
DES MOINES UNIVERSITY
MEDICINE & HEALTH SCIENCES
Research Symposium
DECEMBER 3, 2020
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 11th annual Des Moines University (DMU) Research Symposium! This year, the DMU Research Symposium has gone virtual. In response to the pandemic, we have had to make changes as to how the symposium is held for the health and safety of the participants. However, we have not lost the essence of the event.

The 2020 Research Symposium will showcase 81 interdisciplinary oral and poster presentations in anatomy and paleontology, biomedical science, clinical research, movement science, public health, and education research in the health sciences. Presenters include graduate and undergraduate students from DMU and surrounding local institutions, as well as faculty and members of the medical and scientific community.

This year's Symposium will also host seven poster presentation breakout sessions which will allow participants to meet virtually to discuss the poster presentations in their area of interest and to network with others in similar research areas.

We are excited to welcome Dr. S. Vincent Grasso, DO'91, MSIS, MBA, as our keynote speaker. Dr. Grasso is the Global Practice Lead for Healthcare & Life Sciences at IPsoft, and has more than 30 years of surgical, research, consulting and community leadership experience. Dr. Grasso brings not only the necessary medical acumen and expertise to provide excellent patient-centered care, but also has an established track record of leveraging cutting-edge technology in hospital and healthcare organizations, which benefit both patient care and the business of delivering exceptional healthcare services. Dr. Grasso's current projects focus on the utilization of artificial intelligence to help curb the opioid crisis, improve mobile healthcare for home visits, and assist administrators with revenue cycle management.

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, colleagues, and peers.

For some students, it is their first step into the formal world of research presentation. This Symposium is more than an opportunity to present research. It is an opportunity to discuss their work, receive constructive feedback, and 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.

This Symposium demonstrates the strong research that is occurring on the DMU campus and in our community. As you attend the Symposium, we hope you will reflect on how the discoveries we are making in research today will impact the scientific and medical community, as well as the future of your patients.

Thank you for attending!

The DMU Office of Research

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AGENDA

Time	Session
12 pm	**Welcome**
12:15 pm	**Utilization of AI Ecosystem Assets in Healthcare (Non-CME)** *S. Vincent Grasso, DO'91, MSIS, MBA, Global Practice Lead: Healthcare & Life Sciences, IPsoft* • Differentiate value proposition of distinct Artificial Intelligence (AI) Ecosystem Assets to healthcare delivery. • List limitations of existing healthcare delivery workflows. • Develop re-engineered clinical workflows taking advantage of AI Ecosystem Assets.
1 pm	**Poster Discussion Breakout Sessions**
2 pm	**Renal cortical KLF15 and KLF2 are downregulated in chronic heart failure** ***Andrew Philipose, DO'23,*** *Kalie A. Savage, DO'23, Kiefer W. Kious, MBS, Jayson P. Kemble, DO'22, Luke J. Smith, DO'22, Hugo S. Díaz, Rodrigo Del Rio, PhD, Noah J. Marcus, PhD*
2:05 pm	**A mixed-methods approach to enhance interprofessional teamwork in a rural environment** ***Philip Jurasinski, DO'21, MPH'21,*** *Pamela Duffy, PT, PhD, FAPTA, Teri Stumbo, PhD, PT, Julie Ronnebaum, DPT, PhD, GCS, Alison Krueger, MSN-Ed, RN, Amy Morris, PhD, Nehad El-Sawi, PhD*
2:10 pm	**Profile of microRNA expression in urinary exosomes is dependent on non-invasive lymphoma induction in mice** ***Brittany Wilson, DO'23, MBS'24,*** *Rebekah Betar, DO'23, Alexander Martin, DO'23, Zack Niazi, DO'23, Michael Boyer, Lori Winter, Victor Babich, PhD, Francesca Di Sole, PhD, Elitsa Ananieva, PhD*
2:15 pm	**Regulation of pH by growth factors is dependent on the expression of the calcineurin homologous protein-2 in human osteosarcoma cells** ***Tiffany Chang, DO'23, MBS'24,*** *Serena S. Luong, DO'19, Adam P. Zobel, DO'20, Elitsa Ananieva, PhD, Victor Babich, PhD, Francesca Di Sole, PhD*
2:20 pm	**Methylation levels at growth differentiation factor-15 related CpG sites are not related to death risk from cardiovascular disease among monozygotic male twins discordant for cardiovascular disease: National Heart, Lung, and Blood Institute Twin Study** ***Spencer Moore, DO'23,*** *Pallavi Mukherji, DO, Ming Leung, Jun Dai, MD, MSc, PhD*
2:25 pm	**Chronic norepinephrine infusion reduces GPER expression in the hypothalamus of ovariectomized mice** ***Lane Heinlein, DO'23,*** *Cristina Petty, DPM'23, Nikhil Pallikonda, DO'23, Jennifer Giles, MA, Lori Winter, Eric Wauson, PhD, Quang-Kim Tran, MD, PhD, Sarah Clayton, PhD*
2:30 pm	**Poster and Oral Presentation Awards and Closing Remarks**
2:45 pm	**Adjourn**

DES MOINES UNIVERSITY
DMU.EDU/RESEARCH

2019 YEAR END SPONSORED PROJECTS GRANT STATS

32 FACULTY & STAFF SUBMITTED GRANTS

50 TOTAL SUBMITTED GRANTS
37 EXTERNAL // 13 INTERNAL

AWARDS & CONTRACTS GRANTED

$1,104,283 IN EXTERNAL AWARDS

9 INTERNAL

18 EXTERNAL

27 TOTAL AWARDS

CURRENT GRANT HOLDERS

INTERNAL **17**

19 EXTERNAL

99 STUDENTS TRAINED FROM GRANT FUNDING

MENTORED STUDENT RESEARCH PROGRAM
- 54 TRAINED STUDENTS
- 34 DMU STUDENTS
- 14 UNDERGRADS FROM 7 INSTITUTIONS

15 SUPPORTED BY EXTERNAL GRANTS

84 SUPPORTED BY INTERNAL GRANTS

KEYS TO PROJECT DEVELOPMENT
WORKSHOP SERIES STARTED

SPEED NETWORKING EVENTS
HELD FOR RESEARCH FACULTY TO INCREASE COLLABORATION

ACCOMPLISHMENTS

26 PRESENTATIONS FROM INTERNAL R&G GRANTS

465 RESEARCH SYMPOSIUM ATTENDEES

59 PEER REVIEWS PUBLICATIONS AND BOOKS/BOOK CHAPTERS

99 RESEARCH SYMPOSIUM PRESENTATIONS

407% INCREASE IN EXTERNAL DOLLARS AWARDED FROM 2014 TO 2019

PURPOSE

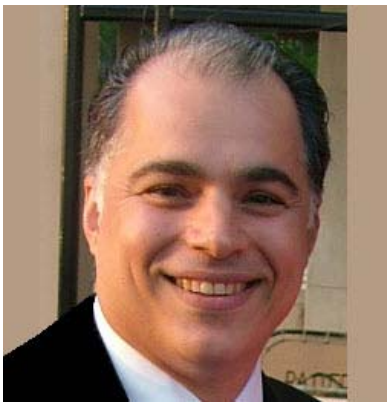
The Research Symposium aims to recognize the research efforts of those at Des Moines University and in the surrounding medical and scientific communities. The Symposium provides a forum for the collaboration of ideas, the production of new hypotheses, and demonstrates to attendees the critical role that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

CONTINUING EDUCATION CREDIT

- **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 1.5 AOA Category 2-B credits and will report CME and specialty credits commensurate with the extent of the physician's participation in this activity.
- **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 1.5 continuing education contact hours.
- **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 1.5 *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 1.5 continuing education contact hour(s). No partial credit awarded.
- **Other Professionals:** This live activity is designated for 1.5 *AMA PRA Category 1 Credit(s)™*.

Educational grants were not accepted for this activity.

KEYNOTE SPEAKER



S. Vincent Grasso, DO'91, MSIS, MBA
Global Practice Lead: Healthcare & Life Sciences, IPsoft

Dr. S. Vincent Grasso is the Global Practice Lead for Healthcare & Life Sciences at IPsoft, and has more than 30 years of surgical, research, consulting and community leadership experience. A graduate of St. Peter's University (B.S.), Des Moines University College of Osteopathic Medicine (DO), Mount Sinai School of Medicine (Surgical Residency), Yale University Department of Surgery (Advanced Laparoscopic Surgery Fellow), Yale University NASA Commercial Space Center for Medical Informatics and Technology Applications (Informatics Fellow), New Jersey Institute of Technology (MSIS) and University of Massachusetts Amherst (MBA), Dr. Grasso brings a uniquely-qualified skillset to all of his endeavors. In addition to being a trained physician and AI Luminary, Dr. Grasso is a chef, piano player, and, in his spare time, he volunteers serving the underprivileged at a clinic in Newark, New Jersey. To top it off, he has also traveled to Mount Everest to test medical equipment at altitude!

Dr. Grasso brings not only the necessary medical acumen and expertise to provide excellent patient-centered care, but also has an established track record of leveraging cutting-edge technology in hospital and healthcare organizations, which benefit both patient care and the business of delivering exceptional healthcare services. Dr. Grasso's current projects focus on the utilization of AI to help curb the opioid crisis, improve mobile healthcare for home visits, and assist administrators with revenue cycle management.

Dr. Grasso's presentation is not eligible for continuing education credit.

HOW TO READ A POSTER ABSTRACT

A common approach for evaluating posters involves considering the following factors in the technical and visual 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), and affiliations 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.	
Poster is self-explanatory.	
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.	

	Poster	Page
Presenting Author(s) in Bold. G = Graduate UG = Undergraduate HS = High School		
ANATOMY/PALEONTOLOGY		
Evaluating the effects of force, velocity, and focus of impact on skeletal trauma patterns: A forensic anthropological case study **Halie Larsen, MSA'21,** Heather M. Garvin, PhD, Michele Catellier, MD	1 G	14
Determining humeral or femoral classification of an unknown epiphyseal head of *Homo naledi* **Lauren Eddy, DO'23** and Heather M. Garvin, PhD	2 G	14
Assessing the developmental age of a subadult *Homo naledi* vertebral column **Olivia Matz, DO'23, MSA'23** and Heather M. Garvin, PhD	3 G	14
Does cranial size affect frontal sinus volumes in males and females? **Cole Amundson, DO'23, MSA'25** and Lauren Butaric, PhD	4 G	15
Skull growth and airway occlusion **Coray Preece, DO'23** and Lauren Butaric, PhD	5 G	15
Scaling frontal sinus measures by orbit area in ante- and postmortem radiographs **Rebecca Manzo, DO'23, MSA'23** and Lauren Butaric, PhD	6 G	16
Growing up: Examining male and female ontogeny in subadult populations **Katherine A. Plotzke, DO'23** and Lauren Butaric, PhD	7 G	16
Using 3D frontal sinus models to identify the most reliable orientation for forensic analysis **Allison Richman, DO'23, MSA'23** and Lauren Butaric, PhD	8 G	17
The effect of increasing load on plantar fascia thickness **Rachel Woo, DO'22,** Panagiotis Chatzistergos, Robert Yoho, DPM, MS, FACFAS, Vassilios Vardaxis, PhD	9 G	17
Structural MRI atlas of the kudu brain (*Tragelaphus strepsiceros*) **Tate Vernon, DO'21,** Mark Haagensen, Paul R. Manger, Muhammad A. Spocter, PhD	10 G	18
A preliminary investigation of behavioral laterality in the domestic goat (*Capra hircus domestica*) **Jasmeet Kaur Sandhu, DO'23,** Midhad Mrvoljak, DO'24, Eric Rowe Wicinski, Muhammad A. Spocter, PhD	11 G	18
BIOMEDICAL SCIENCE		
Increased NMDA receptor function during protracted withdrawal in rats exposed to chronic intermittent ethanol **Daniel T. Christian, PhD**	12	18
Characterization of gene expression changes in limbic brain areas linking alcoholism and comorbid mood disorders **Nalo Bowman, MBS'21,** Daniel T. Christian, PhD, Vanja Duric, PhD	13 G	19

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Effects of chronic inflammatory pain and ketamine treatment on limbic brain gene expression ..... **Maximillian Striepe, DO'23,** Allison Ash, MBS'20, Ellesavette Kokkinos, DO'24, MBS'24, Dakota Nerland, DO'22, Gabriel Berenbeim, DO'22, Benjamin Wilke, DO'21, Lori Winter, Lauren Points, Matthew Girgenti, Ronald Duman, Vanja Duric, PhD	14 G	19
Genetic determinants of erythrocyte glutathione S-transferase pi activity and kinetics in dogs ..... **Natalie Ake, PharmD'21,** Amanda Hoerres, PharmD, Caitlyn Owens, James Sacco, PhD	15 G	20
Erythrocyte glutathione transferase activity in cats ..... **Rachel Dietz, PharmD'23** and James Sacco, PhD	16 G	20
Effect of chronic intermittent hypoxia on inflammation and redox related gene expression in renal cortex..... **Kalie A. Savage, DO'23,** Andrew Philipose, DO'23, Kiefer W. Kious, MBS, Jayson P. Kemble, DO'22, Luke J. Smith, DO'22, Hugo S. Díaz, Rodrigo Del Rio, Noah J. Marcus, PhD	17 G	21
Characterization of the role of the mitochondrial branched chain aminotransferase in anti-lymphoma T cell immunity ..... **Christie Adam, MBS'24,** Alexander Martin, DO'23, Rebekah Betar, DO'23, Mercedes Foster, MBS'25, Michael Boyer, Elitsa Ananieva, PhD	18 G	21
Using siRNA technology to inhibit the oncogene c-Myc in EL-4 lymphoma cells ..... **Faizan A. Khan, DO'23,** Kelsey Hupp, Michael Boyer, Elitsa Ananieva, PhD	19 G	22
The cytosolic branched-chain aminotransferase is a downstream target of the mammalian target of rapamycin pathway in lymphoma cells..... **Zackaria Niazi, DO'23,** Michelle Brenner, DO'19, Michael Boyer, Elitsa Ananieva, PhD	20 G	22
Comparative study of bone sarcomas revealed that osteosarcomas favorably respond to modulations in leucine uptake and metabolism..... **Alexander Martin, DO'23,** William Reiche, DO'20, Nickolas Fifelski, DPM'21, Michael Boyer, Elitsa Ananieva, PhD	21 G	23
Disruption in leucine uptake and metabolism inhibits the growth and cell division of human bone sarcomas ..... **Spencer Stanford, DO'23,** William Reiche, DO'20, Michael Boyer, Elitsa Ananieva, PhD	22 G	23
The oncogene c-MYC regulates branched chain amino acid metabolism in T lymphocytes..... **Rebekah Betar, DO'23,** Michelle Brenner, DO'19, Michael Boyer, Elitsa Ananieva, PhD	23 G	24
The effect of estrogen on leptin's signaling ..... **Suzanne Elliott, MBS'24,** Michael Boyer, Maria Barnes, PhD	24 G	24
Dysfunction of renal glucose handling restored by central leptin receptor blockade in a model of estrogen deficiency..... **Patrick T. Walsh, DO'23, MBS'23,** Bryce J. Fiebiger, DO'22, Jonathan Van Erdewyk, DO'21, Bilal Khan, DO'20, Victor Babich, PhD, Maria Barnes, PhD, Francesca Di Sole, PhD	25 G	25

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Genetic variants on the calcineurin homologous protein genes associated with an increase in blood pressure **Thomas F. Fusillo, DO'23, MHA'23,** Liran BenDor, DO, Skylarr Halsey, Afshin Parsa, MD, MPH, Francesca Di Sole, PhD, Victor Babich, PhD	26 G	25
Vesicle-associated membrane protein 8 as a potential calmodulin target in autophagy **George Callaway IV, MBS'24,** Annie Yao, DO'21, Vanessa Lopez, Eric Wauson, PhD, Quang-Kim Tran, MD, PhD	27 G	26
J-curve effects on basal autophagy and ER marker in the vascular endothelium by excessive sympathetic activation **Linh Tran,** Jennifer Giles, MA, George Callaway IV, MBS'24, Eric Wauson, PhD, Quang-Kim Tran, MD, PhD	28 UG	26
Effects of a G protein-coupled estrogen receptor agonist on cardiac remodeling induced by chronic sympathetic activation **Caleb Kragenbring, MBS'24,** Lori Winter, Sarah Clayton, PhD, Quang-Kim Tran, MD, PhD, Eric Wauson, PhD	29 G	27
Chronic norepinephrine infusion reduces GPER expression in the hypothalamus of ovariectomized mice Lane Heinlein, DO'23, **Cristina Petty, DPM'23,** Nikhil Pallikonda, DO'23, Jennifer Giles, MA, Lori Winter, Eric Wauson, PhD, Quang-Kim Tran, MD, PhD, Sarah Clayton, PhD	30 G	27
Effect of co-administration of acyclovir and MST-312 or epigallocatechin gallate on herpes simplex virus-1 plaque formation **Brandon Hennessy, DO'23,** Prajakta Pradhan, Marie Nguyen, PhD	31 G	28
Characterization of lytic bacteriophages that target *Acinetobacter baumannii* **Faithe Keomanivong, MS,** Bailey Pehde, MBS, Devon Niewohner, DPM'22, Michael Carruthers, PhD	32	28
Isolation and growth parameter determination of bacteriophages targeting *Acinetobacter baumannii* strain AB5075-UW **Jake L. Mullenbach, DO'23,** Faithe Keomanivong, MS, Michael Carruthers, PhD	33 G	29
A putative 4-α-glucanotransferase from *Trichomonas vaginalis* **Nicholas Koehn, DO'23,** Andrew Brittingham, PhD, Wayne A. Wilson, PhD	34 G	29
IL-38 downregulates expression of PD1 and ICOSL in cervical cancer **Theresa A. Schneider, DO'23,** Qian Bai, Huaping Xiao, Mark R. Wakefield, MD, Yujiang Fang, MD, PhD	35 G	30
IL-29 is a promising cytokine for immunotherapy of cervical cancer **Jackie L. Ha, DO'23,** Chenglu Qin, Ziwen Zhu, Huaping Xiao, Xuhui Chen, Qian Bai, Lucas Gatten, Mark R. Wakefield, MD, Yujiang Fang, MD, PhD	36 G	30
Celery: A super vegetable for melanoma **Phillip Anderson, DO'23,** Ziwen Zhu, Marco Lequio, Qian Bai, Mark R. Wakefield, MD, Jackie L. Ha, DO'23, Yujiang Fang, MD, PhD	37 G	31
Raspberry exhibits a robust anti-tumor effect on cervical cancer **Alexander J. Somers, DO'21,** Ziwen Zhu, Alex Clumb, Qian Bai, Mark R. Wakefield, MD, Yujiang Fang, MD, PhD	38 G	31
Grapefruit: A possible magic fruit to enhance immunotherapy for pancreatic cancer **Gagik Gabrielyan, DO'23,** Ziwen Zhu, Qian Bai, Mark R. Wakefield, MD, Yujiang Fang, MD, PhD	39 G	32

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Strawberry may boost cancer immunity for pancreatic cancer by upregulation of TAP2... **Ian M. Lake, DO'23,** Ziwen Zhu, Qian Bai, Mark R. Wakefield, MD, Yujiang Fang, MD, PhD	40 G	32
Effect of a tropical fruit, mangosteen, on expression of PD1, PDL1 and PDL2 in melanoma ..... **Matthew Zhou, DO'23,** Marco Lequio, Mark R. Wakefield, MD, Yujiang Fang, MD, PhD	41 G	33
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Testing the reliability of expired commercial aspirin (acetylsalicylic acid) using UV-VIS spectrophotometry ..... **Matt Kapustka,** Tanner Stewart, Holly Showalter, PhD	44 HS	33
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Consideration of radiofrequency ablation of Morton's neuroma, prior to surgical intervention: A literature review ..... **Benjamin Bogert, DPM'21,** Rebecca Schwartz, DPM'21, Benjamin Klopfenstein, DPM'21, Tyler Reed, DPM'21, Sean Grambart, DPM, FACFAS	51 G	35
Cost effectiveness of physical therapy in addition to podiatry management of plantar heel pain ..... **Andrew Ferguson, DPM'22** and Shane McClinton, PT, DPT, PhD	52 G	36
Association of SSRI use with fall risk factors in community-dwelling older adults ..... **Samantha Janssen, DPT'21** and Catherine Stevermer, PT, PhD, GCS	53 G	36
Ultrasound use for measurement of muscle volume to estimate plantar intrinsic foot muscle strength ..... **Katelyn Ugo, DPM'22,** Madison Burandt, DPM'23, Panagiotis Chatzistergos, Robert Yoho, DPM, MS, FACFAS, Vassilios Vardaxis, PhD	54 G	37
Interdisciplinary approach to pediatric rib fractures in non-accidental trauma ..... **Sara Judickas, DPM'22,** Alyssia Morley, DO'22, Lori Byrd, MS, Jeffrey Gray, PhD	55 G	37

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Reducing redundancy and excessive detail: Short video podcasts for basic science review **Martin Schmidt, PhD** and Johnathan Pederson, MS	58	38
Mental health education in medical students: An initial comparison of NAMI 2020 and NAMI 2019 **Sonia Kumar, DO'23,** Julia R. Van Liew, PhD, Chunfa Jie, PhD	59 G	38
Contact-based NAMI program promotes sustained changes in medical students' perspectives on mental illness **Julia R. Van Liew, PhD,** Chunfa Jie, PhD, Maximilian Striepe, DO'23, Sonia Kumar, DO'23	60	39
MercyOne pharmacy staff perceptions of student CQI projects **Morgan Ridout, PharmD'21,** Kimberly Tang, PharmD'21, MBA'21, Lynn Kassel, PharmD, BCPS	61 G	39
The use of synthetic ankle models in athletic training education prepares students for patient scenarios: A pilot study **Nicole Timmons, MAT'22,** Megan P. Brady, EdD, ATC, Richelle M. Williams, PhD, ATC	62 G	40
Boom goes the gas leak: Mass casualty simulation and its efficacy in medical education **John Dube, DO'22,** Alyssa Manteufel, DO'22, Morgan Alwell, DO'23, Marijo Botten, DO'22, Daniela Frankova, MD, PhD, FACP, Paul Schenarts, MD, Thomas Benzoni, DO, EM, AOBEM, FACEP, Teresa Aoki, MD	63 G	40
Attending the flipped classroom is not a flop when learning ECG interpretation skills Sarah Clayton, PhD and **Matthew Henry, PhD**	64	41
Comparison of student's self-ratings to their observed team skills during an interprofessional pediatric case **Julie Ronnebaum, DPT, PhD, GCS** and Laura Delaney, MPAS, PA-C	65	41
Does learning style effect physical therapy student performance in the changing education environment due to the COVID-19 pandemic? **Julie Ronnebaum DPT, PhD, GCS,** Kristin Lowry, PhD, Vassilios Vardaxis, PhD	66	42
Implementation of the Inventory for Assessing the Process of Cultural Competence among Healthcare Professionals – Student Version (IAPCC-SV) in Des Moines University's Doctor of Physical Therapy Program: Pre-test findings **Tracy Porter, PT, DPT, EdD,** Jacob Wesselink, DPT'21, Vassilios Vardaxis, PhD	67	42
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Glenohumeral joint center localization, anatomical invasive/non-invasive and functional methods **Daniel Kasman, DO'21,** Nirmal Maxwell, DO'21, Steven Halvorson, DO'22, David Stapleton, Traci Bush, DPT, OTR/L, DHS, James Choi, MD, Vassilios Vardaxis, PhD	69 G	43
Do older adults need skill in addition to speed to function? **Madison Farren, DPT'22,** Anthony McBroom, DPT'22, Kristin Lowry, PhD, Jessie VanSwearingen, PhD, PT, FAPTA	70 G	44
The effect of load and the empty can exercise on the shoulder 3D scapulohumeral rhythm **James Michaud, DO'23,** Traci Bush, DPT, OTR/L, DHS, Vassilios Vardaxis, PhD	71 G	44
PUBLIC HEALTH		
Sexual assault reporting amid the COVID-19 pandemic **Katelyn Myers, DO'21,** Alyssa Ensminger, DO'22, Rachel Christenson, DO'23, Rebecca Shaw, MD, Simon Geletta, PhD	72 G	45
Investigating the relationships between known risk factors and drug-related mortality in rural Iowa **Devon Niewohner, DPM'22,** Brianne Cook, PA'20, Jacob Garner, DO'22, Nelli Ghazaryan, DO'21, Simon Geletta, PhD	73 G	45
Methylation levels at growth differentiation factor-15 related CpG sites are not related to death risk from cardiovascular disease among monozygotic male twins discordant for cardiovascular disease: National Heart, Lung, and Blood Institute Twin Study **Spencer Moore, DO'23,** Pallavi Mukherji, DO, Ming Leung, Jun Dai, MD, MSc, PhD	74 G	46
Trends in utilization and determinants of antipsychotic medication use in community-dwelling elderly with mental disorders, 2006-2017 **Dooyoung Lim, PhD,** Darren Liu, DrPH, Betty Burston, PhD	75	46
Prevalence of substance use and attention-deficit/hyperactivity disorder: An epigenetic assessment **Natasha Hutchens,** Brandon Hundley, Kelsey Dawes, Rachel Reimer, PhD, Robert Philibert, MD, PhD, Allan Anderson, MD	76	47
The ethical and legal cases for compulsory vaccination **Thomas F. Fusillo, DO'23, MHA'23**	77 G	47

♦ 1 G ♦

Evaluating the effects of force, velocity, and focus of impact on skeletal trauma patterns: A forensic anthropological case study

Halie Larsen, MSA'21[1], Heather M. Garvin, PhD[1], Michele Catellier, MD[2]

[1] Department of Anatomy, College of Osteopathic Medicine, Des Moines University, Des Moines, IA
[2] Iowa Office of the State Medical Examiner, Ankeny, IA

Skeletal trauma is commonly classified as high velocity projectile/ballistic, sharp force, or blunt force trauma. In cases where the circumstances around the injury event are unknown, these designations are determined based on skeletal defect characteristics, which are described as the result of different forces and velocities. Here, we present a case study in which a single mechanism of trauma resulted in defects with characteristics that fall in multiple categories. The case involves an individual traveling in a railcar containing rebar. The rebar shifted, impacting him and resulting in death. A forensic anthropological analysis revealed circular areas of punched out bone with inward beveling that mimicked high velocity projectile trauma (e.g., gunshot wound), blunt force trauma (including crushing injuries and butterfly fractures), and areas of bone scoring (mimicking sharp force trauma). Here, we assess how mass, velocity, and the focal area of impact played a role in creating such a range of skeletal trauma characteristics from a single traumatic event. This case emphasizes the importance of considering the scene and context of each case when interpreting skeletal trauma and how definitions of trauma "types" should not be overly simplified.

♦ 2 G ♦

Determining humeral or femoral classification of an unknown epiphyseal head of *Homo naledi*

Lauren Eddy, DO'23[1] and Heather M. Garvin, PhD[2]

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Homo naledi was first discovered in 2013 in the Rising Stare Cave in Cradle of Humankind, South Africa. The fossils found have been dated to be between 335,000 and 236,000 years old but with certain features, such as cranium size, resembling characteristics of hominins that lived over 2 million years prior. Recent evaluations of sediment removed from the cave in 2014 has revealed various subadult elements, that have yet to be published. Among these findings is an epiphyseal head from either a femur or humerus. The goal of this study is to determine whether this recovered specimen is a humeral or femoral head, as well as the age of the individual based on current day *Homo sapiens* development. Using postmortem CT scans from children 1-3 years of age, epiphyseal head height, width, depth and volume data were collected from humeral and femoral heads. A sphere was also fit to the heads and the sphere diameter recorded as a measure of curvature. The same data were collected from a 3-D surface scan of the *Homo naledi* specimen, and these measurements and ratios of the measurements were compared to determine to which element and age the specimen most resembled. Results appear most consistent with femoral head data of 1-2-year olds, although there are overlap in many humeral and femoral values and changes in values with age, making a definitive designation difficult. Future analyses will aim to increase comparative sample sizes and extend the comparative data from 0-5 years of age.

♦ 3 G ♦

Assessing the developmental age of a subadult *Homo naledi* vertebral column

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In 2014, remains of a new human ancestor, *Homo naledi*, were recovered from the Dinaledi Chamber of the Rising Star cave system in South Africa. This species, estimated to have lived ~250kya, is characterized by a small endocranial volume and retention of some climbing adaptations, while also displaying human-like bipedality and intermediate body size. Examination of sediment removed from the cave has recently revealed subadult remains, including around 60 vertebral fragments that may represent a single vertebral column. These previously undescribed subadult remains are currently being analyzed. The goal of this study was to estimate the developmental age of the vertebral elements to assess whether they could come from one individual, and if so, how old that individual would be by modern human standards. Vertebral fusion patterns and lumbar vertebral measurements were collected from a sample of postmortem CT scans of modern individuals aged 0-5 years and were compared to the *Homo naledi* elements.

There were no inconsistencies in vertebral development amongst the *Homo naledi* vertebral elements, suggesting that these remains may have come from one individual and the vertebral fusion pattern is consistent with modern humans aged 1-3 years. Although the vertebral measurements fall at the very low end of the 1-3 year age range, this is expected given *Homo naledi's* relatively smaller adult body size. Analyses of *Homo naledi* subadult remains can help us better understand growth and development in this unique species.

♦ 4 G ♦

Does cranial size affect frontal sinus volumes in males and females?

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The frontal sinus (FS) is highly variable, with males generally considered as having a larger FS. However, males tend to be overall larger compared to females. This study investigates if males still have a larger FS when controlling for overall size.

20 CT scans (10M/10F) were collected of postmortem American adults of African ancestry from the New Mexico Decedents Imaging Database. CT images were utilized to form a 3D model of the skull and FS with Amira. Then, the models were cleaned up, and FS volume was calculated utilizing Geomagic Studio. In this program, the FS region was determined using the cribriform plate as an objective boundary. Linear distances across the frontal and facial bones were collected in 3DSlicer and used to estimate three measures of size: frontal bone, facial, and overall cranial size.

Raw and scaled frontal sinus volumes (FSV) of males versus females were statistically compared utilizing student t-tests. Raw FSV was significantly greater for males ($p<0.05$); even when FSV is scaled against standardized measurements of the skull, there is a significant difference between male and female FSV (all p-values<0.05). Additionally, regression analyses showed a positive relationship between FSV and the measurements above, with the strongest being with cranial size ($R^2=0.420$).

Ultimately, the results indicate that males have significantly larger FSVs, even when cranial size is considered. The data collected in this research will be used as a building block in several studies utilizing the FS for forensic identification, and for better understanding modern human craniofacial variation.

♦ 5 G ♦

Skull growth and airway occlusion

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The maxillary sinus, nasal cavity, and other skull landmarks are of clinical importance to otolaryngologists, oral-maxillofacial surgeons and related fields. Abnormal development can lead to malocclusion of the dentition and airway occlusion, leading to long term health problems. This study is part of a larger investigation into the growth and development of various skull landmarks, including the maxillary sinus and nasal cavity, to understand the relationship these have on future health issues. We specifically focus on the airway dimensions among individuals with Class I, II, and III occlusion patterns.

At this point, longitudinal lateral radiographs from 20 Class I males have been processed. For each male, 7-20 radiographs across ontogeny were analyzed. 21 skull landmarks were plotted on the radiograph and a maxillary sinus outline was obtained using the program ImageJ. The area of the maxillary sinus and distances between various landmarks were calculated.

Statistical analyses will be conducted to determine relationships between the growth and development of the skull landmarks, nasal cavity, and maxillary sinus. These data will be compared with Class II and III skeletal patterns among both males and females, and combined with other dental data, to determine their impact on long term health. A comprehensive analysis will provide understanding into the development of normal and abnormal occlusal patterns. This will ultimately help clinicians anticipate potential health concerns associated with airway occlusion, and/or provide more informed treatment options in Class II and III skeletal patterns.

♦ 6 G ♦

Scaling frontal sinus measures by orbit area in ante- and postmortem radiographs

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Osteological forensic investigations utilize frontal sinuses for human identification. However, it becomes difficult to compare frontal sinuses from a random group of individuals because sinus size depends on radiographic technique and positioning. Furthermore, anteroposterior (AP) versus posteroanterior (PA) techniques may magnify the sinuses and facial bones. To alleviate the problems of positioning and technique, orbit area has been suggested to scale frontal sinus measures.

Our study tests whether scaling of frontal sinuses by left orbit area will standardize all measurement variables in our sample. First, we downloaded all available cranial radiographs (497 total) from the Ross-Lab Database. We found 26 individuals with paired antemortem/postmortem images and measurable sinuses. For each individual film, we measured left orbit area; total sinus area; left, right and total sinus width; and left, right and total sinus height using ImageJ (scale: 300dpi to 1in). The paired raw and scaled antemortem/postmortem measurements were compared using paired t-tests/Wilcoxon signed rank using SPSS. There was a statistically significant difference in the means of most paired raw antemortem/postmortem data ($p=0.002$ to $p=0.036$), with the exception of right sinus width ($p=0.097$). There were no statistically significant differences between any paired scaled antemortem-postmortem measurements ($p=0.182$ to $p=0.889$). These results confirm scaling frontal sinuses by orbit area standardizes frontal sinus measures across images obtained with differing technique; this method will be used in a planned larger study. Future studies could include comparing orbit size across age-ranges, sex, ancestral groups, and attempting to more easily obtain orbit size with linear measurements.

♦ 7 G ♦

Growing up: Examining male and female ontogeny in subadult populations

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The nose is thought to be an important structure in the face and is well studied in adults. However, its patterns of growth and development are largely unknown. The ontogeny of the nasal cavity among subadult (<20yoa) males (n=18) and females (n=16) was investigated using CT scans. The scans were compiled into 3D cranial models using Amira, extra structural features were removed using Geomagic, and cranial landmarking was done using 3DSlicer. Landmarks were used to obtain linear distances and size measures; patterns were visualized by box- and growth-plots with Loess curves. There is morphological variation in nasal shape and height between males and female adults on the basis of sex differences in growth development. In most measures, males and females are similar at the youngest ages (0-5y11m), with differences appearing at/near puberty. The measurements of internal nasal breadth, internal nasal height, and overall nasal size have different developmental growth patterns between males and females, with the most variation within each sex being found in the 0-5y11m age group. On average, younger subadults have smaller choanal heights and wider choanal breadths in comparison to their adult counter parts, which have taller and narrower choanae. Interestingly, height measures show largest growth spurts in males at the 11-14y11m age, while patterns in breadth are less clear. This aligns with 2D studies suggesting height-dimensions as being functionally important for oxygen demand. This research will contribute to a larger study on the developmental growth of the nasal region across populations from diverse ecogeographic zones.

♦ 8 G ♦

Using 3D frontal sinus models to identify the most reliable orientation for forensic analysis

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Human frontal sinuses have been described as the "fingerprint" of the skull because of the high variability between individuals. CT scans can be used to identify and quantify the differences in 3D frontal sinuses (3D-FS) more accurately than traditional x-rays. Analyzing the 3D structure will allow for further exploration into variation between sex, ancestry, and other potential factors.

Thirty 3D-FS models were transformed with their corresponding cranial model with the superior orbital border demarcating the inferior border in 3DSlicer. The models were aligned in Frankfurt, Caldwell, and Frontal orientations with 5-degree variations, creating a total of 810 2D sinus images (FSI). FSI were scaled and outlines automatically generated using ImageJ; outlines were run through SHAPE-software and underwent elliptical Fourier analysis. FSI-outlines were analyzed using principal component analysis. PC1 (54.35% of variation) tracks how the sinuses vary from one large sinus to a smaller sinus with two distinct lobes. PC2 (18.89% of variation) tracks whether the sinuses have a lobe in the middle versus two distinct lobes, one on each side. These two PCs were plotted against each other to look for outliers and patterns in frontal sinus shape. Early analysis is focused on determining the cause of outliers, specifically variation in sinus size and asymmetry. Future analyses will be run for each individual orientation for in-depth exploration into differences of specific measures (e.g., height, breadth) between individuals and potential contributing factors, that may affect reliability of using sinus outlines in forensic investigations.

♦ 9 G ♦

The effect of increasing load on plantar fascia thickness

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Some studies have shown that measuring the thickness of the plantar fascia (PF) can be applied to clinical medicine. McMillan (2009) recommends that PF thickness >4mm is diagnostic for plantar fasciitis. Abul (2015) found that the overall thickness of the plantar fascia within a group of 156 healthy individuals was 3.0 +/- 0.5mm. The question proposed here is, how the thickness of the plantar fascia change with varying loads on the foot? We hypothesized that the plantar fascia will exhibit elastic behavior and appear thinner as the load increases and the foot arch likely flattens.

The plantar fascia thickness of 23 subjects was measured using long axis ultrasound imaging (US): free hand, seated, bilaterally standing, and in single legged stance, from least to most load on the foot. The PF thickness was measured at its attachment on the calcaneus and at 10, and 20 mm distance distally, using an in-house written software in Matlab, that segments the proximal PF section of the US image.

Our data were consistent with the literature with respect to US PF thickness at the proximal end (2.87 +/- 0.63mm, pooled over load and measurement site). However, the thickness increased with load and was not uniform across measurement sites. These preliminary findings (small sample size) question the simple elastic behavior assumption for this connective tissue and suggests that the location of measurement should be explicitly stated when assessing PF thickness for clinical purposes.

♦ 10 G ♦

Structural MRI atlas of the kudu brain (*Tragelaphus strepsiceros*)

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The Kudu is a member of the antelope family, known for their unique spiral horns. As part of the cetartiodactyla, the Kudu is notably understudied from an anatomical perspective. To date, no published studies have detailed the underlying neuroanatomical structure of the Kudu brain. With this in mind, the following study was aimed at providing a preliminary description and MRI brain atlas for this species. Using MRI scan data obtained from a postmortem scan of one adult specimen (male), obtained through collaboration with the University of Witwatersrand, we provide a working MRI atlas. Every tenth coronal image, sampled rostro-caudally from the scan data, was compiled to create a sequential library of 39 total images. The image stack was then manually labelled using comparative anatomical descriptors available for other mammalian species. Labelled components include, surface landmarks such as the sylvian sulcus as well as sub-cortical structures such as the ventricles, basal nuclei, thalamus and components of the internal capsule. This project serves as a basis for helping to elucidate the neuroanatomical substrate supporting complex behavior in artiodactyls.

♦ 11 G ♦

A preliminary investigation of behavioral laterality in the domestic goat (*Capra hircus domestica*)

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Once considered a hallmark of human uniqueness, behavioral laterality and associated brain asymmetry has emerged as a feature widely shared with other mammals. In light of this, we undertook a preliminary investigation of side preference in the domestic goat (*Capra hircus domestica*), an emerging reference species for the study of mammalian behavior. Using an Object Avoidance Task, we evaluated behavioral laterality in five adult sheep (2 males, 3 females) and recorded the side preference of each test subject when avoiding an object along a given path. A minimum of thirty consecutive trials were used per test subject yielding a total of 89 trials scored thus far, with 7 trials being scored as incomplete. Our preliminary findings suggest that goats possess a marked leftward bias in object avoidance (82.0% Left, 10.1% Right, and 7.9% incomplete). These observations suggest that like humans, goats possess a left hemisphere dominance in motor processing. While preliminary, these observations are intriguing as several recent studies on the goat have also revealed that goats possess surprisingly complicated behaviors such as the ability to differentiate human attentive states and reading human communicative cues. This data is interpreted in light of what is known for laterality in the mammalian species and the potential evolutionary pressures resulting in this convergence in behavior.

♦ 12 ♦

Increased NMDA receptor function during protracted withdrawal in rats exposed to chronic intermittent ethanol

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Functional dysregulation of the glutamate system during withdrawal from chronic drug exposure is a primary driver of drug craving and relapse. Animal models of psychostimulant use have demonstrated dynamic alterations in both AMPA and NMDA receptor function and expression that contribute to drug seeking behavior. These changes begin as early as 5 days following cessation of drug use are persistently expressed into long term withdrawal (>60d). Evidence of AMPA and NMDA receptor dependent changes during short term withdrawal (24h) suggest that similar mechanisms may drive drug craving and relapse behaviors following chronic exposure to ethanol. To this end, we investigated NMDA receptor mediated synaptic function during protracted withdrawal from chronic intermittent ethanol (CIE) exposure using whole cell patch clamp electrophysiology. We focused on the basolateral amygdala (BLA), as glutamatergic signaling in this region is

robustly modulated by short term (24h) withdrawal from CIE (10d, 12hr/day) and regulates anxiety like behavior expressed during withdrawal. Adolescent male rats exposed to repeated cycles of CIE (12hr/day, 4d on/3d off, 3 cycles) demonstrated increased functional contributions of NMDA receptors in comparison to animals exposed to room air (CON) after >35days of withdrawal. These results mirror increased NMDAR function during protracted withdrawal from cocaine self-administration, suggesting possible common mechanisms underlying aberrant synaptic function during withdrawal from multiple drugs of abuse. Ongoing studies are focused on elucidating the specific NMDA receptor subunits (GluN2B/GluN3) contributing to the identified functional increases.

♦ 13 G ♦

Characterization of gene expression changes in limbic brain areas linking alcoholism and comorbid mood disorders

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Recent clinical evidence has suggested a link between drug use disorders and development of comorbid mood disorders such as depression and anxiety; however, the underlying molecular brain mechanisms are still largely unknown. In this study, we investigated the effects of chronic intermittent ethanol exposure on expression of genes involved in neurotrophic factor signaling, (e.g., brain-derived neurotrophic factor; BDNF), mitogen-activated protein kinase (MAPK)-related pathways (e.g., ERKs, MKP-1, etc.) and glutamatergic function within brain areas thought to be responsible for regulation of addiction (amygdala and nucleus accumbens) and depressive behaviors (hippocampus and prefrontal cortex). In this model, male rats were exposed to ethanol vapor (aerosolized 95% ethanol) in 12-hour on/off cycles repeated for 4 days and then followed by a 3-day extended withdrawal period. The cycle was repeated 3 times and then animals were allowed to enter protracted withdrawal (38-45 days). Preliminary results derived from quantitative polymerase chain reaction (qPCR) analysis suggest that chronic intermittent alcohol exposure did not alter expression of BDNF, MKP-1 and ERK1/2 genes within the hippocampus, which is a major component of neurocircuitry involved in regulation of stress responses. However, ongoing studies are further investigating expression of these genes in the amygdala and nucleus accumbens, regions with primary function in addiction. Overall, the finding of this study may help elucidate specific molecular brain mechanisms underlying development of mood disorders associated with ethanol withdrawal state that could eventually lead to improved treatment of mental health aspects of alcoholism and other forms of drug abuse.

♦ 14 G ♦

Effects of chronic inflammatory pain and ketamine treatment on limbic brain gene expression

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Major depressive disorder represents a significant portion of healthcare spending at over $210 billion, with 62% of costs towards depression with an associated comorbidity such as chronic pain. Despite this, brain mechanisms linking a chronic pain state to development of depression are still not well understood. We recently performed a genome wide microarray analysis of the hippocampus in male rats exposed to chronic inflammatory pain (i.e., 21 days of exposure to Complete Freund's Adjuvant, CFA) that identified significantly dysregulated genes including CCL5 and s100a9. Both target genes play a role in neurodegenerative and inflammatory events within the central nervous system that may also contribute to limbic pain processing. In the current study, we demonstrated that chronic pain increases the expression of CCL5 and s100a9 genes in the hippocampus and other limbic areas (e.g., prefrontal cortex) involved in mood regulation, as well as in the brains of female rats exposed to the same 21-day pain paradigm. Furthermore, administration of ketamine, a fast-acting antidepressant and analgesic agent, produced a protective effect as chronic pain-evoked increases in limbic CCL5 and S100a9 gene expression were prevented. Overall, the results of this study further elucidate the presence of transcriptional alterations in the hippocampus and prefrontal cortex during the chronic pain state. Additionally, the dysregulation of genes involved in neuroinflammatory and neurodegenerative processes in the limbic brain areas continues to strengthen the idea that these processes may be involved in the development of mood disorders during the chronic pain state.

♦ 15 G ♦

Genetic determinants of erythrocyte glutathione S-transferase pi activity and kinetics in dogs

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Background: Glutathione S-transferase pi (GSTP1), the major GST in mammalian blood, plays an important role in detoxification by catalyzing the conjugation of xenobiotics with glutathione (GSH). In dogs, exposure to certain environmental chemicals may result in canine cancer, but it is not known whether this risk can be modulated by polymorphisms in the *GSTP1* gene. The goal of this ongoing study was to characterize and correlate GST enzyme activity and kinetics in erythrocytes with *GSTP1* polymorphisms.

Methods: Whole blood and saliva samples were collected from 33 healthy dogs. eGST activity and kinetics, using the substrate 1-chloro-2,4-dinitrobenzene (CDNB) and co-substrate GSH, were determined spectrophotometrically. DNA and RNA were isolated from saliva and blood respectively and used to amplify select regions of the *GSTP1* gene, which were screened for variants via Sanger sequencing.

Results: The apparent K_m and V_{max} for the eGST reaction using CDNB as substrate were 0.81+/-0.49 mM and 4.72+/-1.80 µmol/min/g Hb, while the apparent K_m and V_{max} of GSH were 0.57+/-0.33 µM and 3.88+/-1.70 µmol/min/g Hb. Both reactions fitted a linear Michaelis-Menten model. eGST activity was not associated with age or sex of the dogs. Multiple genetic variants were found in the promoter, coding and untranslated regions of *GSTP1*. The synonymous 336T>C polymorphism (rs852782669) was associated with lower eGST activity (p=0.015), which is predicted to occur via aberrant gene splicing.

Conclusion: A *GSTP1* variant that occurs in one third of dogs may be associated with decreased function of the GSTP1 enzyme in canine blood.

♦ 16 G ♦

Erythrocyte glutathione transferase activity in cats

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Background: Glutathione S-Transferases (GSTs), expressed in various mammalian tissues, are a broad class of enzymes responsible for the elimination of numerous xenobiotics. In humans, abnormal levels of GST expression have been associated with an increased risk of developing cancer. This detoxification pathway has not been investigated in the domestic cat. The goal of this pilot study was to investigate the activity and kinetics of GSTs in the blood (eGSTs) of cats.

Methods: Whole blood was collected from 21 healthy cats. Following optimization, a spectrophotometric assay was used to determine the kinetics of the two substrates involved in the GST reaction: 1-chloro-2,4-dinitrobenzene (CDNB) and glutathione (GSH). Ethacrynic acid inhibition was assessed in 7 cats, to determine potency, type of inhibition, and the mechanism of eGST conjugation.

Results: The apparent K_m and V_{max} for the eGST reaction using CDNB as substrate were 0.42+/-0.11 µM and 24.95+/-7.27 µmol/min/g Hb, while the apparent K_m and V_{max} of GSH (at 1 mM CDNB) were 0.80+/-0.29 µM and 44.18+/-12.92 µmol/min/g Hb. Both reactions followed Michaelis-Menten kinetics, possibly indicating that the activity observed was from one isoform. Overall, the eGST activity in cats is higher than in other mammals. Unlike other mammals such as dogs and humans, ethacrynic acid is a non-competitive inhibitor of eGST with an IC_{50} of 4.37+/- 0.934µM.

Conclusion: Inhibition studies reveal a potential difference in the conformation of the enzyme's active site. The high GST activity in blood observed has profound implications for cancer chemotherapy and susceptibility to environmental carcinogens in cats.

♦ 17 G ♦

Effect of chronic intermittent hypoxia on inflammation and redox related gene expression in renal cortex

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Renal hypoxia is recognized as an important factor in the pathogenesis of renal injury and chronic kidney disease (CKD). Renal hypoxia can be precipitated by a wide array of hormonal and hemodynamic factors. Sleep apnea syndrome (SAS) causes repeated bouts of hypoxemia, coupled with hemodynamic abnormalities and neurohormonal activation. Despite clinical correlations between sleep apnea and CKD few studies have addressed molecular pathways that may lead to CKD in patients with SAS. The aim of this study was to identify changes in renal gene expression associated with exposure to chronic intermittent hypoxia (CIH), a model of SAS. We hypothesized CIH would elicit increases in pro-inflammatory, pro-oxidative, and pro-fibrotic gene expression. To address these hypotheses, we exposed rats to 10 days of CIH (or sham) and examined renal cortical expression of IL1β, IL6, TNFα, Nrf-2, GCLC, NQO1, MnSOD, CuZSOD, P40phox, P67phox, SP1, CTGF, and Collagen III via qRT-PCR. Preliminary data suggests CIH results in upregulation of IL1β, IL6, TNFα, Nrf-2, MnSOD, NQO1, GCLC, SP1, CTGF, and Collagen III mRNA in renal cortex. These preliminary studies suggest that short term exposure to CIH is sufficient to promote induction of inflammation and pro-fibrotic genes, and adaptive expression of antioxidant defense programs. Further study is required to more clearly delineate the links between CIH and activation of these gene programs in the kidneys. A better understanding of the molecular pathways activated by CIH is important for understanding CKD pathophysiology in patients with SAS and related pathology such as the cardio-renal syndrome in heart failure.

♦ 18 G ♦

Characterization of the role of the mitochondrial branched chain aminotransferase in anti-lymphoma T cell immunity

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T cells experience increased uptake of branched chain amino acids (BCAAs) during activation, which they use to meet their increased biosynthetic demands. However, once inside T cells, BCAAs are subjected to degradation initiated by the mitochondrial branched-chain aminotransferase (BCATm). We hypothesized that if BCATm is absent from T cells, this would provide more intracellular BCAAs to stimulate T cell activation leading to improved T cell function. To explore this, we created a unique mouse model with BCATm deleted from T cells (T-BCATm^{KO}) and tested the response of the mice to lymphoma. Initial characterization of T-BCATm^{KO} and control littermates (T-BCATm$^{fl/fl}$) included PCR, qRT-PCR, and Western Blotting of DNA, RNA, and total protein, respectively, isolated from brain, liver, heart, thymus, and T cells followed by mouse inoculation with $2.5x10^5$ EL-4-OVA lymphoma cells (n=4/group) or phosphate- buffer saline (control mice, n=2/group). Tumor growth was monitored for 20 days and animal weight, food intake, and tumor volume were recorded daily. There was no significant difference between the weight or food intake between the different mouse groups. Statistical analysis via one-way ANOVA revealed a significantly delayed tumor growth and smaller average tumor volume of T-BCATm^{KO} compared to T-BCAT$^{fl/fl}$ mice (P= 0.025). In addition, T cells isolated from T-BCATm^{KO} mice released more interferon gamma after 48, 72 hours compared to control T cells, suggesting that T cells form T-BCATm^{KO} mice are more active and possibly contributed to the reduced tumor development. The findings indicate the BCATm might be suitable target for T cell immunotherapy.

♦ 19 G ♦

Using siRNA technology to inhibit the oncogene c-Myc in EL-4 lymphoma cells

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Lymphomas are categorized as neoplasms that come from our lymphatic system and are able to have widespread systemic effects as well as a varying presentation. Many therapeutic approaches have been unsuccessful due to drug resistance and side effects. Because of this there is a necessity for novel anti-lymphoma therapies. Previously, Dr. Ananieva investigated the importance of c-Myc oncogene and its relationship to branched-chain aminotransferases (BCATc and BCATm) as key enzymes in lymphoma. Our present research attempts to answer the question of whether introducing a small interfering RNA (siRNA) that targets c-Myc may the expression of BCATc and BCATm in lymphoma cells.

To test this, we grew the mouse lymphoma cell line EL-4 in cell culture incubator at 37ºC and 5% CO_2 followed by cell transfection with c-Myc-siRNA (or control nontargeting siRNA) via electroporation. We then allowed the cells to grow and collected cell pellets at 48- and 72-hours post-transfection. We took these samples and performed Western Blotting to measure changes in the protein expression of c-Myc, BCATc, and BCATm.

Research is currently ongoing but preliminary results have shown a 30% reduction in c-Myc and BCATc protein expression upon introduction of 80nM c-Myc-siRNA. We have currently carried out another round of transfection with 200nM of c-Myc-siRNA and are expecting ~ 50% reduction in BCATc or BCATm protein expression. Future experiments will focus on testing how silencing c-Myc with siRNA impacts the promoter activity of the genes expressing BCATc and BCATm with the ultimate goal to target these genes for anti-lymphoma therapy.

♦ 20 G ♦

The cytosolic branched-chain aminotransferase is a downstream target of the mammalian target of rapamycin pathway in lymphoma cells

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Branched-Chain Amino Acids (BCAAs) play a vital role in the activation of the mammalian target of rapamycin (mTOR). BCAA catabolism reduces BCAA substrate availability for mTOR pathway but provides metabolites for cell growth. Lymphoma cells utilize the mTOR pathway for biosynthesis and cell growth. This is achieved through various downstream targets of mTOR including the ribosomal S6 kinase (S6K1) and protein-kinase B (AKT). Lymphoma cells also use enzymes of BCAA catabolism, such as the branched-chain aminotransferases BCATc and BCATm and branched-chain α-ketoacid dehydrogenase complex (BCKDH-E1α and BCKDH-E2) for energy generation. While BCAAs are known activators of mTOR pathway, the impact of this pathway on the expression of BCAA enzymes in lymphoma cells is not known.

To assess whether BCATc, BCATm, BCKDH-E1α and BCKDH-E2 are downstream targets of mTOR pathway in lymphoma cells, we treated the murine lymphoma cell line, EL-4, with increasing concentrations of rapamycin (mTORC1 inhibitor) and torin (mTORC1 and mTORC2 inhibitor) for 24 hours and measured cell viability, mRNA and protein expression levels of the BCAA enzymes. Rapamycin and torin inhibited the growth of EL-4 cells in a concentration dependent manner where rapamycin caused 50-70% and torin caused 35- 83% growth inhibition, respectively. Rapamycin suppressed mRNA and protein expression of BCATc and BCKDH-E2 (mRNA only). Torin suppressed the protein expression of BCATc. This study thus identified BCATc as a new downstream target of mTOR pathway in lymphoma cells and pointed toward a possible feedback loop regulation of mTOR activity by BCATc in lymphoma cells.

♦ 21 G ♦

Comparative study of bone sarcomas revealed that osteosarcomas favorably respond to modulations in leucine uptake and metabolism

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Bone sarcomas are heterogeneous tumors that are resistant to traditional treatments. One solution to bone sarcoma resistance might be to target the amino acid leucine. Leucine regulates protein synthesis by activating complex 1 of the mammalian target of rapamycin (mTORC1), while leucine degradation is a source of energy.

We hypothesized that the leucine antagonist, N-acetyl-leucine-amide (NALA), and the inhibitor of leucine degradation, gabapentin, would reduce the energy charge and viability of bone sarcoma cells. For that purpose, we treated human osteosarcoma (143B) and chondrosarcoma (SW1353) cells with 25 mM NALA, 5 mM gabapentin, and 5 mM metformin, the latter is an activator of the energy sensor AMP-activated protein kinase (AMPK). After 24-h treatment, we fed the cells with radioactive leucine to measure leucine degradation followed by determining cell viability, the ATP levels, and the activity state of AMPK and mTORC1 signaling in the cells by Western Blotting.

In the osteosarcoma 143B cells, leucine degradation was inhibited by NALA and gabapentin leading to activation of AMPK, downregulation of mTORC1 pathway, and reduction in cell viability. In contrast, the chondrosarcoma SW1353 cells were resistant to gabapentin and when metformin was used, the resulting activation of AMPK did not inhibit mTORC1 or cell viability. Thus, the effects of the pharmacological inhibitors were dependent on the heterogeneity of the bone sarcomas, a finding that needs to be considered regarding treatment approaches.

♦ 22 G ♦

Disruption in leucine uptake and metabolism inhibits the growth and cell division of human bone sarcomas

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Osteosarcoma and chondrosarcoma are devastating bone sarcomas with low survival rates. The prognosis for bone sarcoma patients depends upon their response to chemotherapy and surgical intervention. An approach to treat bone sarcomas is to target leucine, an essential amino acid that supports tumor growth. We aimed to investigate how a pharmacological inhibition of leucine uptake by N-acetyl-leucine amide (NALA) and suppression of leucine degradation at the branched-chain aminotransferase (BCATc) step by gabapentin would affect the cell division of human osteosarcoma 143B and chondrosarcoma SW1353 cells.

We treated 143B and SW1353 cells with NALA (25mM) and gabapentin (5mM) for 24-h and determined the proliferation and the distribution of the cells among G1, S, and G2/M phases of the cell cycle by using propidium iodide and Flow Cytometry followed by determining the expression of the cell cycle inhibitors $p27^{Kip1}$ and retinoblastoma (Rb) by using Western Blotting.

Gabapentin affected 143B but not SW1353 cells, the latter do not express BCATc. The 143B cells had an increased expression of $p27^{Kip1}$ and reduction in phosphorylated Rb in response to gabapentin suggesting that gabapentin arrested the growth of 143B cells. NALA affected both cell lines leading to increased $p27^{kip1}$ expression, dephosphorylation of Rb, and subsequent cell arrest in the G1 phase.

This study demonstrates that modulations in leucine uptake and metabolism impact the growth of osteosarcomas and chondrosarcomas (NALA only) and could be used in therapeutic approaches.

♦ 23 G ♦

The oncogene c-MYC regulates branched chain amino acid metabolism in T lymphocytes

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Branched-chain amino acids (BCAAs) are considered essential substrates for biosynthetic processes during the activation of T lymphocytes. Enzymes degrading BCAAs, such as the mitochondrial and cytosolic branched-chain aminotransferases (BCATc and BCATm, respectively) are candidates for immunosuppressive enzymes. How BCATc and BCATm are regulated in T lymphocytes is understudied, but preliminary results from Ananieva's laboratory suggest that the oncogene c-Myc may regulate the gene expression of BCATc and BCATm during T cell activation.

The aim of this project was to investigate how c-Myc regulates BCATc and BCATm in T-Lymphocytes.

T lymphocytes were isolated from spleens of C57BL/6 wild type mice and activated with anti-CD3 and anti-CD28 for 48 hr followed by expansion to T helper type 1 with interleukin IL2 for 48 hr before treatment with the pharmacological inhibitor of c-Myc 10058-F4 (100μM) in the presence of anti-CD3 and anti-CD28. After 24hr, untreated and 10058-F4 treated T cells were subjected to leucine transamination assay, while cell material was collected for gene (mRNA) and protein expression of BCATc and BCATm.

In the presence of 10058-F4, the gene and protein expression of BCATc and BCATm were significantly reduced, which resulted in decreased leucine transamination. The results revealed that inhibition of c-Myc affects the gene expression and function of BCATc and BCATm implying that c-Myc is a positive regulator of the gene expression of these enzymes in T cells. Future experiments will evaluate the impact of c-Myc on the promoter activity of BCATc and BCATm in T cells by using 10058-F4 or siRNA technology.

♦ 24 G ♦

The effect of estrogen on leptin's signaling

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During menopause, when endogenous estrogen levels are depleted, a rise in hypertension is observed in 75% of post-menopausal women, suggesting there is a cardioprotective effect from estrogen. In previous studies, estrogen has been shown to effect hypothalamic paraventricular nuclei by its action to lessen the impact of a glutamate induced increase in blood pressure. These data, along with others, suggest that the cardioprotective effect of estrogen is regionally specific in the central nervous system. However, the mechanism(s) behind estrogen's attenuating effect on blood pressure have not been fully elucidated. We propose that estrogen regulates blood pressure in part, by inhibiting the actions of leptin. Leptin is an adipocyte-derived peptide hormone. Activation of its signaling pathway within the central nervous system can alter blood pressure. Studies with injections of leptin in rodent's dorsomedial hypothalamus showed an increase in blood pressure, while antagonism of leptin receptors correlated with diminished blood pressure. Both results suggest that adjustment of leptin signaling in the dorsomedial hypothalamus is sufficient to alter blood pressure. SOCS3 is a negative modulator of cytokine activity and leptin signaling. In this study, we hypothesize that estrogen can block leptin receptor activation and downstream signaling events by increasing the expression of SOCS3. GT1-7 mouse hypothalamic neuronal cells were treated with estradiol (100nM) for 0, 15, 30, 60 or 90 minutes. Western blot analysis was used to identify the change in SOCS3 and leptin receptor expression.

♦ 25 G ♦

Dysfunction of renal glucose handling restored by central leptin receptor blockade in a model of estrogen deficiency

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Hormonal changes accompanying menopause have several effects on women such as weight gain in the form of adipose tissue. This associates with increased production of leptin, an adipocyte derived hormone, that acts mainly on the central nervous system. Leptin regulates body weight, but it also plays a primary role in regulation of glucose homeostasis. In an estrogen-deficient adult female rodent model (ovariectomized; OVX), we measured significant weight gain, increase in glomerular filtration rate (GFR) and protein expression of an early biomarker of kidney injury. The mechanism proposed for increase in GFR and renal damage is lipotoxicity due to intrarenal lipid accumulation associated with increased perirenal adipose tissue.

In this study, we aim to determine renal glucose handling in response to estrogen deficiency. Sodium-glucose cotransporter-2 (SGLT2) is the main mediator of renal glucose handling and is co-expressed in renal proximal tubules (PTs) with Na/H exchanger-3 (NHE3), a key player of salt regulation. Using immunohistochemistry, we measured significant reduction in renal SGLT2 protein expression levels in OVX animals when compared with their controls. NHE3 protein expression levels were also decreased as previously shown. The effect on SGLT2 was completely reversed by treatment with leptin receptor antagonist (LAN), delivered for four weeks into the lateral ventricle by an osmotic pump, while NHE3 effect in the same PTs was not affected by LAN treatment.

These findings may shed light in the understanding of leptin regulation of glucose homeostasis and lead to potential benefit against kidney dysfunction caused by fat accumulation dependent on estrogen deficiency.

♦ 26 G ♦

Genetic variants on the calcineurin homologous protein genes associated with an increase in blood pressure

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Hypertension directly affects about one in five adults in United States and approximately 1,300 Americans die from hypertension-related causes every day. Hypertension is known to be highly heritable through genetics; however, the effect of genetic variants in blood pressure regulation is not well established. In 200,000-individual genome study, we identified five single nucleotide polymorphisms (SNPs) on the calcineurin homologous protein (CHP) genes that were significantly correlated with increased blood pressure. Using computational analysis, we mapped the SNPs location within putative transcription factor binding sites in non-coding regions of CHP genes. CHP is a binding partner of Na^+/H^+ exchanger-3 (NHE3), a key player in renal salt regulation and blood pressure control. Furthermore, the level of CHP protein expression is known to regulate NHE3 activity. We hypothesized that these SNPs affect NHE3 activity through CHP gene regulation, with a downstream effect on blood pressure. We cloned the human CHP promoters and measured activity of each SNP on its respective CHP promoter expressed in human kidney cells using the luciferase reporter system. Major to minor allele replacements of two of five SNPs revealed significant effects on CHP promoter activity. Expression of the other three SNPs did not show significant effect on promoter activity. Ongoing research involves identifying changes in binding of transcription factors to SNP regions of CHP genes dependent on the switch from major to minor alleles. Functional analysis of CHP genetic variants might aid the discovery of novel susceptibility loci responsible for genetic predisposition to the development of hypertension.

♦ 27 G ♦

Vesicle-associated membrane protein 8 as a potential calmodulin target in autophagy

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Macroautophagy is a catabolic process in which unused cellular materials are degraded and recycled in the lysosome for maintenance of homeostasis. The regulation of macroautophagy is still not fully understood, notably regarding the role of calcium and calmodulin. We hypothesized that calmodulin plays an important role in the regulation of macroautophagy. In H9c2 cardiomyocytes, four structurally different calmodulin antagonists produce accumulation of microtubule-associated light chain protein 3 (LC3-II), a marker of macroautophagy. Calmodulin antagonists also substantially inhibit lysosomal acidity. In macroautophagy, a vesicle of cargos targeted for degradation forms and is ultimately fused with the lysosome. As vesicle-associated membrane protein 8 (VAMP8) plays an important role in autophagosome-lysosome fusion and shares homology with VAMP2, a calmodulin target in neurotransmitter release, we hypothesized that VAMP8 may be a target for calmodulin's action in macroautophagy. Using a biosensor-based method to screen for calmodulin-binding sites, we identified a 20-a.a. domain on VAMP8 as its calmodulin-binding domain. Detailed biochemical characterizations identified that the interaction is calcium-dependent and of high affinity. Four loss-of-binding mutations were generated for studies in cell that compare wild-type and mutant VAMP8 in basal autophagy. These mutations produced a 20-fold reduction in calmodulin binding affinity and a 2-fold increase in the concentration of calcium required for binding. These data indicate a role for calmodulin in the regulation of macroautophagy, identify VAMP8 as a new calmodulin-binding protein, and warrant further studies to document the role of calmodulin-VAMP8 interaction in the regulation of autophagosome-lysosome fusion.

♦ 28 UG ♦

J-curve effects on basal autophagy and ER marker in the vascular endothelium by excessive sympathetic activation

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Vascular endothelial functions are important for cardiovascular homeostasis and are controlled by interlinked metabolic processes such as macroautophagy and endoplasmic reticular (ER) stress. Macroautophagy is a process that degrades unnecessary cellular materials and recycling them to produce building blocks for renovation and adaptation. ER stress involves signaling cascades activated in response to accumulation of unfolded or misfolded proteins in the ER. Excessive sympathetic nervous activation leads to pathological remodeling of cardiovascular tissues. Nevertheless, it is completely unknown if excessive adrenergic stimulation affects endothelial metabolism. We hypothesized that excessive adrenergic stimulation would impair basal autophagy and ER stress response in the endothelium. In freshly isolated aortic endothelial cells, norepinephrine (100 μM) produced J-curve effects on autophagic markers, such that expression levels of LC3-II and p62 are reduced following short-term NE treatment, but are increased over time above control value. Immunofluorescence showed increases in the numbers of LC3 and p-62 puncta in endothelial cells treated with NE for 48 hrs. Since mammalian target of rapamycin (mTOR) is a strong regulator of autophagy, we tested if NE affects basal autophagy via changes in mTOR activity. Preliminary data showed that NE treatment produced a J-curve effect on pS6, an mTOR activity marker, in endothelial cells. Interestingly, NE treatment also produced a J-curve effect on the expression of ER marker calnexin. These data suggest that excessive sympathetic activation may disturb basal autophagy and ER function in the endothelium and warrant further studies to identify the mechanisms and approaches to ameliorate these disturbances.

♦ 29 G ♦

Effects of a G protein-coupled estrogen receptor agonist on cardiac remodeling induced by chronic sympathetic activation

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Cardiovascular disease (CVD) is the leading cause of death in females in the United States. The reduction in circulating estrogen concentration in postmenopausal women is associated with significant increases in morbidity and mortality from CVD. Sympathetic hyperactivity is commonly observed in postmenopausal women and is associated with CVD. Nevertheless, the role of estrogenic agonists in ameliorating the adverse outcomes of chronic sympathetic activation is unclear. We hypothesized that activation of the G protein-coupled estrogen receptor (GPER) would reduce cardiovascular remodeling induced by chronic norepinephrine (NE) administration. Female mice with intact ovaries and mice that had undergone ovariectomy surgery (OVX) were implanted with osmotic mini pumps that dispensed NE (10 mg/kg/day), GPER agonist G-1, (120 µg/kg/day), or NE+G-1 at the same individual doses. Eight weeks later, the mice were euthanized and organs were collected for further analysis of gross heart weight/body weight ratio (HW/BW), myocardial cell surface area using wheat germ agglutinin (WGA) staining, and cardiac fibrosis using Masson's trichrome staining. NE administration caused an increase in gross HW/BW in OVX mice, but not in intact mice. However, G-1 administration did not reduce this increase. Interestingly, at the tissue and cellular levels, preliminary data indicate that NE increased cardiomyocyte surface area in OVX mice, and that G-1 prevented this effect. NE also caused an increase in cardiac fibrosis, an effect again prevented by agonist G-1. Overall, our data indicate that female sex hormones protect against NE-induced cardiovascular and heart remodeling, and that GPER activation is partially responsible for this protective effect.

♦ 30 G ♦

Chronic norepinephrine infusion reduces GPER expression in the hypothalamus of ovariectomized mice

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In many disease states, sympathetic hyperactivity has been demonstrated, including hypertension and heart failure. In females, there is substantial evidence to support a protected phenotype, with respect to cardiovascular disease prevalence and severity, prior to the onset of menopause, which suggests a role for sex steroids. While many studies have focused on the protection at the level of the heart and vasculature, we hypothesized that some of this protection may exist in the central nervous system, specifically in the areas that control autonomic outflow. The hypothalamus serves as a major regulatory site for control of autonomic outflow. Additionally, there is evidence to support that estrogen receptors can reduce central sympathetic activity. Therefore, we hypothesized in the current study that chronic norepinephrine reduced expression of estrogen receptors in the hypothalamus in the absence of circulating estrogen. In this study, female mice were ovariectomized at 8 weeks of age. After 3 weeks of recovery, animals were implanted with osmotic minipumps that delivered norepinephrine continuously for 8 weeks (10mg/kg/d). Although preliminary, we found that norepinephrine infusion reduced GPER expression ~25% as evaluated by qPCR in the hypothalamus of ovariectomized mice. These results suggest that chronic sympathetic stimulation may erode the protective phenotype of estrogen receptor expression in the brain. Further studies will delineate the role of sex steroids (i.e. in intact female mice) to withstand the negative effects of norepinephrine on the expression of estrogen receptors in the brain.

♦ 31 G ♦

Effect of co-administration of acyclovir and MST-312 or epigallocatechin gallate on herpes simplex virus-1 plaque formation

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Herpes simplex virus (HSV) is a common viral agent responsible for a wide array of symptoms ranging from simple cold sores to blindness and severe encephalitis. While current antiviral therapies such as acyclovir (ACV) are effective against many HSV infections, treatment options for drug resistant mutants are limited, making discovery of new antivirals imperative. Two such potential compounds are MST-312, a telomerase inhibitor, and epigallocatechin gallate (EGCG), a polyphenol found in tea leaves. Single treatment with either compound has been shown previously to have significant antiviral activity against HSV-1. In this series of experiments, we explored the antiviral activity of MST-312 and EGCG as adjuvant therapies when co-administered with ACV in HSV-1 infected Vero cells. To accomplish this, cells were infected with HSV-1 and exposed to various concentrations of MST-312 or EGCG alone. Viral plaque formation was then quantified and compared to plaque formation in cells co-treated with ACV and either MST-312 or EGCG. When used in combination with ACV, MST-312 between 2 μM and 20 μM concentrations reduced plaque formation to a greater degree than either drug alone. EGCG was found to be especially potent, with concentrations as low as 1 μM completely inhibiting plaque formation. When co-administered with 1.6 μM ACV, EGCG at all concentrations tested was found to reduce plaque formation more than either drug alone. Together, these data suggest an additive interaction between MST-312/EGCG and ACV when co-administered, which supports the potential for MST-312 and EGCG use as an adjuvant therapy in HSV-1 infection.

♦ 32 ♦

Characterization of lytic bacteriophages that target *Acinetobacter baumannii*

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Acinetobacter baumannii, an opportunistic and multi-drug resistant bacterial pathogen, causes significant hospital-acquired infections in immunocompromised patients. Due to its growing resistance, antibiotics as treatment options for *A. baumannii* is quickly diminishing.

An alternative therapy is the use of bacteriophages, which are viruses that infect bacteria. They are the most abundant organism on Earth and can be found anywhere bacteria are present. To understand the mechanisms by which bacteriophages target and kill *A. baumannii,* it's essential to isolate and characterize many more phages. Characterization includes classification through assessing morphological features by electron microscopy, genome sequencing, annotation, and comparative genomics, in addition to determining phage host range.

Herein, we report the isolation of a novel *Acinetobacter* phage called DMU1. Morphology assessment by TEM revealed phage particles with non-elongated icosahedral heads and narrow flexible tails ending in spikes or fibers. In conjunction with morphological characteristics, measurements of virion dimensions indicate this phage belongs to the *Siphoviridae* family. Sequencing revealed the novel phage to have a circular dsDNA genome, 43,482 bp in length with a G + C content of 48%. The genome is predicted to carry 59 protein-encoding genes, one coding for arginine tRNA, and one transcriptional terminator. Phylogenetic analysis indicates DMU1 is closely related to previously characterized *Acinetobacter phage*, SH-AB15497. Together, these phages likely represent a new genus. The phage isolates exhibited a narrow host range, evidenced by only producing plaques on lawns of two *A. baumannii* strains and none on *Acinetobacter baylyi, Acinetobacter nosocomialis, Escherichia coli*, *Pseudomonas aeruginosa*, or *Moraxella catarrhalis*.

♦ 33 G ♦

Isolation and growth parameter determination of bacteriophages targeting *Acinetobacter baumannii* strain AB5075-UW

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Acinetobacter baumannii is a pathogenic gram-negative coccobacillus found throughout hospital environments in extensively antibiotic-resistant states. It commonly infects the skin, respiratory tract, blood, and CNS of immunocompromised patients. Due to high mortality rates, alternative therapies are quickly needed. One strategy under investigation utilizes bacteriophages, viruses that selectively infect and lyse bacterium, with the end goal of curating a library of isolated lytic bacteriophage against *A. baumannii*.

To achieve this, a bacterial strain called AB5075-UW was obtained from the University of Washington Manoil lab and activated sludge was acquired from the Des Moines Wastewater Reclamation Authority. The sludge was enriched for bacteriophage through incubation with the host AB5075-UW. This enrichment culture underwent clarification and filtration and was spotted on a lawn of AB5075-UW, confirming the presence of bacteriophage through the development of clearings called plaques. Isolated samples were taken of morphologically unique plaques, suspended in solution, and spread on lawns of host AB5075-UW to produce a stock of these bacteriophages.

Phage isolates were compared via kill curves, wherein each bacteriophage is paired in varying ratios with AB5075-UW in broth and incubated for 24 hours with optical density measured at regular intervals. Results indicate the presence of a singular phage producing multiple plaque morphologies with a burst time of 25 minutes and a period of ~150 minutes of maximally inhibited bacterial growth until uninhibited growth was established. Future efforts to characterize the phage will utilize genome sequencing and SEM for inclusion into the bacteriophage library.

♦ 34 G ♦

A putative 4-α-glucanotransferase from *Trichomonas vaginalis*

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Glycogen, a store of glucose found in many organisms, accounts for up to 15% of the dry weight of the parasitic protist, *Trichomonas vaginalis*. The genome of *T. vaginalis*, the causative agent of the common sexually transmitted infection, trichomoniasis, possesses 11 open reading frames predicted to encode 4-α-glucanotransferases. These enzymes function to catalyze the transfer of α1,4-linked chains of glucose between glucans and are commonly found in bacteria and plants. Among the 11 open reading frames, three are also predicted to possess glycogen binding domains. We are investigating the function of one such putative 4-α-glucanotransferase (TVAG_191140) and its potential role in glycogen metabolism. TVAG_191140 was amplified by PCR, cloned into a bacterial expression vector that added an N-terminal poly-histidine tag, and expressed in E. coli BL21(DE3). TVAG_191140 protein was then extracted and purified by immobilized metal affinity chromatography. To assess the 4-α-glucanotransferase activity of recombinant TVAG_191140, we incubated the purified protein with glycogen and various sources of α1,4-linked chains of glucose including maltose, maltotetraose, maltopentaose, maltoheptaose, and maltodextrin at concentrations of 20 mM and at pH 4.5, 5.5, or 6.8, with or without 10mM $CaCl_2$. Following incubation, the reaction mixture was analyzed by thin layer chromatography, where 4α-glucanotransferase activity would be evident by the appearance of glucan species of sizes intermediate between those of the substrates used. As yet, no 4-α-glucanotransferase activity has been detected. In subsequent work, we will re-express the TVAG_191140 protein using similar methodology but placing the poly-histidine tag at the C-terminus.

♦ 35 G ♦

IL-38 downregulates expression of PD1 and ICOSL in cervical cancer

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Background: Cervical cancer (CC) is still one of the leading causes of cancer death in women worldwide. Besides surgery, chemotherapy, and radiation therapy, immunotherapy is another promising treatment option for CC. PD1, PDL1 and PDL2 are the three key molecules in the PD1/PDL1 (PDL2) pathway, which downregulates immune response and plays an important role in the development and invasion of CC. PD1/PDL1 (PDL2) inhibitors have been approved to treat cervical cancer with inspiring clinical outcomes. ICOS and ICOSL are two important molecules in the ICOS/ICOSL pathway. It has been shown that upregulation of ICOSL in breast cancer is associated with poor prognosis, suggesting that downregulation of ICOSL might improve the outcome of cancer. IL38 is a new member of the IL1 cytokine family and its role in cancer is unclear. We have previously reported that IL-38 has differential effect on expression of PD1, PDL1 and PDL2 in colon cancer. This study was designed to investigate the effect of IL38 on the expression of PD1, PDL1 and PDL2, as well as ICOS and ICOSL in CC.

Methods: RT-PCR was used to evaluate the mRNA expression of PD1, PDL1 and PDL2, as well as ICOS and ICOSL in a widely used CC cell line, HeLa, in the presence and absence of IL38.

Results: We found that PD1, PDL1, PDL2, ICOS and ICOSL were constitutively expressed in CC cells. The mRNA expression levels of PDL1 and PDL2 were comparable in the presence or absence of IL38. However, the expression level of PD1 was much lower in the presence of IL38 when compared to that in the absence of IL38.The mRNA expression level of ICOS was comparable in the presence or absence of IL38. However, the expression level of ICOSL was much lower in the presence of IL38 when compared to that in the absence of IL38.

Conclusions: IL38 has little effect on expression of PDL1, PDL2 or ICOS, but significantly downregulates expression of PD1 and ICOSL indicating its differential effect on expression of these molecules in CC. Further study might provide some new information about the potential role of IL-38 for CC.

♦ 36 G ♦

IL-29 is a promising cytokine for immunotherapy of cervical cancer

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Background: IL-29 is an interesting cytokine in the IFNλ family. Its role in the pathogenesis of neoplasia is complicated and has been studied in other cancers such as lung cancer, gastric cancer, and colorectal cancer. We have previously reported that IL-29 promotes the growth of pancreatic cancer. However, the direct role of IL-29 in cervical cancer has not been studied yet. This study was performed to investigate if it has any direct effect on cervical 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 cervical cancer cell line, SiHa. We further investigated the potential molecular mechanisms by using RT-PCR and IHC.

Results: We found that the percentage of colonies of SiHa cells was decreased in the presence of IL-29. This was consistent with a decreased OD value of cancer cells. Furthermore, the relative caspase-3 activity in cancer cells increased in the presence of IL-29. The anti-proliferative effect of IL-29 on cancer cells correlated with increased expression of the anti-proliferative molecules p18 and p27. The pro-apoptotic effect of IL-29 on cancer cells correlated with increased expression of pro-apoptotic molecule TRAILR1.

Conclusions: IL-29 inhibits cervical cancer cell growth by inhibiting cell proliferation and promoting cell apoptosis. Thus, IL-29 might be a promising cytokine for immunotherapy of cervical cancer.

♦ 37 G ♦

Celery: A super vegetable for melanoma

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Background: Among all skin cancers, melanoma is the most lethal malignancy and its incidence is increasing. In recent years, it has been shown that seed extract from the popular vegetable celery inhibits the growth of A375 melanoma cells. However, nothing is known about its effect on another widely studied melanoma cell line HTB-72. This study was designed to investigate if celery seed extract (CE) has any direct effect on the growth of HTB-72 melanoma cells.

Methods: Clonogenic survival assay, cell proliferation, and caspase-3 activity kits were used to evaluate the effects of CE on HTB-72 melanoma cells. We further investigated the possible molecular mechanisms using RT-PCR.

Results: CE treatment of HTB-72 melanoma cells was found to decrease the number of cancer cell colonies and decrease the associated OD value. CE's anti-proliferative effects correlated with decreased PCNA mRNA, decreased cdk4, and increased p27 relative to control. CE's pro-apoptotic effects correlated with an increased caspase-3 activity. Further pro-apoptotic effects of CE on HTB-72 cells are still being investigated.

Conclusions: Celery seed extract (CE) inhibits HTB-72 melanoma cells by inhibiting proliferation and promoting apoptosis. Such a study might be helpful to develop a new promising treatment for melanoma.

♦ 38 G ♦

Raspberry exhibits a robust anti-tumor effect on cervical cancer

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Background: Cervical cancer (CC) is one of the leading causes of death in women worldwide. Raspberry is a widely consumed fruit, and its anti-tumor activity has been shown in various cancers. Little is known about the direct effects of raspberry on CC. We have previously shown that raspberry inhibits the growth of HeLa CC cells. This study was designed to investigate raspberry's direct role in the growth of another widely-studied CC cell line, SiHa, and its potential mechanisms.

Methods: Clonogenic survival assay, proliferation kit, and caspase-3 activity kit were used to evaluate the effects of raspberry extract (RE) on cell survival, proliferation, and apoptosis of a widely-used CC cell line, SiHa. We further investigated the possible molecular mechanisms by using RT-PCR.

Results: The percentage of SiHa CC cell colonies decreased in the presence of RE. The decreased OD value in the presence of RE supported this. The relative caspase-3 activity in SiHa CC cells increased in the presence of RE. The anti-proliferative effect of RE on SiHa CC cells correlated with an increased expression of anti-proliferative molecule p16 and decreased expression of pro-proliferative molecules cyclin B and cyclin D. The pro-apoptotic effect of RE on SiHa CC cells correlated with an increased expression of pro-apoptotic molecule TRAILR1 and decreased expression of anti-apoptotic molecule FLIP.

Conclusions: Raspberry notably constrains SiHa CC cells' growth through inhibition of proliferation and promotion of apoptosis. This study extends our previous study and indicates that the anti-tumor effect of raspberry on CC is not cell line specific. Such a study might help improve treatment for CC.

♦ 39 G ♦

Grapefruit: A possible magic fruit to enhance immunotherapy for pancreatic cancer

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Background: Pancreatic cancer (PC) is the most lethal digestive cancer and the fourth leading cause of cancer death in the US. Treatments for advanced PC is limited and immunotherapy may be a promising option. PD1, PDL1, and PDL2 are the three key molecules in the PD1/PDL1 (PDL2) pathway, which downregulate immune response and play an important role in the development and invasion of PC. Pembrolizumab, targeting the PD1/PDL1 (PDL2) pathway, has been approved for the treatment of PC. ICOS and ICOSL are two major molecules in the ICOS/ICOSL pathway, and they also play a critical role in the development and invasion of PC. Grapefruit is a subtropical fruit widely consumed in the US. Its anti-tumor effects have been shown in colon cancer and breast cancer, however, nothing is known about its effects on the expression of the important molecules in PD1/PDL1 (PDL2) or ICOS/ICOSL pathways in PC. This study was designed to investigate the effect of grapefruit on the expression of PD1/PDL1, PDL2, and ICOS/ICOSL in PC.

Methods: In a widely used PC cell line, MiaPaCa-2, RT-PCR was used to evaluate the mRNA expression of PD1, PDL1, PDL2, and ICOS/ICOSL in the presence and absence of grapefruit extract (GE).

Results: PD1 and ICOS were not detectable in PC cells, whereas PDL1, PDL2, and ICOSL were constitutively expressed in PC cells. The mRNA expression levels of PDL1 and ICOSL were comparable in the presence or absence of GE. However, in the presence of GE the expression level of PDL2 was much higher than in the absence of GE.

Conclusions: PDL1, PDL2, and ICOSL, but not PD1 or ICOS were constitutively expressed in PC cells. Grapefruit has little effect on the expression of PDL1 or ICOSL, but significantly upregulates the expression of PDL2. This suggests the differential effect on the expression of these molecules in PC. Further studies might provide some new strategies to enhance immunotherapy for PC.

♦ 40 G ♦

Strawberry may boost cancer immunity for pancreatic cancer by upregulation of TAP2

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Background: Pancreatic cancer (PC) is very aggressive with few symptoms until the cancer is advanced. It is regarded as the most lethal digestive cancer and its incidence has been increasing in recent years. PC cells need to evade immunity for their development and invasion. Besides secretion of immune-inhibitory cytokines and induction of apoptosis of T cells, downregulation of HLA or HLA-associated molecules is another tactic for PC cells to evade immunity. TAP1, TAP2 and CD74 are HLA-associated molecules that play critical roles in cancer immunity. It has been shown that downregulation of TAP1 is associated with poor prognosis in colon cancer, and upregulation of CD74 is associated with good prognosis in pleural mesothelioma. Strawberry is a popular fruit widely consumed in the US. Its anti-tumor effects have been shown in cancers such as lung cancer and breast cancer. However, nothing is known about its effects on expression of TAP1, TAP2 and CD74 in PC. This study was designed to investigate the effect of strawberry on the expression of TAP1, TAP2 and CD74 in PC.

Methods: RT-PCR was used to evaluate the mRNA expression of TAP1, TAP2 and CD74 in a widely used PC cell line, MiaPaCa-2, in the presence and absence of strawberry extract (SE).

Results: TAP1, TAP2 and CD74 were constitutively expressed in PC cells. The mRNA expression levels of TAP1 and CD74 were comparable in the presence or absence of SE. However, the mRNA expression level of TAP2 was much higher in the presence of SE when compared to that in the absence of SE.

Conclusions: TAP1, TAP2 and CD74 were constitutively expressed in PC cells. Strawberry showed differential effects on the expression of these three molecules. Strawberry had little effect on the expression of TAP1 or CD74, but significantly increased the expression of TAP2. This suggests that strawberry may boost cancer immunity for PC by upregulation of TAP2. Further study might provide some new strategy to enhance cancer immunity for PC.

♦ 41 G ♦

Effect of a tropical fruit, mangosteen, on expression of PD1, PDL1 and PDL2 in melanoma

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Background: Melanoma is the most lethal skin malignancy. Its incidence is rapidly increasing in recent years and it has been known to have immunologically provocative features. Cytokine-based immunotherapy is approved but the results are modest at best. PD1, PDL1 and PDL2 are key molecules in the PD1/PDL1 (PDL2) pathway, which downregulates immune response and contributes to the development and invasion of melanoma. PD1/PDL1 (PDL2) inhibitors are approved to treat melanoma. Mangosteen is popular tropical fruit. Its anti-tumor effects have been shown in colon cancer, breast cancer and leukemia, however, nothing is known about its effects of expression of PD1, PDL1 and PDL2 in melanoma.This study was designed to investigate the effect of mangosteen on the expression of PD1, PDL1 and PDL2 in melanoma.

Methods: RT-PCR was used to evaluate the mRNA expression of PD1, PDL1 and PDL2 in melanoma cell line, HTB-72, in the presence and absence of mangosteen extract (ME).

Results: We found PD1, PDL1 and PDL2 to be constitutively expressed in HTB-72 melanoma cancer cells. The mRNA expression levels of PDL1 and PDL2 were similar in the presence and absence of ME. However, the expression level of PD1 was much lower in the presence of ME.

Conclusions: Mangosteen has little effect on the mRNA expression of PDL1 and PDL2, but significantly downregulates the mRNA expression of PD1 in melanoma. This indicates that mangosteen exhibits a differential effect on expression of PD1, PDL1 and PDL2. Further study might provide some new information on immunotherapy in melanoma.

♦ 42 ♦

Influence of boric acid on yeast ethanol and fatty acid production – the pyruvate decarboxylase bypass

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Boric acid (BA) is a time-tested antiseptic with proven effectiveness in the treatment of a broad spectrum of superficial microbial infections. BA inhibits NAD/NADH-dependent reactions and impairs mitochondrial energy production. BA-treated yeasts show a reduction of mitochondrial respiratory activity and an increase in ethanol production by ethanolic fermentation, presumably to compensate for the loss of mitochondrial energy production. An analysis of cell composition showed that in addition to inducing the shift to fermentative metabolism, BA also effects a redistribution of energy stores away from carbohydrate (glycogen) towards increased lipid storage. Lipid and ethanol production are both dependent on pyruvate decarboxylase (PDC) activity, which produces acetaldehyde in the cytoplasm in direct competition with mitochondrial oxidation of pyruvate. Our data show an increase in PDC-gene expression during BA stress, which suggests that BA-treated cells actively shunt pyruvate away from the mitochondria into ethanol and fatty acid synthesis. BA could thus have a potential application for industrial processes that aim to increase the production of ethanol and fatty acid through yeast metabolism of carbohydrates.

♦ 44 HS ♦

Testing the reliability of expired commercial aspirin (acetylsalicylic acid) using UV-VIS spectrophotometry

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Aspirin is a very common over the counter pain reliever. 7 different brands were tested, 5 of those being 325 mg label claims and two low dose brands. All of the tablets tested were expired, so our hypothesis was that the content would be lower than the label claim. In order to obtain a representative average, three tablets of each brand and three absorbance measurements of each tablet were averaged from the spectrophotometer. One Molar NaOH was added to the tablets and

heated up in order to saponify the acetylsalicylic acid to salicylic acid. 0.02M FeCl3 in 0.1M HCl was used to complex with the salicylic acid to create a purple color. A Thermo Scientific Multiskan GO spectrophotometer with the wavelength set to 530 nm was used to measure the absorbances in a 96 well plate. Our standard curve was made from pure ASA that was also saponified and was linear with a R2 value of 0.9999. Once testing was completed and the data was analyzed, the hypothesis ended up being true, as only one of the seven brands tested was at or above the label claim. One of the tablets was an edible dog aspirin that contained flavorings that could have possibly interfered at 530 nm. Six of the seven % label claims were between 83 and 93 percent. There was not much of a correlation between expiration date and % label claim which could have been because of the way the tablets were packaged.

♦ 45 G ♦

IL-32: An immunotherapeutic foe to ovarian cancer

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Diagnosing sickle cell disease poses a challenge to low income countries where poverty reduces clinic revenues making the use of modern diagnostic methods impractical. We developed an inexpensive, microscopic method to distinguish the homozygous genotype (SS) seen in sickle cell disease (SCD) patients from the heterozygous genotype (AS) seen in sickle cell trait (SCT) by modifying an established sodium metabisulfite method. We hypothesized that the two zygosities can be differentiated by observing the number and intensity of sickling cells over time. Solutions of 2% sodium metabisulfite were prepared and 10 µL was mixed with 10 uL of patient blood. Sickle cells were counted using 100x oil immersion brightfield microscopy in 30 minute intervals for three hours and categorized into stages of formation using a 0-4+ Likert Scale. RBCs of sickle cells samples had an average of 135, 4+ sickle cells compared to 12, 4+ sickle cells in the sickle cell trait samples at three hours. Based on these results, this inexpensive method can possibly be used to diagnose SCD and SCT, benefiting countries where there are limited resources.

♦ 46 G ♦

Profile of biliary bacterial contamination and associated microbiological outcome among patients with instrumented biliary system undergoing pancreaticoduodenectomy or hepaticojejunostomy

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Our main objective was to analyze microbial cultures and the proportion of multidrug resistant (MDR) bacteria in patients who underwent biliary instrumentation for drainage prior to procedures on the common bile duct, mainly pancreaticoduodenectomy. Furthermore, we analyzed the relationship between intraoperative culture isolates to postoperative frequency of clinically indicated cultures (a measure of clinical suspicion for infection) and the culture-positive surgical site infection rate.

♦ 47 G ♦

Enlarging neck mass in a healthy 24-year-old male

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In this case report, we discuss the multidisciplinary workup of a carotid body paraganglioma found in an otherwise healthy 24-year-old male. Paragangliomas are rare, vascular neuroendocrine tumors that arise from extraadrenal sympathetic or parasympathetic paraganglia. While classically associated with symptoms of catecholamine excess, head and neck paragangliomas can be more difficult to diagnose due to their indolent and asymptomatic presentation. Imaging and metanephrine levels are an essential part of diagnosing these tumors and determining a treatment plan. Additionally, germline mutations in the succinate dehydrogenase complex have been found in 40% of these patients. As such, a thorough history should be obtained for patients found to have a head and neck paraganglioma. All patients with these tumors should be sent for genetic evaluation of potential hereditary predispositions.

♦ 48 G ♦

Ultrasound-guided great saphenous vein access: A pilot study

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Early recognition of difficult IV access and utilization of ultrasound-guided techniques prior to multiple unsuccessful attempts improves patient care in the Emergency Department (ED). Several factors impact ultrasound-guided peripheral IV (PIV) cannulation, including depth and size of target vessel. For these reasons, the great saphenous vein (GSV) in the medial distal thigh may provide an alternative site for cannulation. Our objective was to determine the feasibility and safety of ultrasound-guided GSV PIV placement as an alternative site in patients with difficult IV access.

A prospective convenience sample presenting to the ED at Saint Marys Hospital, Rochester, MN between 24June and 28July 2019. Inclusion criteria included age 18 years and older, history of difficult IV access, or two unsuccessful attempts. Ultrasound-guided access was conducted with both in- and out-of-plane approach. The study was reviewed and approved by the Mayo Clinic IRB for twenty patients.

GSV cannulation was successful in 14/19 (73.7%) patients. One patient dropped out after initial consent. Phlebotomy, blood transfusion, IV medications including norepinephrine, and IV contrast for CT imaging were successfully performed. Dwell time length was as long as eleven days. No reported infection, thrombosis, or extravasation was identified throughout the entirety of the cannulation dwell time, hospitalization, or within 72 hours after discharge.

Ultrasound-guided GSV PIV placement is a feasible alternative to upper arm cannulation. Refinements in early technique improved success rates during the study. No unforeseen complications or safety issues were identified. Blood, medications, and IV contrast were successfully and safely administered through the GSV.

♦ 49 G ♦

Primary mucinous carcinoma of the nasal bridge

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Mucinous carcinoma is an extremely rare appendage tumor that is highly recurrent and resistant to chemotherapy and radiotherapy. It has an unremarkable appearance and must be distinguished as a primary tumor or as a metastasis from distant sites. Detailed imaging studies and immunohistochemical investigation are often essential. There is no standard of care established for primary cutaneous mucinous carcinoma.

Here, we report a case of surgery-refractory PCMC on the left nasal bridge in a 62-year-old female that ultimately required removal by Mohs surgery. We will also report the histological findings and highlight key information for determination of primary or metastatic mucinous carcinoma and management of PCMC.

♦ 51 G ♦

Consideration of radiofrequency ablation of Morton's neuroma, prior to surgical intervention: A literature review

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Radiofrequency ablation (RFA) of Morton's neuroma has been shown to be an effective alternative to surgery and rivals other commonly utilized conservative treatment options for this pathology. The aim of this study was to examine the existing literature regarding RFA of neuromas in the feet (most commonly Morton's neuromas in the 3rd intermetatarsal space). A multi-database search including PubMed, Google Scholar, and reference lists of included studies was performed. We excluded any articles that solely focused on radiofrequency ablation, without the mention of pedal neuromas and vice versa. Overall, our study examined the outcomes of eight journal articles pertaining to RFA of 267 pedal neuromas in 240 patients.

The following factors were examined across all the selected articles: RF type, setting of procedure, number of patients and neuromas, average age of patients, average number of RFA stimulations, average follow-up time, imaging guidance, pre- or post-procedure injections (steroid or alcohol sclerosing), overall satisfaction, and need for future neurectomy.

This literature review demonstrates the high overall satisfaction rates of patients who receive RFA (60-90%) and the relatively low number of patients who end up requiring surgical intervention afterward (3-30%). It should be considered as a viable treatment option for Morton's neuromas that fail to respond to non-invasive conservative treatment.

♦ 52 G ♦

Cost effectiveness of physical therapy in addition to podiatry management of plantar heel pain

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Background: Plantar heel pain (PHP), or plantar fasciitis, is a prevalent ailment affecting the foot. Individuals with PHP incur approximately 800,000-1 million visits to physicians annually at an estimated cost of $192-$376 million. After initial conservative treatments 18-50% of individuals continue to have symptoms and 30% have recurrent symptoms which increase the economic burden of PHP. Many patients seek care from podiatrists and physical therapists for treatment of PHP, but there is limited evidence of the cost effectiveness of collaborative care provided by these professionals. The purpose of this study was to compare the cost effectiveness of usual podiatric care (uPOD) and uPOD plus physical therapy treatment (uPOD+PT).

Methods: Seventy-one patients seeking care from a podiatrist were randomized to receive uPOD or uPOD+PT. Treatment was provided in accordance with usual physical therapy and/or podiatry practice patterns. All costs related to treatment were tracked for 1 year and the European Quality of Life-Five Dimensions (EQ-5D) questionnaire was used to assess change in quality of life and calculate the quality-adjusted life year (QALY). Differences in total societal costs of treatment over 1 year and cost per QALY were compared between groups ($p<0.05$).

Results: uPOD+PT resulted in greater changes in EQ-5D at 1-year (uPOD 0.097, uPOD+PT 0.176; 0-1, where 0=death and 1=perfect health), but total societal cost and cost/QALY were similar between groups (P=0.848 and 0.839, respectively).

Conclusions: In this study, uPOD and uPOD+PT improved quality of life at a relatively low cost. Both uPOD and uPOD+PT are cost-effective treatments for PHP.

♦ 53 G ♦

Association of SSRI use with fall risk factors in community-dwelling older adults

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Introduction: Falls occur in 1/3 of community dwelling older adults. A fall risk factor often studied is medications, such as Selective Serotonin Reuptake Inhibitors (SSRIs), with side effects including postural hypotension, hyponatremia, weight gain, dizziness, lethargy, sleep disturbance, impaired gait/balance, impaired attention, blurred vision and sedation. The purpose of this exploratory study was to explore potential associations between SSRI's and patient characteristics as predictors for fall risk, while reviewing which potential risk factors are documented by physical therapists.

Methods: This was a retrospective study of patients who attended physical therapy at the DMU clinic between April-October of 2019, were aged 65 or over, had a diagnosis of anxiety or depression, and reported taking an SSRI. The primary researcher used a data query and manual review of EMR data.

Results: There were 10 included participants in this study. Sertraline was the most commonly prescribed SSRI. Gait speed was documented in 1/10 patient records, subjective sleep in 4/10 records, balance measures in 4/10 records, cognition in 3/10 records and falls in 7/10 records.

Discussion/Conclusion: There was insufficient data to evaluate whether SSRI's contribute to fall risk, but there were falls reported within this study group. The small sample size suggests that health care providers may be aware that SSRIs are on the Beer's Criteria Medication List for older adults as a potential inappropriate medication. This project suggests that gait speed, sleep, balance, and cognition were inconsistently documented for patients who may be at risk of falls.

♦ 54 G ♦

Ultrasound use for measurement of muscle volume to estimate plantar intrinsic foot muscle strength

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The plantar intrinsic foot muscles (PIFMs) play a vital role in weight bearing activities and maintaining the longitudinal arch of the foot. However, due to limitations with accurate strength measures, these muscles are often overlooked in the clinical setting when treating lower extremity injuries. The study aimed to identify a method to estimate individual PIFM strength using ultrasound (US) imaging. The 3D physiological volume of the Flexor Digitorum Brevis (FDB) for 23 subjects was measured using a series of cross-sectional US images between the proximal and distal aponeurosis. The images were digitized, allowing for the reconstruction of the FDB physiological volume. Multiple linear regression model was used to predict the FDB muscle volume based on subject size and strength characteristics as independent variables. Our data showed a significant regression equation, with an R^2 of .664. Subject's predicted FDB volume is equal to a constant + 1530.3 (Foot Length) + 188.7 (Lesser Toe Strength). Foot length was measured in centimeters and lesser toe strength measured by a force plate with the subject seated and the ankle in 20 degrees plantarflexed position. Both foot length ($p = .000$) and strength of the lesser toes ($p=.002$) were significant predictors of the physiological 3D volume of the FDB. Our findings show that both the size of the individual, as expected, and his/her specific strength are reflected in the physiological 3D volume of the muscle. The physiological 3D volume measurement of PIFMs can be promising in the management of foot pathologies such as plantar fasciitis.

♦ 55 G ♦

Interdisciplinary approach to pediatric rib fractures in non-accidental trauma

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Posterior pediatric rib fractures are highly suggestive of abuse in children ages 0-3 years old. While suggestive in cases of suspected abuse, these types of fractures are typically challenging to identify on radiographic imaging. Review of the current literature on pediatric fractures of abuse and interviews of experienced experts yielded themes regarding the characteristics, mechanics, radiological analysis, and medicolegal aspects of pediatric rib fractures of abuse. Current radiological best practices include the skeletal survey and two-week follow-up imaging to detect signs of callus formation. MRI advancements and more systematic reporting with an electronic tool provide options for increasing the rate and reliability in radiological analysis of cases of pediatric abuse, but at this intersection of medicine, law, and physics, challenges still remain. An emphasis placed on improving the current methods and tools could increase efficiency in follow-up and allow for more successful intervention in these interdisciplinary cases.

♦ 56 G ♦

Investigation of study strategies for COMAT subject exams by third year medical students

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Third year osteopathic medical students are often faced with overwhelming anecdotal advice and little objective data on how to prepare for the Comprehensive Osteopathic Medical Achievement Test (COMAT). This study investigated COMAT clinical subject exam preparation habits and correlation with actual scores. In addition, we are exploring the effect online rotations, due to the SARS-COV2 pandemic, has had on COMAT scores. Third year medical students at Des Moines University who have taken up to three COMAT exams were administered an anonymous, self-reporting survey. These students were surveyed on COMAT exams taken, scores received, preparation time, resources utilized, and changes made from the first COMAT to the second.

♦ 57 ♦

Changing the tests, keeping the questions: Influence of exam scheduling on student performance

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Exam scheduling has a major influence on student performance, knowledge retention and well-being. DMU-COM progressed from testing one course at a time to block testing, first by administering selected first-year course exams back-to-back (2019; B2B) before proceeding to block testing material of all parallel courses (2020; NGBC). It was hypothesized that block testing would result in a more predictable schedule with more frequent lower-stakes testing, improving knowledge retention, decreasing stress and increasing student satisfaction. To assess the impact of exam scheduling on student performance, Biochemistry (BC) and Medical Cell and Tissue Biology (MCTB) exam item statistics and course grade distributions were tracked through the exam schedule transition. These courses were chosen because they shared exam days during B2B. The data showed that in the first phase of the transition (B2B), BC exam grades were largely similar to previous years, regardless of testing schedule. In MCTB, scores dropped after the transition to B2B, possibly due to course policies that permitted students to retest after failed exams, which lowered the stakes and allowed students to focus their efforts on BC exams instead. Student comments on B2B scheduling were overwhelmingly negative, even though the benefits of true integrated block testing were recognized. After harmonization of course policies and the implementation of NGBC block testing, exam item statistics returned to or exceeded their pre-2018 long-time averages. However, the COVID pandemic might have significantly confounded these data, as factors such as unproctored exams, remote lectures and social isolation clearly influence student well-being and study focus.

♦ 58 ♦

Reducing redundancy and excessive detail: Short video podcasts for basic science review

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The clinical systems courses of the second year DO/DPM curricula rely on a review of Basic Science topics for content integration across disciplines. A review of student comments and lecture recordings has shown that the practice of scheduling stand-alone Basic Science lectures within clinical systems courses often creates redundancy and excessive detail. We hypothesized that a review of relevant Basic Science topics can be accomplished more effectively with short, interactive Video PodCasts. To test the hypothesis, we produced two narrated, animated powerpoint presentations as lecture substitutes in the DPM/Clinical Systems 2 course. These 10-15-minute presentations were built around the same learning objectives as the lectures and featured annotated quizzes - but did not discuss irrelevant details or clinical correlations presented elsewhere in the course. Students were given the choice to study using the lecture, the PodCast or both modalities. Usage of recordings was tracked anonymously, and students were invited to comment on the PodCasts' effectiveness after the exam (Approval #IRB-2020-25). The data showed that students utilized the podcast as frequently as the lectures, often in combination. 92% of survey respondents rated the PodCasts as very useful/somewhat useful. Free text comments on the PodCasts' effectiveness were overwhelmingly positive, but it was repeatedly remarked that students preferred having a choice and would rather not be forced to limit their studies to the PodCasts alone.

♦ 59 G ♦

Mental health education in medical students: An initial comparison of NAMI 2020 and NAMI 2019

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DMU partners with NAMI to provide all third-year medical students with a two-day, contact-based learning session aimed at fighting provider stigma against mental illness (MI) by exposing students to instructors' personal experiences with MI. The curriculum was updated specifically for May 2020 delivery. Then, due to COVID-19, delivery was over Zoom and nearly 40% of students received an online psychiatry rotation instead of an in-person experience before attending.

Given these changes, the initial effect of the 2020 NAMI program was compared to 2019 using a subset of surveys measuring students' affect, beliefs, and behaviors towards MI administered before the intervention and one-week post-intervention. To look for significant differences between years, two-tailed independent samples T-tests were used to compare surveys': 1) baseline pre-intervention values, and 2) pre-post, one-week change values.

One baseline difference was found, showing students had lower confidence integrating psychiatry in routine care entering NAMI 2020 (ACIP, F=0.44, p=0.04). For pre-post, one-week change scores, there was a larger decrease in stereotyping attitudes in 2020 (Characteristic Scale, F=3.05, p=0.04). There were no other significant baseline or pre-post differences in other measures of affect, beliefs, and behaviors towards MI between the years.

Secondary analyses compared students' subjective experiences with the sessions. Results indicated higher ratings of overall session quality (F=12.04, p=0.00) and depth (F=37.25, p=0.00) in 2020, but no difference in session smoothness (F=5.79, p=0.49) or group climate (F=0.029, p=0.72). Overall, there were minimal differences in initial outcomes for NAMI 2020 versus 2019, despite key changes, but some significant differences regarding students' experiences.

♦ 60 ♦

Contact-based NAMI program promotes sustained changes in medical students' perspectives on mental illness

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All third-year medical students (N=211; DO-2020) attended the NAMI Provider Education Program (PEP) in May 2019, with 186 enrolling in the research study (response rate=88%). Surveys at pre-program, one-week follow-up, and 6-month follow-up assessed affect, beliefs, and behavior in working with patients with mental illness (MI). Linear mixed-effect models for repeated measures were used, with AIC criteria for model selection.

Results demonstrated effectiveness in target domains of improved affect, beliefs, and behavior in working with patients with MI, with heightened impact over time. Six months after the program, students were less anxious about interacting with patients with MI (-0.44, $p < 0.0001$), had less stigma and stereotyping negative attitudes about MI (-0.09, $p = 0.0403$; -0.32, $p = 0.0001$), reported more confidence integrating psychiatric practice into routine medical care (+0.54, $p < 0.00001$), and demonstrated increased competence in principles of collaborative mental health treatment (+0.1, $p = 0.0116$). Students with a history of mental health help-seeking, specialty interest in psychiatry, and personality traits higher in agreeableness, extraversion, and openness to new experiences achieved even greater benefit on select outcomes.

The NAMI PEP was associated with sustained 6-month improvements in factors important for competent care of patients with MI. The program was effective during this initial integration as a curricular requirement for an entire cohort, extending its external validity and generalizability under realistic medical education conditions. The program has potential to promote lasting changes in management of psychiatric illness and is a promising practice for replication at other academic medical institutions.

♦ 61 G ♦

MercyOne pharmacy staff perceptions of student CQI projects

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Advanced practice pharmacy experience (APPE) students completing rotations at MercyOne West Des Moines have performed continuous quality improvement (CQI) projects since 2018 in order to evaluate the safety and appropriateness of medication use within the institution. The purpose of this study was to assess the engagement level of pharmacy staff with student CQI projects to determine whether CQI projects are useful and worth continuing in the future.

The primary outcome of the study is to quantify the connection of pharmacy staff to student CQI projects. Secondary outcomes include quantifying staff engagement prior to CQI implementation and the perceived value added after implementation. A Qualtrics survey was sent to all (n=25) staff members eligible for participation. Microsoft Excel was used for data entry and descriptive statistic calculations. Institutional IRB approval was obtained.

A total of 8 complete responses were received and utilized in the study analysis (response rate of 32%). All participants felt more connected to CQI posters and believed that CQI projects are valuable for the department and should continue. More participants attended presentations before CQI implementation (n=8) compared to after (n=7), though the difference was small. Over half (62.5%) of participants recognized departmental changes occurring due to CQI projects.

The CQI projects have been positively received as providing educational value resulting in departmental protocol changes. Pharmacy staff reported a greater number of opportunities for engagement with CQI posters aside from attending a presentation, eliminating many of the barriers to engagement previously cited, which included shift scheduling and overlapping responsibilities.

♦ 62 G ♦

The use of synthetic ankle models in athletic training education prepares students for patient scenarios: A pilot study

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Athletic training education requires students to clinically assess and diagnose musculoskeletal injuries, including ankle sprains. Recently, athletic training education has incorporated patient simulation manikins into learning, such as synthetic ankle models. However, to date, no reliability, validity or student experiences have been studied. Therefore, the purpose of this pilot study is to determine if a synthetic ankle model would improve students' confidence in performing clinical diagnostic tests.

Thirteen (13) pre-athletic training (Pre-AT) students participated in this cross-sectional pilot study. Pre-AT students were taught ankle clinical diagnostic tests for assessing Grades 1-3 ankle sprains. Data collection included a pre-lab questionnaire assessing current confidence in clinical diagnostic tests. Pre-AT students performed clinical diagnostic tests over two trials (five tests per trial) using the ankle simulation model. A post-lab questionnaire was performed after all trials. Data analysis include paired sample t-test ($p<0.05$), descriptive statistics (frequencies and percentages).

Results demonstrated the majority of Pre-AT students agreed (n=6, 46.2) or strongly agreed (n=7, 53.8%), they felt more prepared to assess a lateral ankle sprain, agreed (n=6, 46.2%) or strongly agreed (n=3, 23.1%) that they felt the ankle model replicated a real patient experience, and were moderately (n=7, 58.3%) to extremely (n=4, 33.3%) confident in performing clinical tests following the lab.

Pre-AT students demonstrated increased confidence in accurately performing clinical tests, felt more prepared and felt the synthetic ankle model replicated a real patient experience. Athletic training education should continue to advance teaching techniques to replicate patient scenarios.

♦ 63 G ♦

Boom goes the gas leak: Mass casualty simulation and its efficacy in medical education

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Background: In 2003 the American Association of Medical Colleges recommended incorporation of disaster medicine training into medical students curriculum. However, disaster medicine training is still not widely adopted, despite high interest from students and faculty.

Methods: On February 14th, 2020, students of the DO, PA and DPM programs at Des Moines University participated in a simulated mass casualty drill. 42 individuals: 20 DO 2nd year students, 12 PA 1st year students, and 2 DPM 2nd year students participated as providers. 64 individuals: 55 DO/DPM 1st year students and 9 simulation center actors, participated as simulated patients (SP) 9 faculty members participated as facilitators. Teams of two to three students worked a triage station for simulated patients (SP) injured in a nearby gas explosion mass casualty. Teams performed an initial exam and assessment on each SP, and management plan was discussed with faculty. A post drill survey was conducted to assess participants perceived effectiveness of the activity.

Results: 34 (81%) student providers, 34 (53%) trained actors, and 8 (89%) attendings completed the survey. Survey results show overall satisfaction (4.7/5) with the educational activity. Student providers found the drill helped integrate class knowledge and improve their clinical skills. Trained actors found educational value as performers and would recommend the drill to others. The trend was followed by the faculty, who agreed the drill had educational merit and improved the skills of those involved.

Conclusions: A mass casualty simulation activity is an effective teaching tool to promote disaster response skills in medical students.

♦ 64 ♦

Attending the flipped classroom is not a flop when learning ECG interpretation skills

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Interpreting ECGs is a critical skill taught at various points in the medical curriculum. This skill is taught using a flipped classroom format to allow practice of interpretive skills with faculty guidance during a cardiovascular system course at Des Moines University (DMU). Comparatively, the other units of cardiology and vascular biology are delivered using a lecture-based format. The implementation of classroom capture and casting technologies has changed access to content. Students can now access live, streaming, and/or recorded formats of material. Broadening this accessibility has introduced flexibility for both the learner and instructor, as well as altered the necessity to be in attendance. There are many reports that investigate the changing classroom attendance climate and potential impact on student outcomes. At DMU, a variety of techniques have been employed to encourage student attendance and track the impact attendance has on student performance. We hypothesized that student attendance has a favorable impact on ECG interpretation skills-based training as compared to knowledge-based instruction. The results demonstrate that both incentivized attendees and self-selected attendees outperform their classmates in their ability to interpret ECGs and related content. Also, there is a significant correlation between attendance and performance in this setting. However, the attending student does not appear to have a performance advantage when content is delivered by lecture. This evidence can help students prioritize their time when deciding about whether to attend class. Further, the information can guide curricular change to help programs identify curricular activities that have a clear attendance benefit.

♦ 65 ♦

Comparison of student's self-ratings to their observed team skills during an interprofessional pediatric case

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Teamwork is an essential part of effective patient care. A component of effective teamwork is understanding your own roles and responsibilities, as well as other professionals' roles and responsibilities. Ineffective teamwork can lead to safety concerns and decreased patient outcomes. Students perceptions of their own skills and teamwork have been shown to guide their engagement in activities and learning.

A previously developed assessment tool for self-perception of teamwork was developed and piloted. From the data gathered, the tool was expanded to include an observable component. Thus, this study will provide valuable data to the interprofessional community regarding the comparison of how the students perceive their teamwork skills to what is observed.

160 students participate in a simulated interprofessional case. The following professions participated: Doctor of Osteopathy, Occupation Therapy, Physical Therapy, Nursing, Physician Assistant and Pharmacy. Students first met with peers of their own discipline to develop plan of action for the case. Then students split into predefined groups to simulate a discharge team meeting, with each profession being represented. Each team was recorded during their team meeting encounter to gather the observational data.

Preliminary data revealed a significant difference in rating of developing a plan to achieve optimal health outcomes $p < .001$, with Pharmacy students rating themselves the lowest and nursing students rating themselves the highest in this area. Observational data will be completed with full analysis by the conference.

Conclusion: This study will provide insight into the differences that may be seen with scoring of team performance between professions.

♦ 66 ♦

Does learning style effect physical therapy student performance in the changing education environment due to the COVID-19 pandemic?

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With the COVID 19 pandemic, Doctor of Physical Therapy (DPT) programs offering traditional face to face learning (F2F) transformed their educational delivery methods to online (ON). While online delivery methods have shown to be effective, student learning style may impact achievement under ON or F2F delivery. This pilot study examined whether academic achievement, pre-pandemic (F2F) and during the pandemic (ON) differed by learning style preference in two DPT cohorts.

Based on scores from an 11 question Learning Style Inventory, eighty-two DPT students were assigned to one of four learning styles: Assimilative, Divergent, Convergent, or Accommodative. F2F and ON achievement was determined by exam and assignment averaged scores for foundational science content. Paired samples t-tests were used to compare differences between F2F and ON achievement for students in the four learning styles.

The Accommodative learning style was most representative in our DPT cohort (59%) followed by Convergent (23%), Assimilative (11%), and Divergent (7%). The Accommodative and Convergent students demonstrated improved achievement from F2F to ON learning for both exam scores, ($p= 0.034$ and $p\leq0.001$, respectively) and assignment scores, ($p\leq0.001$)), while the Assimilative and Divergent students did not ($p=0.122$-0.341).

Students with Accommodative and Convergent learning styles exhibited improved achievement from the change of F2F to ON delivery of the foundational science content. Consistent with the defined characteristics of Accommodative and Convergent learners, these students may have adapted better to the changing situation. Knowledge of student learning styles may be important when considering future changes in program delivery and design.

♦ 67 ♦

Implementation of the Inventory for Assessing the Process of Cultural Competence among Healthcare Professionals – Student Version (IAPCC-SV) in Des Moines University's Doctor of Physical Therapy Program: Pre-test findings

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Introduction: The IAPCC-SV was selected to measure students' cultural competence at multiple points throughout the Doctor of Physical Therapy (DPT) curriculum. The IAPCC-SV is a 20-item cultural competence assessment tool with established content validity and Cronbach's alpha reliability of 0.783. The purpose of this study is to pilot the use of the IAPCC-SV to assess the cultural competence of two cohorts of DPT students.

Methods: Pre-test data were collected via paper/pencil surveys prior to initiating cultural diversity content within the DPT curriculum. Mean and standard deviations were calculated for the pre-test data from the first cohort. Subsequent data will be analyzed using a two factor, repeated measures ANOVA. One factor will be cohort and the second factor will be the testing event (pre-test, post-test 1, post-test 2).

Results: The IAPCC-SV scale ranges from lowest to highest level: culturally incompetent, culturally aware, culturally competent and culturally proficient. The mean score was 58.8 +/-5.01. Of the 52 students who completed pre-testing, 26 students scored culturally aware and 25 culturally competent. The IAPCC-SV is divided into constructs: Cultural Awareness (CA), Cultural Knowledge (CK), Cultural Skill (CS), Cultural Encounters (CE), and Cultural Desire (CD). CK and CE each represent 25% of the overall cultural competence level, CD 20%, and CA and CS 15%. The construct differences between students scoring culturally competent and culturally aware were CE 12.02%, CD11.86%, CK 9.96%, CA 8.65%, and CS 8.15%.

Conclusion: CE and CD contributed most to differences in pre-test cultural competence levels.

♦ 68 G ♦

Load, orientation and plane of arm elevation effect on shoulder muscle synergies in healthy male subjects

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Normal structure and function of the shoulder is important for many daily living tasks. The complexity of movement in the shoulder can be represented by muscle synergies as they characterize the organization of muscles into functional groups by the central nervous system, with the goal of minimizing redundancy. It has been demonstrated that pathology disrupts conventional muscle synergies and contributes to disease states, thus, muscle synergies provide a framework for rehabilitation. In this study, we aim to identify how load, arm orientation, and plane of arm elevation impact muscle synergies around the shoulder joint.

Twenty right-handed male adults performed an arm elevation/lowering task on 3 planes (frontal, scapular, and sagittal), with the thumb up/down (full can vs. empty can), as well as with load (1, 3, and 5 pounds). To identify the muscle synergies, we used surface electromyography (sEMG) to measure the activity of ten muscles of the shoulder region. We plan to use non-negative matrix factorization (NNMF) techniques to identify the synergies involved.

A descriptive analysis of our findings is showing distinct differences in coordinated muscle activation in each of the three planes. Distinct activation patterns also appeared in terms of muscle activation amplitude when comparing the thumb up (full can) to the thumb down (empty can) tasks. The muscle activation patterns do not appear to vary with load, however, the amplitude of activation does.

Our results show changes in coordinated muscle activity with plane and arm orientation, which can be used in optimization of rehabilitation protocols.

♦ 69 G ♦

Glenohumeral joint center localization, anatomical invasive/non-invasive and functional methods

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The shoulder joint is quite complex and challenging in movement analysis and modelling. One way in which shoulder models may differ is in the localization of the joint center itself. The position of the glenohumeral joint center (GHJC) relative to the scapula is directly linked to the scapulohumeral (SH) muscle moment arms and the kinetics and kinematics of the glenohumeral (GH) joint daily movement. Ten right-handed adult males (25.9 ±4.7 years) with no shoulder pathology participated in this project. We utilize five methods, two anatomical/invasive (CT–computerized tomography) locating the center of the humeral head (CT-HHC) and the center of the glenoid fossa (CT-GLF), one anatomical/non-invasive (US-ultrasound imaging), locating the humeral head center (US-HHC), one functional locating the glenohumeral movement center using a least squares method (FNC-GHJC), and one anatomical/cadaver-based model that is regression based (REG-MSK). The centers derived by the above methods were localized relative to the acromial angle (AA) in the scapular reference frame, in millimeters and as percentages of the trigonum spinae to acromial angle distance. There were no significant differences of the center location lateral to AA between the 5 methods, however there were significant differences in the inferior and anterior directions. The REG-MSK method localized the GHJC most anterior, the FNC-GHJC most inferior, and the CT-GLF most lateral. Interestingly the anatomical/non-invasive US-HHC method localized the GHJC slightly medial to the AA and was only significantly different from the CT-GLF. Our findings support the utilization of US imaging to localize the HHC as a viable, cost-effective, non-invasive, subject-specific method.

♦ 70 G ♦

Do older adults need skill in addition to speed to function?

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The Figure-of-8 Walk Test (F8WT) requires curved path walking, direction changes, navigation and planning and assess walking skill.[1-3] We examined differences in physical and cognitive function between good vs. poor F8WT performance to understand walking skill in relation to function in older adults (OA) with normal straight path gait speed (GS).

Secondary analyses of community-dwelling OA (n=80) data included: GS and step length (SL), step time (ST), and stride width (SW) variables during straight path walking; F8WT time, steps; Late-Life Function & Disability Instrument (LLFDI) Overall, Basic Lower Extremity (BLE) and Advanced Lower Extremity (ALE) function scores, higher scores better; [4] Montreal Cognitive Assessment executive function subscale (MoCA-EF, n=21) max score 5, or Trails B time (n=59). Data with usual GS (≥1.1m/s) was classified into good motor skill (GMS, F8WT<8*sec,* n=42), and poor motor skill (PMS, F8WT≥8*sec*, n=38). ANOVAs determined group differences and Univariate analyses determined whether F8WT skill group predicted function controlling for age, GS and SL.

PMS compared to GMS were older with slower usual GS and shorter SL (p<.015); Univariate analyses revealed that compared to GMS, PMS had reduced LLFDI Overall (63.4±7.4 vs 70.7±8.3), BLE (74.3±10.3 vs 88.5±11.9) and ALE (56.3±10.7 vs 66.3±13.0) function, p<.019 for all, lower MoCA-EF scores (3.67±1.0 vs 4.53±0.74; p=.043) or slower Trails B times (108*s* ±42.8 vs 83.9*s*±26.4 p=.014).

In OA with usual GS, those with poorer walking skill exhibited reduced physical and executive cognitive function. Walking skill in F8WT appears critical to daily life function, even with normal GS.

♦ 71 G ♦

The effect of load and the empty can exercise on the shoulder 3D scapulohumeral rhythm

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Shoulder pain is a common musculoskeletal complaint seen in clinical practice. Shoulder movement coordination in symptomatic patients has traditionally been assessed using scapulohumeral rhythm (SHR). SHR is the ratio of glenohumeral (GH) to scapulothoracic (ST) joint contribution in humeral elevation. The current accepted ratio for the average SHR is 2:1 (GH:ST). Numerous programs for shoulder injury rehabilitation involve protocols that alter the conditions that the scapula is under, which may affect dynamic shoulder coordination and SHR. In this study, we aim to determine the influence of load and arm rotation on 3D-SHR in the frontal, sagittal, and scapular planes.

Twenty right-handed male adults performed seated arm elevation with the thumb up (full can) and thumb down (empty can), as well as with 1, 3, and 5-pound loads. The 3D-SHR was assessed as the slope of the linear regression fit lines at 5° arm elevation angles between 15° to 105°.

We observed three compelling findings. First, three different 3D-SHR patterns were elucidated for the three planes. Second, load did not appear to have a major effect on 3D-SHR pattern in any of the three planes. Third, during the empty can exercise, 3D-SHR was below the classic 2:1 ratio during the initial one-third of arm elevation in the scapular and sagittal planes, as well as the final one-third of arm elevation in the frontal plane.

The new 3D-SHR is an improvement in the assessment of scapular contribution to arm elevation, and it revealed coordination differences with arm rotation and plane of elevation.

♦ 72 G ♦

Sexual assault reporting amid the COVID-19 pandemic

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The novel coronavirus (COVID-19) has had a world-wide impact, and researchers have been working diligently to learn about the effects of the virus. Yet, the impact of the pandemic on sexual assault remains largely unstudied. The Mid-Iowa Sexual Assault Response Team (SART) provides forensic examinations to sexual assault survivors in central Iowa. This project retrieved data collected from the records maintained by the Mid-Iowa SART, with a focus on cases occurring in March through August of 2017-2020. This timeline represents the initial months COVID-19 began affecting Iowa, with corresponding data from previous years. The objectives of this project included evaluating the annual reported caseloads of sexual assault, the proportion of cases involving strangulation, and the proportion of cases involving weapon usage. Using R statistical programming, Chi-square goodness of fit tests were conducted to assess these objectives. The results showed a significant decrease in reported cases of sexual assault in 2020 compared to previous years. Among the reported cases, there was a significant increase in strangulation and weapon usage in 2020. This data indicates that the cases reported tended to be more physically violent than those in past years. These results highlight how COVID-19 has posed a potential threat to sexual assault survivors seeking care for forensic evaluation and recovery. It is vital that these services be prioritized amidst other healthcare demands of the pandemic.

♦ 73 G ♦

Investigating the relationships between known risk factors and drug-related mortality in rural Iowa

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Background: With the increase in prescription opioid overdose deaths worldwide, there is a growing need to understand the risk factors that contribute to these fatalities. As a global issue, there has been a substantial increase in drug overdose mortality in several countries worldwide over the past decade (Paulozzi). Drug mortality rates overall are higher in counties characterized by more economic disadvantage, more blue-collar and service employment, and higher opioid-prescribing rates (Monnat). Nationally, factors including low SES, education level, and race (Rooney), as well as lack of insurance and incarceration status have been identified as contributing variables (Altekruse). While the correlations between these risk factors and opioid overdose mortality have been explored in some areas of the country, namely urban settings, the studies remain somewhat limited in areas with lower mortality.

Methods: Data used in our analysis were taken from the Centers for Disease and Control WONDER All-Cause Mortality data bases, the Health Resources & Services Administration, the United States Census Bureau American Community Survey, and a database maintained by the Northeast Regional Center for Rural Development.

Results: In Iowa, rates of drug overdose are low overall, however among rural counties of the state, the rates are atypically increased in Cerro Gordo, Clinton, Des Moines, Marshall and Wapello counties. This study aims to further explore whether the factors that are associated with drug-related mortality at the national level, are also associated in rural counties of Iowa.

♦ 74 G ♦

Methylation levels at growth differentiation factor-15 related CpG sites are not related to death risk from cardiovascular disease among monozygotic male twins discordant for cardiovascular disease: National Heart, Lung, and Blood Institute Twin Study

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Background: A previous study found that myocardial infarction patients had decreased methylation levels at four growth differentiating factor-15 related CPG sites. These sites have not been studied for cardiovascular disease (CVD) death. Objective: To determine if methylation levels at four CpG sites (site A: cg13033585, site B: cg16936953, site C: cg17150809, and site D: cg18608055) are associated with death from CVD independent of genes and shared environment.

Methods: Nineteen male monozygotic twins discordant for death from CVD were included from the National Heart, Lung and Blood Institute (NHLBI) Twin Study. The study was initiated in 1969; we used data up to December 31, 2014. Methylation profiling was performed using the Illumina Infinium HumanMethylation450 (450K) BeadChip on buffy coat DNA samples collected during exam 3 (1986-87). Principal component analysis was used to generate a score representing baseline CVD risk factors and blood leukocyte cell subtypes. Conditional logistic regression was used to evaluate the association in the original dataset and 10,000 bootstrap replicates.

Results: Methylation levels at the four CpG sites were not statistically significantly associated with risk of CVD death before and after adjustment for the score (all p>0.05) in the original dataset and the bootstrap analysis. Bootstrap analysis showed that site B had an extremely asymmetric 95% confidence interval of hazard ratios [6.51 (95%CI: 0.09, 756), p=0.61].

Conclusion: DNA methylation levels at GDF-15 and MI related CpG sites are not associated with death risk from cardiovascular disease, independent of genes and shared environment. Site cg16936953, however, warrants further investigation.

♦ 75 ♦

Trends in utilization and determinants of antipsychotic medication use in community-dwelling elderly with mental disorders, 2006-2017

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Objective: Despite the increasing costs and use of antipsychotics, little is known about trends and factors associated with its use in the community-dwelling elderly. This study examined national trends in the prescribing of antipsychotic drugs to community-dwelling elderly with mental disorders and determined what individual characteristics and health conditions were related to the use.

Research design: We used multi-year (2006-2017) data from the Medical Expenditure Panel Survey. The sample includes community-dwelling elderly aged 65 and older diagnosed with psychological or behavioral disorders (N=10,279). Multivariate logistic regression was applied to examine the likelihood of antipsychotic use.

Results: An average of 7.4% of community-dwelling elderly with mental disorders filled antipsychotics annually during the study period. A declining trend was observed in the likelihood of antipsychotic use between 2007 (9.8%) and 2013 (6.6%) (AOR=0.52 in 2013, p=0.009), with a slight upward trend after 2013. Older age and higher family income were associated with decreased antipsychotic use, while non-Hispanic black elderly was more likely to use antipsychotics compared to their white counterparts. Among health-related factors, limited physical activities, polypharmacy, and specific types of mental health conditions were related with increased antipsychotic use. Elderly with good perception of mental health and high blood pressure and arthritis chronic conditions were less likely to involve the use of antipsychotics.

Conclusions: The trends in prescribing of antipsychotic drugs to community-dwelling elderly with mental disorders have remained relatively stable (6.0-9.8%). The findings have important implications in understanding factors influencing antipsychotic medication use, particularly among the community-dwelling elderly.

♦ 76 ♦

Prevalence of substance use and attention-deficit/hyperactivity disorder: An epigenetic assessment

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Smoking and alcohol abuse are leading causes of morbidity and mortality in the United States, in particular in those with attention-deficit/hyperactivity disorder (ADHD). Prior studies have demonstrated that while ADHD and substance-use disorders (SUD) are often co-morbid, the relationships of the frequency and severity of each of the disorders to one another are not well understood. In part, this lack of knowledge results from the unreliability of self-report measures of substance use. To address this short-coming, we will use novel DNA methylation digital PCR methodologies to determine the relationship(s) between the prevalence and intensity of both nicotine and alcohol use in adults as a function of ADHD status. In order to accomplish this, we interviewed 435 Iowan adults with validated substance use and ADHD scales, then determined peripheral white blood cell DNA methylation and serum cotinine levels. Together, we anticipate that our findings will significantly advance our understanding of the co-morbid relationship of ADHD and substance use in adults and that DNA methylation methods may serve as a useful tool for understanding the interplay of these disorders.

♦ 77 G ♦

The ethical and legal cases for compulsory vaccination

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Diseases such as mumps, measles, rubella, varicella, pertussis, and more, all vaccine-preventable diseases, were the subject of eradication discussions in the not-too-distant past, at least in the western world. While research has shown that nearly all compulsory vaccination laws are safe and effective, there has been a resent regression of legislation and/or enforcement of these laws in the United States. I conducted a literature review of vaccine history as well as analyzed case law in order to substantiate the legality and ethics of compulsory vaccination. The first instance of compulsory vaccination was an 1809 Massachusetts law requiring smallpox vaccination. In 1905, the U.S. Supreme Court upheld that law in *Jacobson v. Massachusetts*, holding that jurisdictions have the right under certain circumstances to pass and enforce compulsory vaccination laws. While the Fourteenth Amendment puts the government under strict scrutiny when it restricts individual liberties, the Court confirmed that it is the legislature's obligation to pass such laws. Furthermore, in *Zucht v. King*, the U.S. Supreme Court upheld the right of both public and private schools to require a vaccination record for entrance and attendance. The biggest obstacle to enforcing these laws has been vaccine exemptions. As of 2018, 50 states allowed medical exemptions, 47 allowed religious exemptions, and 17 allowed exemptions based on philosophical beliefs or reason of conscience. This third category is the largest of the three. Further analysis and discussion of this topic should be aimed at vaccination law in the age of COVID-19.

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♦ 2 pm G ♦

Renal cortical KLF15 and KLF2 are downregulated in chronic heart failure

Andrew Philipose, DO'23[1], Kalie A. Savage, DO'23[1], Kiefer W. Kious, MBS[2], Jayson P. Kemble, DO'22[1], Luke J. Smith, DO'22[1], Hugo S. Díaz[3], Rodrigo Del Rio, PhD[3], Noah J. Marcus, PhD[2]

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Type II cardiorenal syndrome is characterized by renal dysfunction resulting from chronic heart failure (CHF). CHF is associated with increased sympathetic stimulation of the kidney, hemodynamic abnormalities, and activation of the renin-angiotensin system (RAS) which are thought to collectively contribute to renal hypoxia and tissue injury. KLF15, which is downregulated by both RAS activity and hypoxia, plays an important protective role in the kidney by constraining pro-fibrotic connective tissue growth factor (CTGF). Hemodynamic abnormalities in CHF may lead to downregulation of the shear-sensitive transcription factor KLF2, which can mitigate fibrosis via activation of Nrf2. In addition, hypoxia has been shown to cause downregulation of anti-fibrotic E-cadherin. We hypothesized that KLF15, KLF2, and E-cadherin expression would be reduced and that CTGF, and Collagen I & III expression would be increased in CHF. To test these hypotheses, cDNA was plated with primers for KLF15, KLF2, CTGF, E-cadherin, Collagen I & III, and β-Actin, and analyzed via qRT-PCR. Two-factor independent samples T-tests or Mann-Whitney U tests were used for statistical analysis, as appropriate. We observed that KLF15, KLF2, E-cadherin, and Collagen III, were downregulated in CHF vs sham. In conclusion, renal hypoperfusion, RAS activation, and attendant tissue hypoxia may lead to repression of KLF15, KLF2, and E-cadherin and related disinhibition of pro-fibrotic signaling in CHF.

♦ 2:05 pm G ♦

A mixed-methods approach to enhance interprofessional teamwork in a rural environment

Philip Jurasinski, DO'21, MPH'21[1,2], Pamela Duffy, PT, PhD, FAPTA[2], Teri Stumbo, PhD, PT[2], Julie Ronnebaum, DPT, PhD, GCS[2], Alison Krueger, MSN-Ed, RN[3], Amy Morris, PhD[4], Nehad El-Sawi, PhD[4]

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Early exposure to interprofessional education (IPE) has been shown to improve teamwork, communication, and patient outcomes. Standardized patient encounters increase the confidence of learners for engaging in interprofessional collaboration and practice as future health care professionals. Des Moines University conducted a pilot IPE patient simulation encounter, focused on an elderly standardized patient with diabetes who suffered from multiple falls, several co-morbidities, and was impacted by various social determinants of health. Thirty students were divided into groups, each with different health professions represented. Team members collected a focused history that focused on each of their future roles and collectively created treatment plan priorities. This was followed by a faculty-led large group debriefing and reflection.

Data were collected in the forms of observations of verbal and nonverbal communication from standardized patient encounters, quantitative data from post-event surveys, and qualitative data from faculty, student evaluators, and student participants. The quantitative survey data collected from evaluators and participants reflected understanding of roles and responsibilities and teamwork but varied in the friendliness of interactions and ability to work with others on different tasks. Qualitative responses from faculty addressed strengths and areas for improvement of the IPE event, while student evaluators focused on team interactions, understanding of roles and responsibilities, and future improvement of the event, and participating students were likewise asked what to do to improve the event. Through this pilot project, this exercise showed increased student agency in interprofessional practice settings and reinforcement of the biopsychosocial model of health care delivery.

♦ 2:10 pm G ♦

Profile of microRNA expression in urinary exosomes is dependent on non-invasive lymphoma induction in mice

Brittany Wilson, DO'23, MBS'24[1,2], Rebekah Betar, DO'23[1], Alexander Martin, DO'23[1], Zack Niazi, DO'23[1], Michael Boyer[3], Lori Winter[2], Victor Babich, PhD[2,4], Francesca Di Sole, PhD[2], Elitsa Ananieva, PhD[3]

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Lymphoma accounts for 4% of cancers in the United States and diagnosis of lymphoma involves surgical biopsy of the tumor, which has associated risks. Exosomes are extracellular vesicles secreted in biological fluids that can serve as "liquid biomarkers". Identification of unique cancer biomarkers in urinary exosomes can provide a non-invasive and cost-effective tool for lymphoma diagnosis. Objective was to determine the profile of microRNAs (miRNAs) expressed in urinary exosomes of mice challenged with lymphoma and compare it to miRNAs identified in urinary exosomes of control mice.

C57BL/6 mice (n=12) were injected with either $2.5x10^5$ EL-4 lymphoma cells or phosphate-buffered saline (control mice, n=12). Tumor growth was monitored for 14 days. Urine were collected for 48 hours starting on day 17 and serum, tumor tissues and organs were collected on day 20. Urinary exosomes were extracted using ExoQuick reagent followed by purification of total RNA and RT-qPCR for which a set of PCR arrays consisting of 709 mouse-specific miRNA primers was used. Fold changes in miRNA expression was quantified using the $\Delta\Delta$Ct method.

Mice developed tumors by day 13 with initial tumor appearance around day 7. Body weights for tumor-injected mice were greater than control mice with no significant difference between food or water intake. RT-qPCR arrays of miRNAs extracted from urinary exosomes revealed 470 miRNAs that were differentially expressed between tumor-injected and control mice. miRNAs will be compared to miRNAs from blood and tumor tissues to identify tumor-specific miRNAs that can be used for potential application in the clinical setting.

♦ 2:15 pm G ♦

Regulation of pH by growth factors is dependent on the expression of the calcineurin homologous protein-2 in human osteosarcoma cells

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Osteosarcoma is the sixth most common malignancy in adolescents, and current treatments have not demonstrated improvement in patients' survival over the past three decades. Extracellular acidosis inhibits osteoblast function by reducing bone mineralization, thereby weakening bone matrix, and may play a role in the devolvement of bone characteristics seen in osteosarcoma patients. Development of extracellular acidosis in cancer is due to dysregulation of pH dynamics mediated by constitutive activation of Na^+/H^+ exchanger-1 (NHE1) activity, the main transporter responsible for pH regulation. Current therapeutic agents that target inhibition of NHE1 activity are ineffective due to broad inhibitory effects. The calcineurin homologous protein (CHP) family binds to and regulates NHE1 activity. CHP isoform 1 (CHP1) is expressed in non-cancerous cells, whereas CHP isoform 2 (CHP2) is expressed mainly in cancerous cells. Furthermore, CHP2 has a stronger binding affinity to NHE1 compared with CHP1. We hypothesized that CHP2 binding to NHE1 in cancer cells induces the over-activity of NHE1, making the extracellular pH of cancer cells more acidic than non-cancerous cells. We determined that: 1. human osteoblast (hFOB) and osteosarcoma (143B) cells expressed mainly NHE1; its activity measured using spectrofluorometry was completely blocked by a highly selective NHE1 inhibitor (zoniporide, 10^{-8} M); 2. CHP2 expression was induced through serum-nutrient deprivation used to mimic a cancerous microenvironment and 3. silencing of CHP2 by shRNA restored the response of NHE1 activity to serum-nutrient deprivation in 143B cells. These findings yield potential for CHP2's regulation of NHE1 activity as a novel target in osteosarcoma treatment.

♦ 2:20 pm G ♦

Methylation levels at growth differentiation factor-15 related CpG sites are not related to death risk from cardiovascular disease among monozygotic male twins discordant for cardiovascular disease: National Heart, Lung, and Blood Institute Twin Study

Spencer Moore, DO'23[1], Pallavi Mukherji, DO[2], Ming Leung[3], Jun Dai, MD, MSc, PhD[4]

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Background: A previous study found that myocardial infarction patients had decreased methylation levels at four growth differentiating factor-15 related CPG sites. These sites have not been studied for cardiovascular disease (CVD) death. Objective: To determine if methylation levels at four CpG sites (site A: cg13033585, site B: cg16936953, site C: cg17150809, and site D: cg18608055) are associated with death from CVD independent of genes and shared environment.

Methods: Nineteen male monozygotic twins discordant for death from CVD were included from the National Heart, Lung and Blood Institute (NHLBI) Twin Study. The study was initiated in 1969; we used data up to December 31, 2014. Methylation profiling was performed using the Illumina Infinium HumanMethylation450 (450K) BeadChip on buffy coat DNA samples collected during exam 3 (1986-87). Principal component analysis was used to generate a score representing baseline CVD risk factors and blood leukocyte cell subtypes. Conditional logistic regression was used to evaluate the association in the original dataset and 10,000 bootstrap replicates.

Results: Methylation levels at the four CpG sites were not statistically significantly associated with risk of CVD death before and after adjustment for the score (all p>0.05) in the original dataset and the bootstrap analysis. Bootstrap analysis showed that site B had an extremely asymmetric 95% confidence interval of hazard ratios [6.51 (95%CI: 0.09, 756), p=0.61].

Conclusion: DNA methylation levels at GDF-15 and MI related CpG sites are not associated with death risk from cardiovascular disease, independent of genes and shared environment. Site cg16936953, however, warrants further investigation.

♦ 2:25 pm G ♦

Chronic norepinephrine infusion reduces GPER expression in the hypothalamus of ovariectomized mice

Lane Heinlein, DO'23[1], Cristina Petty, DPM'23[2], Nikhil Pallikonda, DO'23[1], Jennifer Giles, MA[3], Lori Winter[3], Eric Wauson, PhD[3], Quang-Kim Tran, MD, PhD[3], Sarah Clayton, PhD[3]

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In many disease states, sympathetic hyperactivity has been demonstrated, including hypertension and heart failure. In females, there is substantial evidence to support a protected phenotype, with respect to cardiovascular disease prevalence and severity, prior to the onset of menopause, which suggests a role for sex steroids. While many studies have focused on the protection at the level of the heart and vasculature, we hypothesized that some of this protection may exist in the central nervous system, specifically in the areas that control autonomic outflow. The hypothalamus serves as a major regulatory site for control of autonomic outflow. Additionally, there is evidence to support that estrogen receptors can reduce central sympathetic activity. Therefore, we hypothesized in the current study that chronic norepinephrine reduced expression of estrogen receptors in the hypothalamus in the absence of circulating estrogen. In this study, female mice were ovariectomized at 8 weeks of age. After 3 weeks of recovery, animals were implanted with osmotic minipumps that delivered norepinephrine continuously for 8 weeks (10mg/kg/d). Although preliminary, we found that norepinephrine infusion reduced GPER expression ~25% as evaluated by qPCR in the hypothalamus of ovariectomized mice. These results suggest that chronic sympathetic stimulation may erode the protective phenotype of estrogen receptor expression in the brain. Further studies will delineate the role of sex steroids (i.e. in intact female mice) to withstand the negative effects of norepinephrine on the expression of estrogen receptors in the brain.

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