2) sham with 2-week estradiol pellet, (3) sham with 2-week estradiol pellet implanted 2 weeks after sham procedure, (4) ovariectomized (OVX), (5) OVX + 2-week estradiol pellet implanted at the time of the OVX surgery, and (6) OVX + 2-week estradiol pellet implanted 2 weeks after the OVX surgery. Brainstem mRNA was measured using reverse transcriptase and real-time polymerase chain reaction.

Results: Estrogen had no significant effect on ACE2 or MasR expression in intact rats. ACE2 expression unexpectedly decreased in OVX animals with estrogen replacement. Ovariectomy reduced MasR expression; late but not early estrogen replacement increased MasR expression in OVX rats.

Conclusion: Ovariectomy had differential effects on the anti-hypertensive arm of the RAS: MasR expression decreased while ACE2 expression remained unchanged. These results suggest that a beneficial effect of estrogen may be modulated through expression of MasR. These results should be further explored by evaluating disease models with varying activation of ACE2 or MasR. These results suggest that a possible mechanism of the protective effects of estrogen in females is through upregulation of the anti-hypertensive RAS components.

♦ 22 G ♦

Emerging Ethical Issues Related to the Use of Brain-Computer Interfaces for Patients with Total Locked-In Syndrome

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New brain-computer interface and neuroimaging techniques are making differentiation less ambiguous and more accurate between unresponsive wakefulness syndrome patients and patients with higher cognitive function and awareness. As research into these areas continues to progress, new ethical issues will face physicians of patients suffering from total locked-in syndrome (total LIS), characterized by complete loss of voluntary movement, with retention of cognitive function and awareness detectable only with neuroimaging and brain-computer interfaces. Physicians, researchers, ethicists and hospital ethics committees should be aware of and prepared to handle ethical issues unique to these totally locked-in patients.

Several thought experiments are discussed, to highlight potential ethical dilemmas surrounding surrogate decision-making, autonomy, end-of-life care, and pediatric care, which will be unique to total LIS patients. These, along with other ethical problems especially relevant to total LIS patients, merit further discussion among physicians, researchers, ethicists and hospital ethics committees, to facilitate consensus regarding these issues, and improve patient care.

♦ 23 G ♦

Utilization of a Phospho-Kinase Array to Investigate C1q-Dependent Signaling in Macrophages

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Complement protein C1q is important in the clearance of apoptotic cells and regulation of inflammatory responses, and C1q deficiency results in autoimmunity. C1q dampened LPS-dependent TNF-α production and enhanced phagocytosis in both mouse bone marrow derived macrophages (BMDM) and human monocyte derived macrophages (HMDM), and our lab is investigating the mechanism(s) required for these activities. The structurally similar defense collage, adiponectin, shares functions with C1q and both C1q and adiponectin mediate macrophage activation independent of known C1q receptors such as CD91 and LAIR-1. Therefore, we utilized a phospho-kinase array to identify targets within the C1q-dependent signaling pathway(s). Stimulation of BMDM with C1q under conditions that lead to enhanced phagocytosis and dampening of proinflammatory TNFα production led to C1q-dependent alterations in phosphorylation of multiple kinases including AMPKα1, ERK and AKT, which may be important in regulating macrophage activation. These data contribute to our knowledge of mechanisms by which C1q regulates inflammatory signaling and phagocytosis in macrophages.

♦ 24 G ♦

Assessing Validity of Ovary Volume Measured via Trans-Abdominal Ultrasound

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The purpose of this research was to assess the validity of trans-abdominal ultrasound in tracking ovarian changes during the female reproductive cycle. The sole participant was followed during two menstrual cycles in which volumetric measurements of the left ovary were obtained every 2-3 days via trans-abdominal ultrasound from days 8-21 of the female cycle. Measurements were obtained in the long-axis and short-axis views fanning to the point of maximum size with the respective data being compared between the two cycles. The results of these measurements conclude that although one can accurately locate and measure the volumetric size of the ovaries using trans-abdominal ultrasound, it was not particularly effective in measuring the microscopic growth that takes place during a regular menstrual cycle. However, it still remains a useful technique in visualizing ovarian pathology in a less invasive technique to the transvaginal approach.

♦ 25 G ♦

Inhibitors of the Mevalonate Pathway or Its Products Inhibit the Growth of an Aggressive Natural Killer Cell Leukemia Cell Line

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Aggressive natural killer cell leukemia is a rare, but deadly, form of leukemia with survival times measured in months following diagnosis. This leukemia is highly resistant to chemotherapy, making it necessary to find new therapies. Cancer cells are capable of upregulating mevalonate metabolism for protein prenylation and cholesterol biosynthesis. In this study, we investigated whether inhibitors of the mevalonate pathway or its products could inhibit cell functions of the aggressive natural killer cell leukemia cell line YT-INDY. Inhibitors of geranylgeranyl transferase (GGTI-286), farnesyl transferase (tipifarnib) and various Rho GTPases were used. Rho GTPases are small molecules that are produced by the mevalonate pathway that regulate functions such as cell cycle progression, cell growth, and transcription.

The results of our investigation showed that tipifarnib and GGTI-286 were potent inhibitors of YT-INDY proliferation, cell cycle progression and ERK MAP kinase pathway activation. Among the Rho GTPase inhibitors used, we found

that the ROCK inhibitors (GSK429286A and Y-27632) and Rac1 inhibitors (NSC 23766 and EHT 1864) produced significant inhibition of YT-INDY proliferation. Preliminary studies revealed that EHT 1864 and ML141 produced dose dependent inhibition of ERK MAP kinase pathway activation.

We concluded that inhibitors of the mevalonate pathway or products of the mevalonate pathway can interrupt YT-INDY cell growth, suggesting that this approach could lead to more effective treatment of this devastating cancer.

♦ 26 G ♦

Role of Mitogen-Activated Protein Kinase Phosphatase-1 (MKP-1) in Rapid Antidepressant Responses

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The pathophysiology of major depressive disorder (MDD) is complex, and the exact neural mechanisms involved are yet to be identified. However, our recent studies of postmortem depressed human brains as well as preclinical models of depression suggest that increased expression of mitogen-activated protein kinase (MAPK) phosphatase-1 (MKP-1), a key negative regulator of the MAPK cascade, plays a significant role in depression pathophysiology. Moreover, MKP-1 was shown to be both necessary and sufficient for development of depressive-like behavioral responses in animal models. Though, its potential role in treatment of depression, especially in response to rapid-acting antidepressants, such as ketamine, is yet to be determined. In this study, we investigated activation of MKP-1 and its main MAPK substrates after ketamine treatment in both dose- and time-dependent manner. Biochemical analysis showed that ketamine administration evokes robust increases in MKP-1 activation via phosphorylation at 1, 6, and 24 hours within synaptoneurosomes isolated form the prefrontal cortex (PFC) tissue. These changes in activated protein levels were also accompanied by significant increases in MKP-1 mRNA levels at 1 hour, followed by significant decreases at 24 hours. However, ketamine-induced activation of MKP-1 does not appear to be correlated with, and thus driven by, changes in activation of MAPK signaling. Thus, additional studies are underway to potentially identify the exact substrate targets that are responsible for induction of MKP-1 activation following ketamine treatments. Altogether, our findings in the PFC support the idea that MKP-1 may play an important role in ketamine-mediated rapid antidepressant responses, which could potentially contribute to discovery of novel drug targets.

♦ 27 G ♦

Role of MKP-1-Mediated Inhibition of Hippocampal JNK in the Development of Depressive-Like Behaviors

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Major depression disorder (MDD) has been linked to changes in function and activity of the hippocampus, one of the limbic regions involved in regulation of emotions and mood. Our previous work demonstrated that mitogen-activated protein kinase phosphatase 1 (MKP-1) plays an important regulatory role in hippocampal pathophysiology of depression. However, the potential role of JNK, its main neuronal substrate, has not been well described in mood disorders. In this study we investigated whether MKP-1-mediated specific inhibition of JNK is sufficient to produce a depressive-like phenotype in a rodent model. We used recombinant adeno-associated virus (rAAV) vector to locally express a mutated MKP-1 (i.e., MKP-1^{ASA}) in the hippocampal subfields of a rat brain. MKP-1^{ASA} is only able to bind and inactivate JNK pathway without interfering with ERK and p38 signaling. The effects of the MKP-1^{ASA} mutant on development of depressive- and anxiety-like behaviors were compared to animals infused with AAVs expressing either GFP (i.e., control) or wild-type MKP-1. Initial behavioral analysis showed that infusion of wild-type MKP-1 virus into unstressed rats produced robust anhedonic responses (e.g., significantly decreased sucrose preference), while infusion of the MKP-1^{ASA} mutant virus resulted in partial behavioral deficits. These preliminary results suggest that MKP-1-mediated inhibition of JNK may contribute to development of depressive-like responses to some extent; however, additional studies are currently underway to further characterize the role of JNK in depression. Together these studies may contribute to a better understanding of the pathophysiological events underlying the development of MDD and to identification of potential therapeutic and diagnostic targets for this disorder.

♦ 28 G ♦

Hippocampal Mechanisms Linking Chronic Pain and Development of Depressive-Like Behaviors

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Clinical reports indicate that many chronic pain patients also develop symptoms of mood disorders, especially major depressive disorder (MDD); however, the underlying neural mechanisms linking chronic pain conditions and depressive behaviors are still poorly understood. Our previous studies have demonstrated that rodent models of chronic pain mimic some of the stress-like alterations in intracellular signaling and cellular architecture (e.g., decreased MAPK signaling and reduced rate of neurogenesis) within the hippocampus, a limbic brain region involved in regulation of mood. Thus, in this study, we examined the effects of persistent pain on activation of immune-inflammation processes in the hippocampus. Male rats were initially exposed to either injection of complete Freund's adjuvant (CFA; model of chronic inflammatory pain) or spared nerve injury (SNI; model of chronic neuropathic pain). Both pain models produced robust mechanical hypersensitivity throughout the 21 or 42 day period, accompanied by depressive-like phenotype. Biochemical analysis of hippocampal tissue showed that exposure to inflammatory, but not neuropathic, chronic pain induces changes in expression of proteins involved in activation of interlukin-1-beta (IL-1ß)-mediated mechanisms, specifically members of Nod-like receptor (NLR) family of inflammasome multiprotein complex. Chronic inflammatory pain also evoked elevated levels of IBA1 protein within specific subareas of the hippocampus, suggesting potential increases in microglial activation which may, in part, underlie enhanced activation of NLRP3 inflammasome. These results resemble previous findings linking stress-induced IL-1ß up-regulation and suppression of neurogenesis in the adult rat hippocampus and, thus, may present novel factors contributing to the depressive-like behaviors observed in chronic pain models. Furthermore, pain also evoked increased activation of the hippocampal MKP-1 protein, a negative regulator of MAPK signaling that we recently demonstrated to be overactive in depressed hippocampus. Thus, similarities in dysregulation of hippocampal MKP-1 and MAPK signaling in pain and stress may represent an additional neural mechanism that potentially links these two conditions. Together these studies may ultimately contribute towards the identification of new treatment targets and the development of novel clinical strategies to diminish the mental health consequences of chronic pain.

♦ 29 UG ♦

Trichomonas vaginalis Glycogen Synthase Can Functionally Complement the Respective Yeast Mutants

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Trichomonas vaginalis is a protozoan parasite responsible for the widespread sexually transmitted disease trichomoniasis. Like many cells, *Trichomonas vaginalis* uses glycogen as a storage form of carbon and energy, possessing enzymes such as glycogen synthase to properly polymerize glucose into glycogen. A glycogen synthase candidate in *Trichomonas vaginalis* is encoded by the TVAG_258220 open reading frame. Specifically, the C-terminal third of the predicted protein is similar to plant starch synthases and bacterial glycogen synthases. The N-terminal two-thirds of the protein is not homologous to any known protein and its function is unknown. We have previously shown that full length TVAG_258220 is functional as a glycogen synthase by complementation of yeast glycogen synthase mutants and through in vitro studies using recombinant protein produced in an *E. coli* expression system. However, we were wondering if expressing only the C-terminal third of the TVAG_258220 protein would be sufficient to function as a glycogen synthase. In order to answer this question, we constructed plasmids expressing this domain and transformed them in to strains of yeast and *E. coli* cells. We found that glycogen synthase deficient yeast strains as well as *E. coli* strains gained an ability to express glycogen synthase activity and make glycogen when complemented with the *Trichomonas vaginalis* C-terminal glycogen synthase domain. Thus we theorize that this specific domain of the TVAG_258220 protein is a functional glycogen synthase.

♦ 30 G ♦

IL-37 is a Foe to Pancreatic Cancer

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Background: Pancreatic cancer is the most lethal digestive cancer and the fourth leading cause of cancer related death in the US. Both IL-33 and IL-37 are new members of the IL-1 family. We have previously shown IL-33 inhibits growth of pancreatic cancer cells by inhibiting proliferation and inducing apoptosis. IL-37 has been shown to have an antitumor effect on cancers such as renal and lung cancer. However, the effect of IL-37 on the growth of pancreatic cancer has yet to be investigated. This study was performed to investigate the effect of IL-37 on pancreatic cancer.

Methods: Clonogenic survival assay, immunohistochemistry (IHC), TUNEL staining, proliferation, and caspase-3 activity kits were used to evaluate the effects of IL-37 on cell survival, proliferation, and apoptosis of the MiaPan-2 pancreatic cancer cell line. We further investigated the possible molecular mechanisms by using RT-PCR and IHC.

Results: We found the percentage of colonies of MiaPan-2 cells were decreased after treatment with IL-37. This paralleled the decrease in PCNA+ cells, and the decrease in the OD value of cancer cells, after treatment with IL-37. Unexpectedly, TUNEL+ cells and the relative caspase-3 activity in cancer cells were also decreased in the presence of IL-37. This indicated the antitumor effect of IL-37 was mainly through its anti-proliferative effect, and not its anti-apoptotic effect. The anti-proliferative effect of IL-37 on cancer cells correlated with upregulation of the anti-proliferative molecule P27.

Conclusions: IL-37 inhibits growth of pancreatic cancer by inhibiting cellular proliferation through upregulation of P27. Such a study might be helpful to develop a promising immunotherapeutic strategy to treat this lethal pancreatic cancer.

♦ 31 G ♦

IL-29 Exhibits Protumor Effect on Pancreatic Cancer by Upregulation of Cyclin B and Survivin

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Background: IL-29 is a new member of the IFNλ family characterized by its strong antiviral activity. The role of IL-29 in the pathogenesis of neoplasia has been studied in cancers such as lung cancer, gastric cancer and colorectal cancer. However, the direct role of IL-29 in pancreatic cancer has not been studied yet. This study was performed to investigate if it has any direct effect on pancreatic cancer cell growth.

Methods: Clonogenic survival assay, cell proliferation and caspase-3 activity kits were used to evaluate the effects of IL-29 on cell survival, proliferation and apoptosis of a well-studied pancreatic cancer cell line, MiaPan-2. We further investigated the potential molecular mechanisms by using RT-PCR.

Results: We found that the percentage of colonies of MiaPan-2 cells was increased in the presence of IL-29. This was consistent with an increased OD value of cancer cells. Furthermore, the relative caspase-3 activity in cancer cells were also decreased in the presence of IL-29. The pro-proliferative effect of IL-29 on cancer cells correlated with increased expression of pro-proliferative molecule cyclin B. The anti-apoptotic effect of IL-29 on cancer cells correlated with increased expression of anti-apoptotic molecule survivin.

Conclusions: IL-29 promotes pancreatic cancer cell growth by promoting cell proliferation and inhibiting cell apoptosis. Thus, blocking IL-29 signal pathway might be a promising strategy to treat this lethal pancreatic cancer.

♦ 32 G ♦

The Effect of Metallic Hardware on Patient and Surgical Team Scatter Radiation Exposure Utilizing Mini-C Arm in a Simulated Forearm Fracture Fixation Model

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Purpose: The Mini-C arm is commonly used orthopedic surgery and is generally perceived as safe. To our knowledge no studies have analyzed the effect of absence or presence of orthopedic hardware in the fluoroscopy field with respect to changes in scatter radiation exposure. The goal of this study was to determine if the presence of hardware increases scatter exposure to the patient and surgical team.

Methods: Four trials were conducted using a lamb limb specimen and a standard Mini-C arm to simulate a forearm/wrist fracture fixation scenario. Trials 1 and 2 tested scatter with no hardware on the field. Trials 3 and 4 tested scatter radiation with a 3.5 mm LCDCP plate attached to the specimen. Scatter radiation directed at the eyes, thyroid, chest, hands (surgeon only), and gonads of the patient and surgical staff was measured. Comparisons were made using scatter percentage (scatter/direct beam x 100).

Results: The surgeon and first assistant were the only team members exposed to measurable scatter radiation. The presence of orthopedic hardware in the fluoroscopy field produced a substantial 181-fold increase in scatter radiation to first assistant's eyes (0.016% v 2.893%) , 66-fold increase to the surgeon's right hand (0.025%/min v 1.653%/min), and 9-fold increase to the left hand (0.182%/min v 1.653%/min) in the horizontal Mini-C arm trials.

Conclusions: Hardware in the fluoroscopy field increases radiation scatter exposure to a degree that may place the first assistant's yearly eye exposure in excess of the current International Commission on Radiological Protection (ICRP) limit.

♦ 33 G ♦

A Novel Noninvasive High-Efficacy Technique using Nanoparticle-Conjugated Delivery System for Treatment of Infantile Hemangioma

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Introduction: Infantile hemangiomas (IHs) are benign tumors affecting 5-10% of all infants. Surgical treatment is difficult because of the highly vascular nature of the tumor. This study aims to define a noninvasive, high-efficacy treatment method for IHs by a combining photodynamic therapy and pharmacotherapy delivered by a nanoparticle carrier.

Methods: $1.5x10^6$ mouse hemangioendothelioma cells were injected subcutaneously into bilateral axillary regions of twenty, 5-week old male nude mice. For near-infrared imaging, the animals were injected with 200µl of nanoporphyrin nanoparticle conjugated with a fluorophore (DiD) via the tail vein. The animals were then euthanized, major organs and IHs were harvested, and the IHs were examined histologically with von Willebrand Factor (vWF) immunofluorescence staining and Hematoxylene and Eosin (HE) staining.

Results: Mice started to grow tumors approximately 1 week after injection. In vivo imaging revealed that the nanoparticles reached maximum concentration in the IHs at 24 hours post-injection. Ex vivo imaging showed that the majority of the injected dose accumulated in the liver. Histological staining confirmed that the tumors were highly vascular.

Conclusion: The model we have created mirrors the characteristics of human IHs, making it a good model to test the therapy proposed. The next step in the study will be treatment of the tumors with both photodynamic therapy and propranolol-loaded nanoporphyrin nanoparticles. Photodynamic therapy will destroy the vascular cells of IH by triggering the formation of reactive oxygen species. In addition, near-infrared laser will stimulate the nanoparticles to release propranolol at the lesion site, producing a double therapeutic effect.

♦ 34 G ♦

Case Report: OMT to Treat Low Back Pain and Lumbar Radiculopathy Years After Scoliosis Surgery

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The authors describe a case of a 50 year-old female who presented with progressive low back pain and right sciatica symptoms for a year prior to visiting our Osteopathic Manual Medicine Clinic at Des Moines University Tower Medical Clinic in Des Moines, Iowa. The patient reported that she had undergone T4-L4 posterior spinal fusion for scoliosis in 1981. She was provided a thorough neuromusculoskeletal evaluation and osteopathic structural exam. In addition to her postural dysfunction, she was diagnosed clinically with a right L4 radiculopathy. While awaiting results of her diagnostic imaging studies she was provided with osteopathic manipulative treatment (OMT). Resolution of her sciatica symptoms and reduced patient-reported pain scores were demonstrated after two treatments of OMT. With the dramatic response of her symptoms the patient declined a spine surgery consultation and opted to monitor her symptoms. The case demonstrates the role of osteopathic manipulation in the conservative management of radiculopathy and co-existing spinal conditions.

♦ 35 ♦

Combined Norepinephrine and ATP Antagonism Attenuates the Vasoconstriction Response in Young Adult Skin

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Norepinephrine (NE) is responsible for ~60% of the vasoconstriction (VC) response to cold exposure in young adults whereas the remainder is due to unknown coreleased sympathetic adrenergic neurotransmitter(s). We hypothesize that ATP is a cotransmitter and thus, combined ATP and NE antagonism will further inhibit the reflex cutaneous VC response. Two protocols were conducted in young adults; both involved the placement of three microdialysis (MD) fibers in forearm skin and whole-body cooling (T_{sk} = 30.5 ^{o}C). *Protocol 1* infused 1) lactated Ringer's solution (control), 2) 10mM L-NAME, and 3) purinergic receptor blockade with 1mM suramin + L-NAME. *Protocol 2* infused 1) Ringer's, 2) suramin + L-NAME, and 3) suramin + L-NAME + adrenoreceptor blockade with 5mM yohimbine + 1mM propranolol. Laser Doppler flux (LDF) was measured over each MD site and cutaneous vascular conductance (CVC) was calculated as CVC = LDF/MAP and expressed as percent changes from baseline (%ΔCVC). L-NAME was used to block the vasodilatory influence of ATP and unmask the P2X-mediated VC response to exogenous ATP infusion (-21 ± 2 %ΔCVC). During whole body cooling, the VC response (control: -39 ± 3 %ΔCVC) was attenuated in the suramin site (-21 ± 2 %ΔCVC) and further blunted with combined adrenoreceptor blockade (9 ± 1 %ΔCVC; $p < 0.05$). Compared to control (22 ± 1 %ΔCVC), suramin inhibited pharmacologically-induced VC to tyramine (12 ± 2 %ΔCVC), which acts to displace adrenergic neurotransmitters from axon terminals. Collectively, these data indicate that ATP contributes to the cutaneous adrenergic VC response in humans.

Funded by Iowa Osteopathic & Education Research Grant (IOER #03-14-01).

♦ 36 ♦

Effect of Laser Doppler Depth on Cutaneous Vasoconstriction Measurements with Whole-Body Cooling

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Cutaneous vasoconstriction (VC) is an important thermoregulatory mechanism to preserve body core temperature in cold environments. The standard method of measurement involves laser Doppler flowmetry, which utilizes refraction of laser light off red blood cells to quantify cutaneous vascular conductance (CVC). Laser Doppler flowmeters vary in depth of dermal measurement; however, it is not currently known how this affects CVC measurements with thermal perturbation in human skin. A whole-body cooling (T_{sk}=30.5°C) protocol was conducted in 9 young adults. Subjects were instrumented with five laser Doppler flowmeters measuring at various skin depths: One 4mm Doppler (D), two 0.66mm Dopplers (VP7B), and two 0.33mm Dopplers (VP12). Laser Doppler flux (LDF) was measured with each flowmeter placed on the ventral forearm. Absolute CVC was calculated as LDF/MAP and normalized as percent changes from baseline (%ΔCVC). Absolute CVC increased with greater measurement depth while the normalized response was not different between flowmeters. Peak absolute CVC was significantly greater in the deep 4mm Doppler when compared to the more superficial 0.33mm Dopplers (D: 0.2485±0.0422 flux; VP12: 0.0684±0.0084 flux, p=0.005) and between the 0.66mm Dopplers and 0.33mm Dopplers (VP7B: 0.1231±0.0117 flux, VP12: 0.0684±0.0084 flux, p=0.019). Although not significantly different (p=0.077) there was a trend of decreased absolute CVC values with decreasing depth between the 4mm and 0.66mm Dopplers. Collectively, these data indicate that laser Doppler flowmeter depth significantly affects absolute CVC measurements. Additionally, the lack of differences in normalized CVC values provides evidence of uniformity in the cutaneous VC response to cooling.

♦ 37 G ♦

Extramammary Paget's Disease in the Axilla of a Male Patient: Case Report and Review of Literature

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An 82 year old man was seen for a well-demarcated, erythematous plaque in the left axilla. His primary care provider had treated the rash with topical antifungals for months, but it persisted. Clinical and histological diagnosis indicated Extramammary Paget's Disease, and the patient was referred to plastic surgery for lesional excision. The rare finding of axillary Extramammary Paget's Disease in a male patient requires careful clinical and histological examination to prevent misdiagnosing it as a more common pathology, which can lead to unnoticed metastatic spread. Upon diagnosis, current treatment recommendations are under consideration but include wide surgical excision, with sentinel lymph node biopsy for lesions demonstrating dermal invasion >1mm.

♦ 38 ♦

Boric Acid Drains *Candida albicans* Metabolic Reserves

Martin Schmidt, PhD and Michael P. Boyer, BS

The yeast *Candida albicans* is an opportunistic human pathogen that has to adapt to a wide variety of metabolic situations to survive within the host. Metabolic flexibility is thus a major virulence factor for this fungus and the complex network of metabolic adaptions is emerging as a future target for antifungal treatments. Boric acid (BA) is an effective antifungal remedy that has a wide spectrum of action on various classes of biochemical reactions. BA has been shown to affect energy metabolism in eukaryotes, with the ultimate effect of leading to weight loss in rats. The present study examines the effect of BA on energy metabolism of *C. albicans,* particularly on the consumption of glucose, the utilization of less ideal carbon sources and the deposition of metabolic energy (glycogen and triacylglycerol). It was found that BA exposure increases dry biomass yield from glucose, pointing to a more efficient biomass synthesis during BA stress. The toxicity of BA depends strongly on the carbon source, with cells being

particular resistant in media containing high glucose, fructose or lactic acid concentrations. BA stress also decreases the cellular stores of carbohydrates and lipids, most likely reducing cellular water content by reducing glycogen amounts. Cellular cAMP levels were determined to assess the level of metabolic stress in boric acid treated cells; however, no significant increase in intracellular cAMP concentrations was found. Our data show that BA stress drains *C. albicans* metabolic reserves in a cAMP-independent manner. We suggest that the observed reduction in energy storage may contribute to the antifungal action of BA by limiting the pathogens' metabolic adaptability.

♦ 39 ♦

Ketamine Diffusion in Brain Tissue: Implications for *in vitro* Studies of Drug Mechanisms

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Ketamine has been in use for over 50 years as a general anesthetic, acting primarily through blockade of N-methyl-D-aspartate receptors in the brain. Recent studies have demonstrated that ketamine also acts as a potent and rapid-acting antidepressant when administered at sub-anesthetic doses. However, the precise mechanism behind this effect remains unclear. We examined the diffusion properties of ketamine in brain tissue to determine their effects of *in vitro* studies related to the actions of ketamine. Brain slices from adult mice were exposed to artificial cerebrospinal fluid (aCSF) containing ~20 μM ketamine HCl for varying amounts of time. The amount of ketamine within each slice was then measured by tandem high performance liquid chromatography – mass spectrometry to characterize the diffusion of ketamine into brain tissue over time. We successfully modeled the diffusion of ketamine into brain tissue using a mono-exponential function with time constant τ=8.27 minutes. This curve was then compared to a one-dimensional model of diffusion yielding a diffusion coefficient of approximately $0.12 cm^2 \cdot s^{-1}$ for ketamine diffusing into brain tissue. The brain:aCSF partition coefficient for ketamine was determined to be approximately 3. Our results suggest that the diffusion properties of ketamine have a significant effect on drug concentrations achieved within brain tissue during *in vitro* experiments. Ketamine is highly soluble in both water and lipid, quickly equilibrating in lipid-rich brain tissue at concentrations up to 3 times higher than the surrounding aCSF. Due to the concentration-dependent nature through which ketamine exerts its differential actions, these diffusion properties should be considered when interpreting or designing *in vitro* studies related to the actions of ketamine, and caution should be exercised when interpreting results derived from previous *in vitro* studies in which the concentrations of ketamine used greatly exceed those which produce specific effects *in vivo*.

This work was supported by NIH (MH108043) and Iowa Osteopathic Education and Research (IOER) Funds.

♦ 40 ♦

Intersectional Strategies for Genetic Labeling of Mouse Central Nervous System

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The brain is composed of many neuronal and non-neuronal cell types. The connectivity and interactions between these cells are critical to the brain's function. Thus the ability to selectively label and further manipulate specific cell types is crucial. However, cell-type specificity is rarely defined by a single gene. An increasingly effective method is to use intersectional genetic targeting of protein-based promoters in order to achieve more specific labeling of desired cell types.

Our long-term goal is to identify genetic tools to achieve high specificity of genetic labeling in the cell types, neuronal pathways (projections), and brain regions. Using existing transgenic lines that carry Cre and the Cre/Flp double recombinase system (driver lines) in conjunction with the tdTomato reporter, we investigated labeling patterns of various interneuron specific markers: somatostatin (SOM), parvalbumin (PV), cholecystokinin (CCK), and tachykinin 1 (TAC1) as well as their intersections: SOM+PV, CCK+PV, and Tac1+PV. As expected, intersections result in more specific labeling (e.g. fewer cells) of interneurons than individual markers. Out of expectation, we have also identified two pathways labeled with high specificity from non-interneuron marker intersections: Lateral perforant pathway

(Layer 2/3 pyramidal neurons projecting to dentate gyrus in hippocampus) and the retrosplenial projection to layer 5 pyramidal neurons in the entorhinal cortex.

While further characterization and establishment of both driver and reporter lines are necessary, intersectional strategies are demonstrating great potential for targeting expression in specific cell types as well as specific pathways.

♦ 41 ♦

Comparison of the Pelvic Girdle Questionnaire and the Timed-Up-and-Go in Pregnant Women With or Without Pelvic Pain

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Introduction: Pelvic girdle pain is common in pregnant women. The pain can cause women to experience changes in different activities of daily living. These changes tend to encourage women to seek treatment from physical therapists. The purpose of this study was to determine if patient questionnaires and/or clinical measures are consistent in assessing physical performance of daily tasks.

Methods: Thirty-seven pregnant women, ages 18-45, participated in the study. Eleven participants were classified in the 'Pain' group with a positive modified Trendelenburg test. Twenty-six 'Control' group participants did not have pelvic pain. All women completed the Pelvic Girdle Questionnaire (PGQ). Each participant performed 3 Timed-Up-and-Go (TUG) trials across a Zeno walkway (ProtoKinetics LLC; Havertown, PA). The sum from the PGQ was calculated with inapplicable/unanswered questions scored as zero. Each PGQ total was correlated with average TUG duration using a Pearson Correlation Coefficient. An unpaired heteroskedastic t-test compared Control vs. Pain groups on PGQ and TUG scores.

Results: Results indicated a positive correlation (0.43) between PGQ and TUG for all participants. The Pain group's PGQ scores were higher compared to the Control group ($p<0.001$), while there was no difference between groups on the TUG.

Discussion: There was a correlation between PGQ and TUG scores, but no apparent benefit of TUG scores to differentiate the physical performance of individuals with pelvic pain. This is important for clinicians who treat pregnant women with pelvic pain because the PGQ may capture more varied components of movement compared to overall TUG score for evaluating change.

♦ 42 ♦

Virucidal Effects of MST-312 and Epigallocatechin gallate on Herpes Simplex Virus 1

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Herpes Simplex Virus (HSV) is the cause of cold sores, blindness and brain damage and often leads to recurrent infections. The current anti-viral therapies can fail when drug resistant HSV mutants arise. Thus, novel drugs for the treatment of HSV are needed. Previous research in our laboratory has determined that the telomerase inhibitor, MST-312, interferes with multiple steps of the HSV life cycle. The structure of MST-312 contains moieties related to a natural compound found in green tea, epigallocatechin gallate (EGCG). EGCG has been reported to possess direct virucidal activities toward HSV-1. Here, we test the virucidal activity of MST-312 and compare it to that of EGCG. Specifically, HSV-1 was exposed to various concentrations of MST-312 or EGCG for time periods between 1 and 60 minutes and then the ability of the treated virions to form plaques on Vero cells was assessed. When treated for 30-60 minutes, 40 μM MST-312 and 0.5-1.0 μM EGCG significantly reduced the number of HSV-1 plaque forming units. The temperature at which treatment occurred impacted the ability of the compounds to limit viral replication. Both compounds were effective when treatment occurred at 37°C and room temperature (RT). However, no inhibition was seen when virions were treated with MST-312 at 4°C. One minute of treatment with 2 μM EGCG at RT was sufficient to significantly reduce HSV titers. These data indicate that both EGCG and MST-312 possess direct virucidal properties on HSV-1. Higher concentrations of MST-312 were required to inactivate HSV-1 virions compared to EGCG.

♦ 43 G ♦

MIDUS Human Cytokines in Basal Serum and Unstimulated, LPS- and PHA-Stimulated Supernatant Cultures

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Abnormal cytokine levels have been associated with a variety of conditions and are sensitive to demographic factors, including age, race, and body mass index. The assessment of cytokines in serum provides useful biomarkers of illnesses, yet only weakly reflect leukocyte production. Hence, it is important to measure cellular release of cytokines in vitro, to better understand immune processes.

Lipopolysaccharide (LPS) and phytohaemagglutinin (PHA) are common stimulants of immune responses in vitro. There is little information available on how in vitro cytokine production in response to LPS and PHA compare to basal serum levels. However, understanding how LPS- and PHA- stimulated responses resemble baseline, non-stimulated cytokine levels can provide useful information on the capacity of immune cells to respond to activation triggers and inflammation. The purpose of this study was to explore how basal serum levels of select cytokines compare to PBMC cytokine release, when unstimulated or stimulated by LPS or PHA. The measures of cytokines were assessed from fasting blood samples collected in the MIDUS-II Biomarker Project. In order to assess the correlations of each cytokine within and between baseline serum, unstimulated, LPS- and PHA- stimulated supernatants, bivariate correlation analyses were conducted. Although the basal serum and unstimulated, LPS- and PHA- stimulated supernatant cultures were not comparable across all cytokines, there are several in vitro cytokines samples that successfully replicate responses in vivo. By utilizing in vitro methods to mimic immune processes, we can more accurately study cytokine responses to inflammations or diseases, demographic features and neuromodulating hormones.

♦ 44 ♦

X Cell: A Novel Adaptive Lymphocyte that Co-expresses Functional B Cell Receptors and T Cell Antigen Receptors

Chunfa Jie, PhD, Rizwan Ahmed, Thomas W. Donner, Abdel R. Hamad

The adaptive immune responses are carried out by two different lymphocytes (B and T cells). We uncovered a novel adaptive lymphocyte in human and mouse, X cell, which co-expresses B cell receptors (BCR) and T cell antigen receptors (TCR). The X cell is primarily identified as $CD19^{+}CD5^{+}TCRb^{+}$, and is further classified into IgD+ or IgD- subsets on the basis of BCR isotype. The TCRs and BCRs of X-cells were found to be functional and highly responsive to stimulation. The TCRs and BCRs amplified from X-cells were also revealed to be highly diverse with wide V gene usage and have rich oligo-clonality by high throughput sequencing. IgD is the major BCR isotype of X cells, and it has an invariant germline sequence (GVH04-b, DH05-18, and JH04-01) and identical CDR3 sequence in three Type 1 Diabetes (T1D) patients. This invariant clonotype is absent in healthy controls (HC) (n=4), suggesting its association with T1D. Despite the high oligo-clonality, the TCRs of X cells have few dominant TCRVB (TCR V-Beta Repertoire) used as compared to conventional T cells in our preliminary findings. Furthermore, X cells are present in NOD mice and responsive to in vivo stimulation with T cell insulin epitope. With the autoreactive potential through their BCRs and/or TCRs, X cells may provide a valuable diagnostic or therapeutic target in Type 1 Diabetes.

♦ 45 ♦

Making Effective and Accessible Poster Presentations

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To share our knowledge with the most people possible, we want to make our posters accessible. Some considerations for printed posters relate to color choices, font sizes and font types. Some principles include the following: 1) Make sure that color is not used alone to provide meaning or emphasis. 2) Use sufficient contrast with dark text on light backgrounds or light text on dark backgrounds. 3) Make sure the font style is easy to read. 4) Text is large enough to read from three feet away. 5) The text flow is intuitive and the poster is not cluttered.

♦ 46 G ♦

The Effect of Yoga on Physiological and Psychological Measurements in Healthcare Students: A Pilot Study

Shayla McIntyre, DPT'17, Mary Beth Wims, DPT'17, Laura Covill, DPT

Yoga has a positive effect on physiological and psychological measures. The purpose of the current study was to determine the effects of a self-determined yoga practice, including meditation, breathing, and postures, on three psychological measures and vital signs in healthcare students. We hypothesize that self-determined yoga practice would result in improved vital signs and psychological measures.

Participants were recruited from graduate healthcare students at Des Moines University. Twelve subjects (subjects) were recruited from students enrolled in a 12 week yoga elective. Thirteen controls (controls) were recruited from the student body at large.

Subjects were asked to practice yoga (meditation, breathing and postures) at a suggested 4-5 times per week. Controls did not change their normal exercise regimen. All participants had vital signs and psychological measures – the Oxford Happiness Questionnaire (OHQ), the Self-Compassions Scale (SCS), and the Perceived Stress Scale (PSS) – recorded at initiation and completion of a 12-week time frame. A dependent t-test was conducted on pre/post scores of all variables.

Controls showed no significant differences between pre-testing and post-testing for any of the measures collected. Subjects exhibited a diminished respiratory rate ($p=0.0043$) and systolic blood pressure ($p=0.024$) but heart rate and diastolic blood pressure did not change. There was significant difference measured in the psychological scales (OHQ $p=0.0049$) (SCS $p=0.048$) (PSS $p=0.015$).

Implementing a yoga practice including meditation, breathing and physical postures can reduce self-assessed determinants of psychological well-being in healthcare students. Initiating a yoga practice during graduate healthcare education can assist with students' stress, happiness, and self-compassion.

♦ 47 G ♦

The Effectiveness of Three Different Airway Management Techniques for Airway Decontamination: A Manikin Study

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Background: Massive aspiration events are life-threatening events that can occur during intubation. Studying and training for these events is difficult due to their rarity. Three different management techniques have been described (traditional intubation, Intentional Esophageal Intubation (IEI) and Suction Assisted Laryngoscopy Airway Decontamination (SALAD)) but their effectiveness has not been compared. Using a modified airway training manikin, we compared the effectiveness of these techniques.

Methods: IRB approval and informed consent were obtained. Senior anesthesiology and emergency medicine (EM) residents were block randomized per specialty. Participants watched a training video on their assigned technique then intubated during a simulated event. Pre and post study surveys were completed. Data was analyzed using ANOVA and pairwise t-tests. Survey data was analyzed using Kruskal–Wallis and Fisher's exact test. A p-value <0.05 was considered significant.

Results: 21 anesthesia and 10 EM residents completed the study. Tracheal aspirate volume was higher in IEI and SALAD ($p = 0.392$). Time to intubation was similar ($p = 0.805$). Pre-study survey reported PGY2 had lower confidence versus PGY3/4 ($p = 0.046$). Post-study survey reported confidence increase in all residents ($p < 0.001$). PGY2/3 found training more beneficial versus PGY4 ($p = 0.018$) and planned on applying the trained technique ($p = 0.014$).

Conclusions: This is the first study assessing the efficacy of different management techniques for massive aspiration events. Our findings suggest the three tested methods were similar. Participants anecdotally reported the modified airway manikin provided a realistic simulation for managing massive aspiration events. Further study is needed.

♦ 48 G ♦

Measuring Student Confidence in the Clinical Training Through Self-Assessment

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Background: Student self-assessment is viewed as an important tool in medical education by enhancing student performance and promoting critical awareness. In this study we sought to identify the relationship between third-year podiatric medical student self-assessment and student confidence levels after a full year of clinical training in five clinical competency domains.

Methods: Third-year podiatric students from five consecutive classes (2012-2016, N=237) completed a self-assessment survey of their performance for each of five domains (Professionalism, Medicine, Radiology, Surgery, and Biomechanics). The assessment was completed after the students finished the first twelve weeks of third-year clinical rotations (PRE) and a second time at the conclusion of the third year (POST), approximately twenty-four weeks later. Pooled class data for each of the PRE and POST assessment domains was evaluated. Statistical analysis included the Wilcoxon signed-rank test.

Results: The results demonstrated a statistically significant increase in student perceived confidence in all five domains from the PRE to POST assessment period. However, overall student confidence levels in Biomechanics were consistently lower compared to the other domains.

Conclusions: Published studies have shown that the amount of medical student exposure to a clinical skill is directly related to student confidence level. Our results show that even though confidence levels significantly increased in all domains, student confidence in the area of Biomechanics consistently lagged behind the other domains. These findings suggest the need for reinforcement of biomechanics competencies during clinical rotations with the possible supplementation of the curriculum using simulation, a more robust assessment of clinical lab performance and/or biomechanics specific SPAL activities.

♦ 49 ♦

Evaluating the Effectiveness of a Multifaceted Cultural Competency Program Among Health Professional Advanced Summer Scholars (P.A.S.S.) Students

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Background: According to the National Institute of Health (NIH), the rapidly changing demographics in the U.S., demonstrates a critical need for cultural competency training for healthcare providers. Despite some promising efforts, cultural competency training is scarcely integrated into the curricula of medical schools. Additionally, there is a lack of evidence-based cultural competency interventions. To address these gaps in knowledge, we launched a pilot study involving 10 pre-health students from underrepresented backgrounds, who participated in DMU's summer undergraduate enrichment (Health P.A.S.S.) program in the summer of 2016.

Method: Our intervention consisted of discussion on health disparities, social determinants of health, and culturally responsive healthcare centered around six films from the Diversity Health Series (DHS). Additionally, students participated in shadowing experiences involving minority patients. We utilized a mixed methodology to assess the feasibility and effectiveness of this intervention. Participants and attended focus groups and took the Quality and Culture Quiz, designed to measure their level of cultural awareness, before and after participating in the program.

Results: Students scored significantly higher on the post-test (M= 15.8, SD=3.01) of the QCQ compared to the pre-test (M=11.3, SD=2.75), upon successful completion of the intervention; $t(9)=-9.43$, $p < 0.01$. Thematic analysis of focus group transcriptions revealed that this intervention was highly feasible. Additionally, it demonstrated that knowledge about health disparities could empower students from minority backgrounds to serve in underserved areas of nation.

Conclusion: This study augments the literature on the feasibility and effectiveness of utilizing DHS and shadowing experiences in cultural competency intervention development.

♦ 50 ♦

Cultivating Intuition: A Model of Medical Education in Cross-Cultural Bioethics

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Much of the literature on bioethics has sought to formalize ethical practice through reference to concrete decision-making models and ethical standards. While such models and standards provide needed guidance when ethical actor and environment share implicit attitudes, many authors have questioned the suitability of this approach to cross-cultural ethical dilemmas. Cross-cultural interactions, whether global or local, necessarily present the ethical actor with uncertainty and complexity and call into question implicit moral attitudes. The present work outlines the pitfalls of exclusively rationalist approaches and presents a dual-process model for medical education in cross-cultural bioethics. Specifically, the paradigm addresses moral intuition through problem-based learning that emphasizes self-reflection, integration of moral background with the principles of the profession, and exercises to increase emotional attunement with culturally-diverse populations. It addresses moral reasoning through didactic training in multicultural competency, education on non-rational processes, exposure to culturally-diverse codes of conduct, and reference to ethical decision-making models. Ultimately, ethical knowledge does not imply ethical decision making, and nonrational processes do not strictly impair ethical action. As such, it is only through engagement with nonrational processes that culturally-competent, ethical healthcare providers will emerge.

♦ 51 G ♦

Analysis of Post-Professional DPT Student Outcomes: A Retrospective Study

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Background: There has been little published work on professional gains for transitional Doctor of Physical Therapy (DPT) participants, although initial intent was to expand education beyond entry-level. The purpose of this project is to evaluate student perspectives from participating in a post-professional DPT program. The research aims to identify significant outcomes from preselected program student learning outcomes.

Methodology: This retrospective study involved 229 students in an online post-professional DPT program who graduated between 2010 and 2014. The materials for this research project included 177 student academic assignments completed during the capstone course which were accessible from the 2010, 2012-2014 graduates. The culminating assignment included a reflection on program outcome attainment and a professional development plan. A content analysis was performed using text mining software (WordStat, Provalis Inc., Montreal, Canada) to identify primary textual content within the student assignments. An exploratory cluster analysis was completed to extract initial themes. The content and cluster analyses guided keyword categorization using qualitative data analysis software (QDA Miner, Provalis Inc., Montreal, Canada) for additional analysis.

Results: Based on the content analysis, more than 90% of student submissions contained the keywords of 'lifelong learning' (96%, N = 171/177), evidence-based practice as 'EBP' (96%, N=171/177), 'patient care' (92%, N=164/177), and 'knowledge' (91.6%, N=164/177).

Discussion: Initial results appear consistent with program outcomes addressed in student assignments. Future work will evaluate themes for congruence with core professional values. Qualitative data will be triangulated with graduate survey data to provide a comprehensive view of outcomes from a post-professional DPT program.

♦ 52 G ♦

Addressing the Physician Shortage: Shortening Medical School Curricula

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Last August, the AAMC projected a shortage of up to 90,000 physicians over the next decade. A potential solution to this projected shortage is to shorten the medical school curriculum. In many countries, shorter undergraduate medical training programs (6-7 years vs. 8 years for the U.S.) exist but do they result in better clinical outcomes? We hypothesize there is no difference in clinical outcomes from international medical graduates (IMGs) with shorter undergraduate medical training vs. U.S. medical graduates (USMGs). In 2010, researchers in Pennsylvania analyzed the differences in mortality rates between IMGs vs. USMGs for patients admitted for AMI. They found no difference in clinical outcomes between the two groups which suggests the care by IMGs is equivalent to those of USMGs. We would like to further this study by replicating it in Iowa to see if we achieve the same results. To do so, we would use Iowa Hospital Discharge Data from Medicare or Wellmark which contains patient admitting diagnosis, attending physician, and mortality status. We would also obtain physician demographic information from the AMA physician Masterfile including medical school and country of graduation. From the country of graduation and medical school, we could determine the length of undergraduate medical education. If there is no difference in Iowa between mortality rates for patients admitted for AMI and cared for by IMG vs. USMG, this suggests shortening our medical school curricula, a potential solution to the physician shortage.

♦ 53 G ♦

Scapular Impairment in Rhinogenic Headaches

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Impaired scapular position and function have been associated with neck pain. While neck impairments are a feature of cervicogenic headaches, individuals with rhinogenic headaches (RGH) may also have neck impairments. The purpose of this study was to examine scapular position and scapular function in individuals with RGH.

Eighteen subjects with RGH and 15 controls (AC) were assessed for scapular position and dyskinesis. Subjects with RGH completed a Headache Impact Test (HIT) of functional impairment; mean HIT was 55.7 (6.8). Scapular position and dyskinesis were assessed through observation and palpation. Position was rated as either normal or depressed. Dyskinesis was rated as absent or present during active shoulder motion.

Spearman's rho was calculated to determine the relationship between degree of functional impairment and scapular dyskinesis; Spearman's rho was calculated to determine the relationship between degree of functional impairment and scapular position. Correlation coefficient was not significant for dyskinesis 0.09 ($p=0.76$); it was significant for scapular position 0.50 ($p=0.04$*).

There was no significant difference between RGH and AC groups for the presence of scapular dyskinesis (Mann-Whitney=121.5; $p=0.39$), or for impaired scapular position (Mann-Whitney=88.5; $p=0.05$).

Scapular dyskinesis does not appear to be a feature of RGH, however impaired scapular position may be a feature. Degree of functional impairment from RGH may be related to scapular position, however no cause and effect relationship can be determined. Clinicians should consider scapular posture in assessment of patients with RGH. Continuation of the study to attain a larger sample size is needed to achieve adequate statistical power.

♦ 54 ♦

The Presence of Neck Pain in Individuals with Rhinogenic Headaches

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Individuals with chronic headaches often exhibit signs and symptoms of multiple headache types, making diagnosis and appropriate intervention a challenge. While rhinogenic headaches (RGH) are associated with paranasal sinuses and cervicogenic headaches (CGH) originate in the cervical spine, there is potential overlap in these diagnoses since the trigeminal system has a role in innervation of both the sinuses and the neck. The purpose of this study was to determine if individuals with RGH report neck pain.

Twenty-one subjects with RGH participated. Mean headache duration was 80.8 (±73.4) months. Subjects were asked to answer "yes" or "no" to questions regarding the presence of neck pain, whether the neck pain spread from their neck to their area of headache pain, if their headache was aggravated by neck movements or by sustained neck postures.

Neck pain was reported by 76.2% (16) of the subjects; of whom 81.3% (13) reported their neck pain spread to their area of headache. Headache was aggravated by neck movement in 61.9% (13) and by neck postures in 52.3% (11). Pearson Correlation showed no relationship between headache duration and presence of neck pain 0.18 (p=0.44).

Results indicate that many individuals with RGH may have a cervical component to their headaches. Further investigation with a larger sample size is warranted to establish the presence of neck pain and cervical musculoskeletal signs in RGH as compared to a headache-free control group. This will help clarify if neck dysfunction is a potential contributing factor to RGH headaches which has implications for clinical practice.

♦ 55 G ♦

The Energy Cost of Walking While Thinking

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Background: Research has shown that engaging in walking while thinking (WWT) results in changes in cardiovascular and metabolic measures.[1,2] The energy cost of walking is a measure of the work of walking,[4] and is influenced by biomechanical and neuromuscular factors,[3] and possibly brain function.[4] The purpose of this study is to determine if the energy cost of walking is sensitive to cognitive load during WWT.

Methods: Eight young adults participated. For each of six conditions, participants walked at their usual speed for 4 minutes (walking alone, WA) followed by 2 minutes of engagement in a cognitive task (WWT). The cognitive tasks varied by complexity and domain. Indirect calorimetry was used to derive the energy cost of walking (mean oxygen consumption/ treadmill speed, ml/kg m) in each condition during WA and WWT. Paired sample t-tests were used to compare energy costs of WA vs. WWT.

Results: There were no significant differences in the energy cost of WA across conditions, p=.25. There were no significant differences between the energy cost of WA vs. WWT for any of the cognitive tasks, p=.36-.76.

Discussion: Fatigue was not a confound, as the energy cost of WA remained stable across conditions. Close examination of the data indicates that averaging energy cost over the entire 2 minutes of WWT may not be valid. We propose re-segmentation to examine the final 30 seconds of all WWT tasks to ensure correct interpretation of the data.

♦ 56 G ♦

Prevalence of Low Back Pain in Individuals with Plantar Heel Pain: A Retrospective Case Control Analysis

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Plantar heel pain (PHP) is a common foot disorder treated by health professionals, but the interaction between multiple factors that contribute to the aetiology of PHP is poorly understood. One factor supported by clinical observations and preliminary evidence from research is the association between PHP and low back dysfunction. This relationship was investigated in a retrospective case control analysis matched for age, body mass, and gender that accomplished two objectives: 1) compared the prevalence of low back pain (LBP) among individuals with PHP (n=27) to the prevalence of LBP among individuals without PHP (controls, n=27), and 2) assessed the association between foot/ankle function and low back dysfunction using the Foot and Ankle Ability Measure (FAAM) and the modified Oswestry low back disability questionnaire (OSW). Seventy-four percent of individuals with PHP had LBP (average OSW= 25.4, 95% CI: 18.1, 32.7), while only 37% of individuals in the control group had LBP (average OSW= 8.4, 95% CI: 4.0, 12.8). Individuals with PHP were 4.85 times (p= 0.007) more likely to have LBP than the control cohort. OSW scores for individuals with PHP were moderately correlated to FAAM scores (r=-0.497, p=0.008), but OSW and FAAM scores were not correlated with body mass index, age, duration of PHP symptoms, or duration of LBP symptoms (p > 0.01). The results of this study warrant further research to understand the relationship between LBP and PHP as well as how LBP management may impact clinical outcomes of individuals with PHP.

♦ 57 G ♦

Effect of a Prior History of Plantar Heel Pain on Treatment Outcome

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Many patients with plantar heel pain (PHP), or plantar fasciitis, have recurrent episodes of pain even after treatment completely resolves their symptoms. A prior history of PHP may lead to decreased effectiveness of conservative treatment for PHP and may have implications on the best treatment approach. Our primary objective was to determine if prior history of PHP contributed to a decreased response to conservative intervention. Sixty-nine individuals (20 females) with a primary diagnosis of PHP were recruited from the Des Moines University Foot and Ankle Clinic. Pain was assessed using the numeric pain rating scale (NPRS) and functional ability via the foot and ankle ability measure (FAAM) at the initial appointment and six months after starting treatment. Successful treatment was defined as a change greater than the minimal clinically important difference in the NPRS and FAAM. Successful treatment was achieved in 30/43 (69.8%) of individuals without a prior history of PHP and 16/26 (61.5%) of individuals with a history of PHP, but there was no difference in success rates between groups ($\chi^2 = 0.494$, $p = 0.5$). The results suggest that patients with and without a history of PHP are equally responsive to conservative treatment and do not require special consideration when determining appropriate treatment strategies. Further research is needed to identify factors contributing to symptom recurrence and effective treatment solutions to reduce the frequency of recurrent episodes of heel pain.

♦ 58 G ♦

The Role of Patient Expectations and Adherence in Plantar Heel Pain Treatment Outcomes

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Patient treatment expectations and adherence impact clinical treatment outcomes, but this has not been studied in individuals with plantar heel pain (PHP). The purpose of this study was to assess the effect of patient expectations and adherence on PHP treatment outcomes. Eighty patients with PHP were provided treatment directed by a podiatrist or a podiatrist in conjunction with early physical therapy intervention. Expectations of outcome were assessed at baseline. Adherence and outcome scores (pain and function) were recorded at 6 weeks, 6 months, and 1 year after starting treatment. Changes in pain and function outcomes were compared between patients with high versus low expectations, between patients who met and did not meet baseline expectations, and between patients with high versus low adherence to recommended treatment. All patients demonstrated clinically meaningful improvements in pain and function and reported good adherence to treatment recommendations. Interestingly, participants with lower adherence demonstrated higher function and lower pain levels at 1 year ($p = .03$), but no difference at 6 weeks or 6 months ($p=.21$-$.84$). Also, there was no difference in outcome between patients with high and low expectations at any time point ($p=.18$-$.69$). Individuals who met their 6 week and 6 month expectations had lower pain and higher function scores ($p=.001$-$.03$), but this difference dissipated at 1 year ($p=.325$-$.751$). The results of this study suggest that reasonable expectations should be discussed with patients to improve clinical outcomes. Results regarding adherence are very preliminary and should be interpreted with caution.

♦ 59 G ♦

Biomechanical Analysis of Scapular Positioning During Frontal Plane Abduction

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Scapular positioning, orientation and motion is critical to normal shoulder function. Limitations in the scapulothoracic A/P tilting, I/E rotation, and UP/DOWN-ward rotation have been linked to a variety of shoulder conditions. A more complete understanding of the mechanics of the scapula during arm elevation will help improve our ability to assess and rehabilitate shoulder dysfunction.

One of the earliest studies analyzing scapular motion was performed by Inman et al (1944). They observed arm abduction in the frontal plane and found that the humerus contributed approximately 120° of motion while the scapula provided the other 60° a 2:1 ratio for the scapulohumeral rhythm. This relationship, however, is uncertain with respect to all three cardinal planes and further understanding of the scapular motion is needed.

In our study, eighteen (18) subjects performed shoulder elevation to ~90-100° in the abduction and flexion planes, while seated, sidelying, supine and prone. The scapulothoracic motion was evaluated using 3D motion analysis. Preliminary data does not agree with the 2:1 scapulohumeral rhythm proposed, for frontal plane motion. The rhythm is not linear throughout the ROM and it varies between 5:1 at the early elevation range and 1.5:1 later during abduction. Moreover, it varies with the plane of motion and the body position.

Sample data will be presented, showing the scapulothoracic motion on all cardinal planes. The changes in the scapulohumeral rhythm will be discussed and its variability in the different body positions will be highlighted.

♦ 60 ♦

Relative Contributions of the Lower Limb to Peak Propulsive Force During Gait

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Gait speed is one important aspect of activities of daily living and a predictive metric for subsequent disability. Gait speed has previously been correlated to propulsive impulse, the time integral of anterior ground reaction force (aGRF). To isolate possible sources that contribute to peak aGRF, Hsiao et al. have produced and modified a quasi-static method analyzing trailing limb angle (TLA), external ankle moment (Ma), their interaction, and the external ankle moment arm. The purpose of this study was to evaluate the enhanced model presented by Hsiao et al. on healthy individuals.

Understanding the relationship of aGRF contributors to walking speed in healthy adults provides the foundation for clinical protocol development designed to address recovery therapy goals related to ambulation ability.

Twenty healthy young adult males were recruited to participate with each asked to walk at self-selected and fast walking speeds. Kinetic and kinematic data were collected and gait parameters (walking speed, aGRF, TLA, external Ma, and moment arm) were produced. The contributions of TLA, external Ma, their interaction, and moment arm to changes in aGRF were calculated as per Hsiao et al. and statistical analyses were performed.

We found that the modified model's predictive regressions performed well, especially in the case of predicting change in aGRF. These regressions are supported by high coefficients of determination, although they tended to decrease at slower gait speeds. Overall, despite localized variability, results were consistent with the original work by Hsiao et al, demonstrating a preliminary ability to isolate some sources of gait speed.

♦ 61 ♦

Participant Recruitment Associated with a Study on Pregnancy and Pelvic Pain

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Background: Pelvic pain during pregnancy is a prevalent problem. Almost 20% of pregnant women experience pelvic pain. These preliminary results provide an overview of the effectiveness of recruitment methodology for research involving pregnant women with and without pelvic pain.

Methods: The primary research study, "Investigation of mobility across the continuum of pelvic pain associated with pregnancy," initiated data collection in January 2016. Recruitment methods included meeting with healthcare providers, information in the Iowa Doula and Willowsong newsletters, flyers for patients within Des Moines University (DMU) Clinic, posts on Facebook and the 'Dose of DMU' blog, and word-of-mouth. Participant demographics were analyzed. Recruitment methodology was reviewed with the DMU Marketing department.

Results: 74 individuals contacted primary investigators for additional information, with 34 of those participating in the study, producing a 49% participation rate. The pain group (N= 11) averaged 32.1 +/- 3.1 years of age, with the control group (N= 26) averaging 29.3 +/- 8.5 years (p= 0.07). The pain group averaged 29.2 +/- 6.9 weeks along into pregnancy; while the control group averaged 29.4 +/- 7.1 weeks (p= 0.09). On average, 5 data collections per month were completed, with peaks in February and May. Social media traffic on the Clinical Studies webpage peaked in May (62 views) and September (162 views).

Discussion: Challenges in recruiting pelvic pain participants continue, with a study goal to collect data from 64 participants. Spikes in recruitment occurred following Facebook posts, indicating social media may facilitate recruitment more than traditional flyers or word-of-mouth.

♦ 62 UG ♦

The Effect of Medical Education on Prescribing Patterns of Opioid Medications for Non-Cancer Pain in the Primary Care and Emergency Medicine Setting

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Opioid abuse and misuse is on the rise in the United States. Opioids are powerful analgesic agents that can be used for the management of pain in patients with cancer, post-surgical, and other forms of chronic pain. Opioid medications, also known as narcotics, have a high abuse potential and prescribers should monitor their use closely. Rising numbers of abuse and fatalities due to opioids are causes for concerns for the medical community as well as for opioid users. A review of medical education's role on prescribing patterns with respect to education received by medical students, residents, and continuing education will be examined.

A literature review will be completed on the role of education on opioid prescribing habits in the primary care and emergency medicine setting. Peer-reviewed, medical literature will be evaluated to find strengths and areas for improvement in medical education with regards to careful prescribing of opioids and finding other methods for pain management.

Further investigation will be done that will include examination of the type of education provided at Des Moines University for the DO and PA students on this topic. The results from this research will be compared to the findings in the literature review completed later this academic year. Comparing the findings from DMU and what has been published in the literature will provide a greater understanding of the extent to which medical education and continuing education impacts the prescriber's thoughts and practices on prescribing opioids for non-cancer pain in the primary care and emergency setting.

♦ 63 HS ♦

Raising Awareness of Rare Cancers in Iowa: Bone and Joint Cancer

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Waukee Aspiring Professional Experience (APEX), a program through Waukee High School for students exploring health sciences while developing project management and professional skills, has teamed up with Dr. Elitsa Ananieva to learn more about bone cancer. The collaboration aimed at exploring bone and joint cancer in Iowa while raising awareness about bone cancer to increase public involvement and research efforts devoted to bone cancer patients. The Iowa Cancer Registry was used to search incidence and mortality rates of bone and joint cancer between the years of 1990-2013 and to compare bone and joint cancer to the four most common cancers in Iowa: breast, prostate, colon, and lung cancer. Next, the surveillance, epidemiology, and end results program (SEER) administered by the National Cancer Institute were used to compare incidence and mortality rates of bone and joint cancer on the national level. Our results showed that Iowan males were around 20% more likely to suffer from bone and joint cancer than females. In comparison to the four most common cancers, bone and joint cancer mortality rates were very low but remained consistent over the years. In contrast, breast, prostate, and colon cancer mortality rates decreased in the recent years reflecting the increased prevention care and research efforts devoted to these cancers. In conclusion, although rare, bone and joint cancer in Iowa has higher prevalence than on national level, is more common in males, and the survival rates for bone cancer patients are lower than those for breast, prostate, or colon cancer.

♦ 64 G ♦

Meta-Analysis of Quality Improvement in Healthcare Administration

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The healthcare industry has begun to embrace a continuous quality improvement philosophy. This philosophy is supported through the integration of evidence-based medicine and management based off of lean principles. Healthcare administration is the crucial epicenter that is held accountable for ensuring that the highest quality of healthcare is provided (Roberts, Fisher, Trowbridge, & Bent, 2016).

There are currently a minimal amount of articles or case studies whose main focus is on healthcare administration and the role of quality, in comparison to the improvement of clinical practice, within healthcare research. The overall goal is to ensure that the healthcare industry produces the highest quality of services. Improvement efforts have begun to focus on organizational quality and the healthcare administration role as they have clinical practices in the past. Gaining understanding of healthcare administration through non-clinical case studies should allow understanding towards upcoming healthcare leadership and management.

The purpose of this study is to perform a meta-analysis, select case studies with the focus on healthcare administration and quality improvement, and to provide future evidence-based practices to quality and healthcare administration case scenarios. By bringing together various case studies and articles within the field of healthcare, the result would be scholarly prepared administrators that will be actively working towards the improvement of the quality of healthcare.

♦ 65 G ♦

Contribution of Sleep Related Deaths to Infant Mortality in Iowa: An Opportunity for Improvement

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In this study we examined trends in the incidence of infant deaths due to uncertain or less-understood underlying causes – as documented in the death certificates – that occurred in Iowa over nine years. We compared trends within the state to regional and nationwide trends. We specifically targeted sleep-related deaths; as such incidences have been consistently linked to a number of modifiable risk behaviors and factors, and thus are potential targets for public health interventions.

While the infant mortality rate (IMR) in Iowa is consistently below national and regional rates, infant sleep-related deaths exceeded national averages a third of the time and thus had a larger than expected impact on overall IMR. Additionally, an erratic pattern of improvement and retrogression in both IMR and sleep-related infant death rates during the study period suggests that rates have varied in the absence of focused and consistently applied interventions.

According to an Iowa Child Death Review Team report summarizing findings from 2004-2012, 79% of sleep-related infant deaths during this period occurred while the infant slept outside of an approved crib, <50% of the infants were placed to sleep on their back and in only 25% of cases was the infant confirmed to have been sleeping alone.

The American Academy of Pediatrics has issued guidelines stating that infants should be placed on their backs on a firm and unshared sleeping surface but clearly, adherence is less than complete. The trends observed suggest there is opportunity for an innovative and focused public health intervention in Iowa.

♦ 66 G ♦

Blood Pressure Control Through Barbershops

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Hypertension is more prevalent among African-Americans than in non-Hispanic whites (43% vs. 29%, CDC). This project aimed to address this health disparity within the Des Moines African-American community by providing a community-based intervention to identify individuals with undiagnosed and/or uncontrolled high blood pressure.

Over three years, trained volunteers offered one blood pressure screening to customers at four Iowa barbershops that primarily serve African-Americans. 440 participants provided informed consent to allow volunteers to record their blood pressure with Omron 10 series monitors, and also completed a self-administered questionnaire regarding their health conditions. 78% self-identified as African American (343). All participants with elevated readings (>120/80 according to AHA) were encouraged to seek medical care.

Elevated blood pressure readings were observed in 81% of the 343 African-American participants. 62% reported no prior knowledge of having high blood pressure. Most participants (70%) reported having a primary care provider. The prevalence of elevated readings was high among both the individuals who stated that they have a primary care provider (82%), and those who stated that they lack one (81%). 20% of those with elevated blood pressure were taking medication at the time of observation. Taking medication to control blood pressure level was strongly associated with having a primary care provider (χ^2= 6.7, df=1, $p < 0.01$).

Our data suggests that undiagnosed hypertension among African Americans may be more prevalent than previous estimates. Furthermore, the potential for hypertension control for this population critically depends on primary care access.

♦ 67 G ♦

Management of Medical Care for Adults with Spina Bifida

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Introduction: Surgical advances for infants born with spina bifida (SB) have reduced early morbidity and mortality among this population. As a result, individuals with SB now more commonly live into adulthood. With this increased life expectancy and quality of life, there is a need to optimize the health and community participation of individuals living with chronic health conditions like SB.

Methods: A literature search was performed to provide an overview of major health and psychosocial outcomes among adults with SB. Major focuses of this research include: 1) highlighting the difficulties patients face when transitioning from pediatric to adult care and 2) identifying areas in medical management where more data is needed to guide clinical decision making among providers caring for adults with SB.

Results: There is a need for a comprehensive health care team to serve adults with SB as they are at an increased risk for health problems when compared to the general population. Some particular areas of concern include neurosurgical, urological, orthopedic, and metabolic care as well as psychosocial well-being.

Conclusions: Medical care for adults with SB should be shifted towards treatments and care plans that address the comorbidities of SB that have potential for improvement and would enhance daily function and community participation. Understanding health outcomes in adults with SB can help guide medical management in pediatric patients with SB and improve long term care. Future research should focus on addressing such modifiable outcomes.

A Peculiar Case of Non-Small Cell Lung Cancer: A Case Report and Literature Review

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Broadlawns Medical Center, Des Moines, IA

There are over 160,000 deaths annually from lung cancer in the United States equating it as the number one cause of cancer related deaths. The frequency of lung cancer has risen dramatically over the past few decades; however the incidence of deaths, similar to the percentage of smoking adults, has been declining. Tobacco use continues to be the biggest risk factor for lung cancer and the etiology behind 90 percent of lung cancer cases. New research shows potential mortality benefits with screening tobacco users who meet certain criteria with annual low dose computed tomography.

We present the case of DR a 54 y/o tobacco dependent female who presented to the clinic with acute onset right elbow pain. Initial management of the pain included steroid injection after she was diagnosed with medial epicondylitis. Symptomatic treatment worsened pain, therefore differential diagnosis was expanded. Subsequent MRI of the elbow revealed a large boney lesion, bone marrow edema, and inflammatory changes in the pronator teres muscle. Initially patient was diagnosed with osteomyelitis and started on antibiotic therapy. Biopsy of the lesion was performed, and cultures failed to grow any bacteria, however poorly differentiated malignant cells were appreciated under histologic examination. Further work up including PET/CT of the chest abdomen and pelvis demonstrated an apical left lung lesion, and metastatic disease to the liver and right elbow.

In this paper we also review the literature regarding lung cancer screening with low dose CT including limitations and potential benefits it offers to heavy smokers.

♦ 4 pm ♦

The Unmet Needs of Family Planning in Rural Dominican Republic Communities in the Context of Zika Virus

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Objective: Assess the unmet needs of family planning in rural Dominican communities, and discern the level of Zika virus awareness and its impact on contraceptive desires within these communities.

Methods: Women were invited to participate in a survey after receiving healthcare services at the clinics (N=45). Questions pertained to women's reproductive health including: family size, previous contraception usage, current contraception interests, ideal contraceptive duration, Zika virus awareness, and whether Zika virus influenced family planning desires.

Results: The majority of women surveyed indicated a desire for future contraception. Of these, 55.88% desired a long-acting method, compared to 35.29% preferring a short-acting method. However, only two women surveyed had ever used a long-acting contraceptive method. Oral contraceptive pills and condoms were the most commonly used methods reported. Of the women surveyed, 93.33% had heard of Zika virus, yet only 38.10% of these women expressed a desire to alter contraceptive methods due to Zika virus. The proportion of women who indicated a desire to alter contraceptive methods varied significantly between communities.

Conclusions: Women in these rural Dominican communities had a strong interest in long-acting contraceptive methods. Usage of these methods was limited due to inaccessibility. While the majority of women had heard of Zika virus, a minority of women indicated it influenced their desire to alter contraceptive methods. The survey underscores the importance of elimination of barriers to appropriate and desired contraceptive options, and the need for increased emphasis on family planning education and dissemination of relevant global health information within rural communities.

♦ 4:15 pm ♦

Prehospital Quality Improvement and Education in Care for PARCA Patients

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High quality, timely protocol-based care is the primary goal for prehospital ALS systems, especially when it comes to critically-ill patients. Quality improvement (QI) aims to continuously improve performance and ultimately, outcomes. PARCA, (prehospital post-arrival respiratory/cardiac arrest), is a novel patient subclassification that allows very focused QI interventions for the treatment of the most ill and injured patients. The objective of this study was to assess outcomes following PARCA-directed education. Based on the patterns identified in analyzing suboptimal care, unannounced field-based, real-time simulations were designed and conducted in an urban EMS system beginning in 2011. These simulations were individually tailored without disciplinary ramifications. In addition, PARCA patterns lead to the development of guidelines and algorithms that were incorporated into education and simulations. These guidelines were aimed at minimizing delayed critical interventions and thus, reducing witnessed arrests. Overall trends ($P<0.05$) showed that EMS crews accomplished an average of 3.65 critical interventions and patient monitoring tools per PARCA patient in 2011 prior to implementation of the simulations and guidelines, compared to an average of 5.8 in 2014 (95% confidence interval [CI], 0.34-3.96). In those cases, the average time for interventions decreased. This data translated to a decrease in PARCA patients from 5.7% in 2011 to 4.0% in 2014. From this study, PARCA-directed QI can be an effective means to improve patient outcome. This study was limited by a single EMS system. This potentially useful new tool needs to be further explored, used, and standardized in different EMS systems to become validated.

♦ 4:30 pm ♦

Reduced Leucine Availability Inhibits the Growth of Bone Sarcomas by Stimulating the Fuel Sensing Enzyme AMPK

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Bone sarcomas are tumors that commonly originate from the bone and the cartilage. Although rare, bone sarcomas are associated with high mortality in children and adolescents due to their unresponsiveness to traditional treatments. One novel approach to address this resistance is to explore leucine metabolism in bone sarcoma cellular proliferation and protein synthesis. The essential amino acid, leucine, stimulates protein synthesis via complex 1 of the mammalian target of rapamycin (mTORC1), while the intracellular concentrations of leucine are regulated by the mitochondrial (BCATm) and cytosolic (BCATc) branched chain aminotransferases. We hypothesized that the leucine antagonist, N-acetyl-leucine-amide (NALA), would inhibit the cellular growth and protein synthesis of bone sarcoma cells, while the BCATc inhibitor, gabapentin, would have an effect opposite to that of NALA, through the inhibition of leucine degradation. To test this hypothesis, we treated human bone sarcoma cells (143B) with different concentrations of NALA or gabapentin for twenty-four hours, and measured the following: cellular growth, protein content, and the activation of mTORC1 and the fuel-sensing enzyme AMP-activated protein kinase (AMPK). Our results revealed that both NALA and gabapentin inhibited the bone sarcoma cellular growth and protein content in concentration dependent manner. However, while NALA stimulated AMPK, gabapentin inhibited AMPK, as evidenced by changes in the phosphorylation of AMPK. The observed changes in the activation of AMPK indicate that leucine may impact the energy status and the growth of bone sarcomas. Thus, a therapeutic approach aimed at reducing leucine availability may be one novel solution to treat bone cancer patients.

♦ 4:45 pm ♦

Comparing the Effects of Medicaid Expansion According to States' Medicaid Expansion Status

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Background: The implementation of the Affordable Care Act (ACA) has been demonstrated to reduce uninsured rates and health disparities. However, it is a challenge to analyze the direct impact of each provision. The purpose of this study was to examine healthcare insecurity and insurance status in relation to the effects of Medicaid Expansion.

Methods: We used a nationally representative sample from Gallup for analysis of participant-level data and categorized responses by Medicaid Expansion state and non-Expansion state. Additionally, we compared the rates of healthcare insecurity and insurance coverage in the year before the implementation of Medicaid Expansion (2013), the first year of implementation (2014), and the year after implementation (2015).

Results: Preliminary results showed a statistically significant difference between states that expanded Medicaid having a lower percent of uninsured and higher healthcare security compared to states that rejected it. In fact, states that rejected Medicaid expansion had a significantly higher rate of uninsured even before the implementation of Medicaid Expansion in 2014.

Discussion: This analysis is additional evidence that Medicaid Expansion improves healthcare uninsured rates. Furthermore, our analysis of healthcare insecurity refutes skeptics' claim that Medicaid Expansion drives up healthcare costs for individuals. Our results demonstrate an association between states that expanded Medicaid and participants' report that they had enough financial resources for healthcare. These findings support the conclusion that expanding Medicaid not only improves coverage, but also reduces the financial burden of healthcare, which may be a barrier to those seeking essential healthcare services, even when insured.

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